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Task 4 Final Report: Curriculum Support in Czech Technical Universities

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FINAL REPORT ON
CZECH ENERGY EFFICIENCY PROJECT
(DHR-0030-C-00-5064-00)

submitted by
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Operated through
The Alliance of Universities for Democracy
and the
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The University of Tennessee, Knoxville

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Final Report on Czech Energy Efficiency Project (DHR-0030-C-00-5064-00)

This project was offered to meet the needs of US AID-Prague for training in technical and financial analysis of energy efficiency/environment programs at three universities in the Czech Republic It was a collaboration between faculties of engineering and management of the Technical University of Liberec Technical University Ostrava Czech Technical University in Prague and the University of Tennessee (UT)

The project enabled and supported development of pre- and post-graduate courses in environment and energy efficiency at the three Czech universities and was operated in conjunction with Electrotek Concepts Inc The University of Tennessee, Knoxville and The Alliance of Universities for Democracy

PROJECT PHASE SUMMARIES

All three participating Czech universities are implementing significant changes as a result of the program Regional (Czech-Polish) cooperative activities have also been originated as a direct result of the program This project was undertaken in four phases which are summarized in this section A detailed description of events and specific outcomes for each phase follows the phase summary section

Phase 1 Project announcement and planning - November, 1996, Prague

Planning meetings were held with project principals in Prague in conjunction with the Seventh Annual Conference of the Alliance of Universities for Democracy (AUDEM) Nov 3-6, 1996 The UT Project Team (Hake, Jendrucko and Fowler) had separate meetings in Prague during the days of the Conference with representatives of the three participating Czech universities to review project objectives and determine specific needs of each university Five project participants gave a presentation on the project at a general session of the Prague Conference The session was well attended Interest in the project was expressed by Conference participants from other countries, especially Poland, Slovakia and Romania Following the end of the Alliance Conference a final meeting was held at Hotel Krystal attended by several faculty from each Czech university and the UT project personnel More specific planning for the January Workshop was the principal purpose of this meeting Also discussed were the strategies each Czech university would use to recruit and select faculty from their institutions to participate in the Workshop

Phase 2 Energy Efficiency Workshop - January, 1997, Prague

This was a five day workshop attended by twenty two persons from the three technical universities in Liberec Ostrava and Prague plus one visitor from Poland Prof Adam Gula Czech Technical University served as local host for the Workshop enabling lodging and meals for all participants and US faculty at the Hotel Krystal in Prague The workshop was conducted by UT professors Richard Jendrucko (engineering), Jerry Fryxell (management) and Charles Bamford (management)

Workshop participants were invited to complete detailed questionnaires evaluating the

content, pedagogy and overall value of the Workshop

* 90 percent agreed that "overall this program provided information that will be useful to the energy curriculum at my university "
* 95% agreed (with 68% in *strong agreement*) that "the content of the program was appropriate and clear," and
* 100% agreed that "the program was well organized "

Participants were particularly impressed with the range of energy efficiency and related environmental management issues covered the wide range of curriculum ideas offered and the participatory style of experiential exercises undertaken during the Workshop Initially uncomfortable with this style of instruction participants became enthusiastic with the participatory style by workshop's end As indicated in formal evaluations reported in Appendix C and described in Phase 2 Detail section

* 59% checked that they "liked the session and how it was taught"
* an additional 38% of participants not only liked the approach but indicated they "will try this approach" in their classes

For a project whose goals are behavior modification these responses indicate exceptional and we might add, an unexpected degree of acceptance

Workshop visitor Prof Adam Gula director of the Polish Foundation for Energy Efficiency in Krakow, added to the level of understanding of both instructors and participants He has communicated his opinion that such a curriculum reform project is needed also in Poland and his hope that such a project might be undertaken in coordination with Polish technical universities

Specific energy efficiency/ environmental management interests of the participants were canvassed and used to tailor the content of project Phase 3

Phase 3 Curriculum Development - April, 1997, Knoxville, Tennessee

Three of the five faculty from each of the three Czech universities participating in the Workshop came to Knoxville for two weeks of advanced energy efficiency instruction, visits with area firms employing energy efficiency and environmental management techniques This phase included individualized support from UT engineering, business and education faculty as Czech faculty considered techniques and curriculum materials to be offered at their universities and in their communities Specific content of the two week training session in Knoxville was developed based on experience and discussions with Czech faculty during the January Workshop

To aid determination of relevance, all participants were asked to complete an evaluation form for the program which included and overall assessment and an assessment of each component of the program On a five-point scale which ranged from '*strongly agree*' to '*strongly disagree*'

* eight participants *agreed* (five *agreed strongly*) that "Overall this program provided information that will be useful to the energy curriculum at my university "
* nine *agreed* (six *strongly agreed*) that "The content of this program was appropriate and clear "
* nine *strongly agreed* that "This program was well organized "

Every program element was found useful by at least one-third of the participants, and three-

fifths of the program components will be used heavily ("much" or "almost all") by more than half of the Czech faculty Program components with content that will be heavily used by at least two-thirds of the participants included

- briefings on the organization and management of the UT Assessment Center
- the Energy Assessment exercise included in the visit to a local manufacturing plant
- the visit to the Opryland Hotel steam plant and engineering complex with demonstrations of energy efficiency and energy conservation techniques
- visit to the Tennessee Valley Authority Bull Run Steam Plant
- visit to Oak Ridge National Labs
- the afternoon and evening spent at the Narrow Ridge Environmental Center

Over two-thirds of the total content of the two week program was recommended to be retained in any future energy efficiency programs in Central and East Europe by more than half of the participants Nearly all the program (21 of 22 components) was judged of value by one-third of the participants

Phase 4 Implementation Support - May, 1997, in Liberec, Ostrava and Prague

Based on assessment by the participants themselves, it appears that Phase 1, 2 and 3 of the project were successful Of course, the value of this project in the long term is the effect on the engineering and management curriculum While this is itself a long term process, one indicator of long term potential impact is behavior modification in the short run It is possible to observe behavior modification in the short run and this was part of the purpose of Phase 4 of the project

The Implementation Support phase of the project took place in the Czech Republic from May 14 through Wednesday, May 28, 1997 The UT Team (Jendrucko, Fryxell, Counce and Hake) visited Liberec, Ostrava and Prague to work directly with designated faculty and staff at each of the three Czech universities defined in this project Technical University of Liberec Technical University of Ostrava and Czech Technical University

The schedule was arranged so that two full weekdays were spent at each of the three sites Additional weekend days were spent in Liberec and Ostrava as these sites were less familiar to the UT team than Prague

Several faculty from departments in engineering and management accompanied the UT team during visits to the three universities as well as for all meals in order to maximize interaction and mutual learning opportunities Strategic visits to non-university sites were planned as well to illustrate energy and environmental management problems and also for the Czech faculty to assess possibilities for case studies with support and suggestions from the UT team These visits included a plant tour of DIAMO Co uranium mining recovery operation in North Bohemia the Liberec Municipal Thermal Plant the Crystalex Co plant acid-rain damage sites in the Iser Mountains trip to wood combustion site in Ostravice excursion to OKD coal mine tour of environmentally damaged sites in Beskydy Mountains, and an excursion and discussion with management of the Nova Hut power plant to assess possibilities for energy audit demonstrations as part of course curriculum

Outcomes

* A participant in the January Workshop, implemented the Commons Simulation in one of her classes this Spring semester This is an interactive classroom simulation designed to help students better understand business decisions when use of common environmental resources are concerned It is also a pedagogical aid to increase student participation The professor was highly pleased with the result and plans to continue using the tool in future classes
* To assist in development of the course module it is possible that a UTK doctoral student would spend a semester at the Technical University of Liberec teaching a course plus developing a case around the brown coal-fired steam plants in Turow, Poland and their companion plants just a few kilometers away in Germany
* One of the strongest positive examples of impact of the project on short term behavior was the experience of a professor at the Technical University of Ostrava Elaborated as an anecdote in the detail section, his story is a moving account of excitement caused by immediate inclusion of new material and new teaching techniques in two of his courses upon return to Ostrava after the April, 1997 Phase C in Tennessee It is also an account of new hope and rededication to the highest ideals in the role of a university in an economy in transition in general and specifically to energy and environmental education in the Czech Republic
* Another professor told of developing a new technology for co-generation to reduce summer heat/pollution problems to be incorporated in class material as soon as possible
* One of the professors plans to include cases in his courses next fall after witnessing the technique in the January Workshop and also visiting a case class while at UT in April
* One of the engineering professors initiated a collaboration with a professor in management to initiate a new course combining economy of production and consumption of energy with management of firms in the electrical industry
* Czech Tech has just been asked to lead a new group on energy efficiency for the Association of Producers of Electrical Systems (APES) Through APES lessons learned in this project could have an immediate national impact
* A significant immediate impact of this project was that related to the Energy Assessment Center concept demonstrated at UT [The UT Energy Assessment Center helps identify firms for the student teams to visit and perform actual energy audits Teams prepare a report based on their visit showing their analysis of the technical information gained in the field noting areas of concern develop recommendations for improvements in energy efficiency / environmental management practices and strategies for implementation Each team presents their report to the rest of the class and also to the participating firm Several firms are used each semester] The main points of the Energy Assessment Center concept implementation are reviewed below
    * Upon return from UT in late April a professor decided to try to implement the Energy Assessment Center Concept at Czech Tech He realized he had not only to find Czech firms that would be open to student team audits but also to find funds required to support the experience
    * The first two Prague area firms contacted agreed and, to the surprise of the professor offered enthusiastic support One of the firms (both are identified and described in the

detail section) explained that they had a big waste heat problem but had not had the time to deal with it they would welcome collaboration with the university and would open their company to the student teams Both firms offered modest funds to help underwrite the project and agreed to accept the first student teams in the near future

* With two firms and two successes, the professor decided to share the results with university officials and seek their support for pushing ahead with required curriculum reform and potentially, a major new initiative for Czech Tech assisting small area firms in energy efficiency/environmental management
* The UT team met with the professor's department head dean and the Vice Rector for academic affairs and research All were interested in the concept asked many questions about the UT Assessment Center and declared support of the concept and of their support for Professor Kabele
* There is every reason to believe that the Czech Tech Energy Assessment Center
  * will proceed and serve as a continuing laboratory for future students,
  * will be internally financed,
  * will serve an unmet need for small manufacturing firms in the Prague area,
  * and will accomplish these with long-term sustainability and have a long-term positive effect on energy consumption and the environment

Concluding Comment

Above are a few of the examples of project influence on short run behavior that we were able to observe in a short visit just weeks after the last of the "input" phases of the overall project Other events are likely to occur as a result of the project

For example, in July 1997 a delegation of project faculty from the Technical University of Liberec travelled to Krakow, Poland to pursue common interests in energy efficiency and environment with Prof Adam Gula Gula is a professor at the University of Mining and Metallurgy in Krakow and also director of the Polish Foundation for Energy Efficiency He and the Liberec professors first became acquainted at the Energy Efficiency Workshop in Prague as Phase 2 of this project The Czech delegation met with Professor Gula, the dean and several professors at the Krakow university The meeting was successful enough to draft a far-reaching project of Czech-Polish cooperation They have realized how many problems they have in common both as countries and as technical universities They indicate that following a possible 1997-98 Polish USAID Project on Energy Efficiency/ Environmental Management they will most likely strive to establish a Czech-Polish Centre for Energy Efficiency Problems Their hope is for the Czech-Polish Centre to involve Prague, Ostrava and Liberec on the Czech side and universities in Krakow Gliwice and Wroclaw on the Polish side (see letter in Appendix G) Activites are underway to expand the influence to a Czech-Polish-Slovak Centre

In summary there can be no long term effect without such influences as those described above in the observable near term This project has already had a positive influence on education in energy efficiency and environmental management at all three Czech universities and as noted, with significant potential for industry in the Czech Republic and possibly also for education and industry in a larger multinational region

DETAIL REPORT OF PROJECT ACTIVITY

DETAIL PHASE 1 - Project announcement and planning - November, 1996, Prague

Four UT project personnel Richard Jendrucko Oscar Fowler Bob Stanelle and David Hake (referred to as UT team) met representatives of Czech Technical University in Prague Technical University of Liberec and the Technical University of Ostrava All meetings were at the Hotel Krystal in Prague in conjunction with the 7th Annual Conference of the Alliance of Universities of Democracy

Individual Meetings

There were four organized meetings on the project plus a formal presentation during the Conference announcing the project

The first three meetings were separate meetings between the 'contact person' designated by the rectorate at each Czech university and UT group named above The purpose of these three meetings was for the UT team to get better acquainted with the particular needs and strengths of each university in project areas and to provide the contact person with a detailed briefing on the project itself The individual meetings were

Monday lunch, November, 4, 1996 The first meeting was with Prof Jiri Kratochvil, Head of Power Engineering at the Technical University of Liberec (TUL) The UT team learned of Czech curriculum in areas that related to energy efficiency / environmental management and of specific needs and interests Team explained the goals of the project and discussed possible participants from Liberec The meeting lasted approximately three hours

Tuesday lunch, November 5, 1996 Met with contact person Prof Pavel Kolat, Head of the Department of Power Engineering at Technical University of Ostrava (TUO) Format similar to the Monday meeting Needs and curriculum development of the Technical University of Ostrava were different from those at Liberec This meeting lasted about two hours

Tuesday, 15 00, November 5, 1996 Met with contact person, Prof Miloslav Nemecek, Faculty of Electrical Engineering, Czech Technical University (CTU) Format similar to those above Meeting lasted about two hours

It was obvious from these three meetings that the needs and issues at each university were different For example the Technical University of Ostrava (TUO) has been able to retain a senior faculty since 1992 and as a result has several programs already in place in area related to energy efficiency and environmental management Also, TUO staff indicated they were the only university in the Czech Republic certified to measure stack emissions It seemed that TUO had more specific goals for curriculum development in project area than either of the other two universities TUL goals in project areas were less specific than those of Ostrava and those for Czech Tech fell somewhere between Ostrava and Liberec We learned that, since 1990 CTU had lost many faculty in their 40's and 50's to the dynamic private sector in Prague They now have very young and very senior faculty and are attempting to rebuild the middle ranks These factors have major influence on specific approaches of each university under this project

Conference Session

Chronologically the next project event was Session 13B of the Alliance Conference "A Four University Energy Efficiency / Environment Project " This was held at 10 45-12 00 Wednesday, Nov 5 A copy of the Conference Program (ref page 13) is attached as Appendix A The session with David Hake presiding, included the following talks

Energy Environment Issues at Technical University of Liberec
Jiri KRATOCHVIL Professor and Head, Department of Power Engineering Equipment Technical University of Liberec, Liberec, Czech Republic

Energy Environment Opportunities at Technical University of Ostrava
Pavel KOLAT Professor and Head Department of Power Engineering, Technical University of Ostrava, Ostrava, Czech Republic

The Future Education Schedule of CTU Prague Focussed on Energy Efficiency
Miloslav NEMECEK, Jan KYNCL and Jiri TUMA, Professors, Czech Technical University in Prague

Problems and Opportunities in Energy Environment at UT
Richard JENDRUCKO, Professor and Director, Industrial Assessment Center, College of Engineering The University of Tennessee, Knoxville

Outline of the Czech Energy Efficiency Project
David HAKE, Professor of Management, The University of Tennessee

Several Conference participants from other countries were very interested in this project and asked to be kept informed of activities Each presenter will be invited to include their presentation in the Alliance publication, Perspectives in Higher Education Reform, a volume based on the Prague Conference which will be published by the Alliance later in 1997

Planning Meeting

The next project event was the group Planning Meeting for the January Workshop This was held Wednesday Nov 6 1996 at the Hotel Krystal at 14 00 The purpose of the meeting was to plan for the January Workshop, both from the point of view of content and participation The meeting lasted nearly three hours

Workshop Content Discussion Consensus on content was difficult to reach due to the large differences between the three Czech universities in stage of faculty development, stage of curriculum development and local energy/environmental conditions One major area of discussion was curriculum development which would integrate energy efficiency/environmental management material Several models were listed (a) to modify existing coursework (b) to develop one or more new courses for full-time students (c) to develop an entirely new program, and (d) post-graduate training to include non-degree programs for industry government and others Ostrava declared it would focus on models (a) first with model (b) second The focus of other universities was not so clear It was generally agreed that the January Workshop should include material on general principles tools methods approaches and frameworks After long discussion weights were assigned as follows 40% in environmental management/pollution prevention 25% energy efficiency technologies 25% curricular issues specifically pedagogical techniques and

teaching across disciplines, 10% political issues specifically overview of U S environmental regulations and required reporting, and relations with environmental NGO's The agenda for the January Workshop was determined based on these suggestions It was agreed that simulations, case studies and other teaching methods used in the UT Colleges of Engineering and Business would be incorporated

Workshop Participation and Timing Because of the increased focus on pedagogy, it was determined that the size of the participant group needed to be controlled It was agreed that each of the three Czech universities would select no fewer than five but no more than eight persons from their universities as participants It was also agreed that in order to maximize teaching pedagogical techniques through direct participation in group exercises, that the language of the Workshop should be English The representatives of each university felt this would not inhibit selection of participants for the Workshop It was again stressed that selection of three persons from each university for Phase 3 of the project in Tennessee would be made from the participant group at the Prague Workshop

It was decided that the dates of the January Workshop that best fit schedules of the three Czech universities and the UT group was Saturday Jan 11 through Wednesday Jan 15, 1997

Planning Meeting Participants In addition to the UT Team, the following persons attended the planning meeting

Czech Technical University

(Contact Person) Miloslav NEMECEK, Professor of Electrical Engineering
Frantisek JIROUS, Professor, Department of Thermal and Nuclear Power Plants, Faculty of Mechanical Engineering
Karel KABELE, Instructor, Mechanical Engineering
Jiri TUMA, Professor, Faculty of Electrical Engineering and Vice Dean of Electrical Engineering Faculty for Research and Science

Technical University of Liberec

(Contact Person) Jiri KRATOCHVIL, Head, Department of Power Engineering
Jaroslav SULC, Department of Power Engineering
Miroslav OLEHA, Department of Power Engineering

Technical University of Ostrava

(Contact Person) Pavel KOLAT, Professor, Department of Power Engineering
Zdenek TOMAN, Prof Dept of Power Engineering

Visitors

Prof Adam GULA, Director, Polish Foundation for Energy Efficiency Krakow, Poland
Wojciech FULINSKI, Assistant Polish Foundation for Energy Efficiency Krakow Poland
Ryszard POHORECKI, Professor, Faculty of Chemical and Process Engineering, Warsaw University of Technology
Andris KRESLINS, Professor and Director, Institute of Heat, Gas and Water Technology, Riga Technical University, Riga, Latvia

USAID Debriefing

The final project related event during November 96 in Prague was a debriefing at the US Embassy on Thursday November 7 at 15 00 Meeting participants were Bob Posner and David Hake Following a summary of activities and Hake's observations about the many meetings that had taken place in the last three days, Mr Posner offered several helpful suggestions regarding the January Workshop, educational political realities in the Czech Republic and also future project phases

DETAIL PHASE 2 - Energy Efficiency Workshop - January, 1997, Prague

Phase 2 of the project took place in Prague from Saturday through Wednesday January 10-15 1997

Instructors

Instructors for the Workshop, all at The University of Tennessee were Dr Richard Jendrucko Professor Department of Mechanical Engineering Dr Jerry Fryxell, Professor, Department of Management, Mr Charles Bamford, Instructor and doctoral candidate in Strategic Management

Logistics

The Workshop was held in two locations Weekend sessions were at the Hotel Krystal and weekday sessions were held at the Czech Technical University Rectorate

Participants

Twenty two persons participated in one or more sessions Eighteen participants attended all sessions Several other professors/instructors from Czech Technical University in Prague participated in one or more sessions they felt of particular interest Those that attended all sessions and completed the workshop included the following persons

Technical University of Liberec

Dr Jiri Kratochvil, Professor and Head, Department of Power Engineering Coordinator of TUL delegation
Dr Miloslav Olehla Professor and Head, Dept of Applied Cybernetics
Dr Jaroslav Sulc, Senior Lecturer
Dr Hana Stranikova, Senior Lecturer
Jiri Hulicka Doctoral Student

Technical University of Ostrava

Dr Pavel Kolat Professor and Head of Department of Power Engineering Coordinator of TUO delegation
Dr Zdnek Toman Lecturer
Dr Jiri Mika, Senior Lecturer
Dr Mojmir Vrtek, Senior Lecturer
Dr Pavel Noskievil Senior Lecturer

Dr Leos Pchalek Senior Lecturer

Czech Technical University in Prague

Dr Miloslav Nemecek, Professor Faculty of Electrical Engineering, Coordinator of CTU delegation

Dr Jiri Tuma Vice-Dean of Research and Science Professor

Dr Franecek Jirous Professor

Dr Jan Kyncl Assistant Professor

Karel Kabele Assistant Professor

Special Guest

Adam Gula Professor University of Mining and Metallurgy Krakow Poland

Materials

A 188 page notebook was prepared for the Workshop (Appendix B) A copy of the notebook was given to each participant The notebook contained the course outline an outline and specific materials for each of the fifteen modules during the five day workshop copies of all overheads used during the week, copies of especially valuable articles from journals full copies of the several cases that were used as training aids during the Workshop, glossaries of terms and other materials

Evaluation - Responses of Participants

A Program Evaluation Form was passed to all participants (including the occasional visitors from Czech Tech in Prague that attended particular sessions) asking them to indicate the effectiveness of each content session in terms of the relevance of content and pedagogy The anonymous form also requested overall Workshop Summary opinions

Summary Responses

The overall response was extremely positive Programs of this type essentially intercultural seldom have the high degree of acceptance that this program received This was due in part to the international experience of the instructors in Central and Eastern Europe in part to the content knowledge and pedagogical maturity of the instructors and in part to the information gained from the potential Workshop participants themselves during Phase 1 of this project (at the Conference of the Alliance of Universities for Democracy) and following those contacts, in extensive email correspondence between the participants and presenters prior to the Workshop

For example of the nineteen respondents to the Summary section

1) 90 percent agreed (6 strongly agreed 11 agreed) that "overall this program provided information that will be useful to the energy curriculum at my university "

2) 95% agreed (13 strongly agree 5 agree) that "the content of the program was appropriate and clear " and

3) 100% agreed that "the program was well organized "

Detail Responses

As the data above indicate the overall response was highly positive (Complete detail participant evaluation form responses are included in Appendix B) Selected responses to specific

modules are presented below to demonstrate the range of topics covered and also the general enthusiasm of the participants toward content and pedagogical relevance From responses presented below 59% checked that they "liked the session and how it was taught " An additional 38% of participants not only liked the approach but indicated they "will try this approach" in their classes!

For a project whose goals are behavior modification, these responses indicate exceptional and we might add, an unexpected degree of success

Key The day and Module number are followed by the last name of the lead instructor for the module Participants were asked to check their evaluation of both the content *and* pedagogy for each module The number of participants checking each response is given

Saturday Module II - Jendrucko Linkages to environmental management Teaching in an open society

Content

0 - this was mostly irrelevant
2 - I will probably use something
8 - I will use some content
5 - I will use much content
4 - I will use almost all of this content

Pedagogy

0 - this module had no effect on how I will teach in the future
10 - I liked this session and how it was taught
9 - I liked this session and will try this approach

Saturday Module III - Fryxell Commons Game a team based simulation of decisions top management must make when faced with tradeoffs between profitability and pollution when manufacturing process is dependent on a water resource shared by all other (teams) firms

Content

1 - this was mostly irrelevant
2 - I will probably use something
8 - I will use some content
5 - I will use much content
3 - I will use almost all of this content

Pedagogy

1 - this module had no effect on how I will teach in the future
15 - I liked this session and how it was taught
5 - I liked this session and will try this approach

Sunday Module II - Bamford Role of the Case Study in environmental management

Content

0 - this was mostly irrelevant
3 - I will probably use something

8 - I will use some content
4 - I will use much content
3 - I will use almost all of this content

Pedagogy

1 - this module had no effect on how I will teach in the future
12 - I liked this session and how it was taught
7 - I liked this session and will try this approach

Sunday Module III - Bamford "Double Death," a negotiation group exercise

Content

2 - this was mostly irrelevant
1 - I will probably use something
5 - I will use some content
9 - I will use much content
1 - I will use almost all of this content

Pedagogy

2 - this module had no effect on how I will teach in the future
9 - I liked this session and how it was taught
8 - I liked this session and will try this approach

Monday Module I - Jendrucko Identification of energy efficiency improvements

Content

0 - this was mostly irrelevant
1 - I will probably use something
4 - I will use some content
8 - I will use much content
7 - I will use almost all of this content

Pedagogy

0 - this module had no effect on how I will teach in the future
10 - I liked this session and how it was taught
9 - I liked this session and will try this approach

Monday Module II - Jendrucko Financial analysis for energy efficiency projects

Content

0 - this was mostly irrelevant
4 - I will probably use something
5 - I will use some content
5 - I will use much content
5 - I will use almost all of this content

Pedagogy

0 - this module had no effect on how I will teach in the future
12 - I liked this session and how it was taught
8 - I liked this session and will try this approach

Tuesday Module II - Fryxell ISO 14000

Content

0 - this was mostly irrelevant
2 - I will probably use something
3 - I will use some content
7 - I will use much content
6 - I will use almost all of this content

Pedagogy

0 - this module had no effect on how I will teach in the future
11 - I liked this session and how it was taught
7 - I liked this session and will try this approach

DETAIL PHASE 3 - Curriculum Development - April, 1997, Knoxville, Tennessee

Three of the five faculty from each of the three Czech universities participating in the Workshop came to Knoxville for two weeks of advanced energy efficiency instruction, visits with area firms employing energy efficiency and environmental management techniques This phase included individualized support from UT engineering, business and education faculty as Czech faculty considered techniques and curriculum materials to be offered at their universities and in their communities The participants were

Technical University of Liberec

Dr Jiri Kratochvil, Professor and Head Department of Power Engineering
Dr Miloslav Olehla, Associate Professor and Head, Dept of Applied Cybernetics
Dr Jaroslav Sulc Associate Professor, Power Engineering

Technical University of Ostrava

Dr Pavel Kolat Professor and Head of Department of Power Engineering
Dr Zdnek Toman Associate Professor
Dr Leos Pchalek, Assistant Professor

Czech Technical University in Prague

Dr Jiri Tuma, Professor and Vice-Dean of Research and Science
Dr Jan Kyncl Associate Professor
Karel Kabele Associate Professor

Tennessee Participants

Project personnel from the UT faculty and staff participating in this phase included Prof David A Hake Prof Richard Jendrucko Prof Jerry Fryxell, Prof Robert Counce Prof Oscar Fowler Dr Charles Bamford Mr Robert Stanelle and Ms Dianne Knief

Numerous UT faculty, staff executives and staff of Tennessee business industry and officials of local and state government agencies willingly volunteered their time and in some cases considerable energy, to assist the Czech participants and respond to their interests and questions

The Tennessee Program

The program of activities from Sunday April 6 through Friday April 18 was varied and extensive The abbreviated version of the program is included below to illustrate the range of activities The detailed program is included as Appendix D An analysis of evaluation of the program by the Czech participants follows the program

Saturday, April 5

Participants depart Prague Saturday April 5
Arrive Knoxville Saturday April 5
Lodging Knoxville Marriott Hotel

Sunday, April 6

11 00 Meet in lobby for informal sightseeing

17 30 UT Faculty Club reception for Czech delegation Meet with project and other UT faculty UT students representatives of firms, NGOs and others on Tennessee program Special Welcome Victor Ashe, Mayor of Knoxville, presented Keys-to-the-City to each Czech visitor

Monday, April 7

9 00 Welcome to The University of Tennessee

9 10 Overview of College of Engineering Dean Jerry Stoneking

9 30 Overview of College of Business Administration Dean Warren Neel

10 30 Review of the Tennessee program Distribution of notebooks and set of texts ($200/person) and other curriculum material acquired for Czech faculty

13 30 UT Assessment Center briefing

The Center directed by Prof Jendrucko, is part of a national program funded by the U S Department of Energy The UT Center is one of 30 nationwide Faculty-student teams provide technical assistance to regional manufacturing plants in energy efficiency waste management and productivity enhancement

Tuesday, April 8

9 00 UT Assessment Center, continued

13 00 depart for plant visit to demonstrate UT Assessment Center techniques (Clayton Mobile Homes)

18 30 Participate in Management 401 Glocker room 72, to witness classroom use of the Case technique The case concerns a financial analysis of net present value associated with the "Greenlights Program "

Wednesday, April 9

9 00 Energy curriculum development - Speaker Michael Simek, Office of Industrial Productivity and Energy Assessment Rutgers University New Jersey Presented the national administrative program structure for the national Industrial Assessment Center Program

13 30 depart for plant tour of Parker-Hanifin Corporation Newport, Tennessee Local host Frank Hartman Plant Environmental Engineer

Thursday, April 10

8 30 Discussion at UT on experiential education in engineering co-op programs and other joint

activities involving industry government and university

13 30 depart for visit to Tennessee Valley Authority (TVA) Bull Run coal-fired steam plant for electric generation Tour site, presentation and discussion with plant executives

Friday, April 11

9 00 Briefing on distance education and tour of UT facilities

10 10 Rm 321 Communications Building Observe distance education class of Profs Jendrucko and Counce on 'Industrial Pollution Prevention' in process

11 30 depart for Oak Ridge, Tennessee

a) Oak Ridge Museum of Science and Energy

b) Oak Ridge National Laboratory K-25 Briefing in energy efficiency areas with Martin Marietta Energy Systems

18 30 buffet supper at Hake's All project group invited with spouse, guest

Saturday, April 12

10 30 van departs for trip to Nashville TN

Lodging Clubhouse Inn

evening visit to Grand Ole Opry

Sunday, April 13

10 00 tour Opryland Hotel steam plant Demonstrations of engineering, and operations for the world's largest convention center/ hotel (3 000 rooms) under one roof

A University of Tennessee graduate in Agriculture is the head of landscaping at this hotel which features five acres of botanical garden under roof ringed by interior rooms of the hotel The Hotel is internationally known for its innovations in energy efficiency and environmental design

16 00 visit to downtown Nashville

Monday, April 14

9 00 Tennessee State government visits Tennessee Department of Environment and Conservation Discussion of state regulatory policies regarding energy usage and energy production especially from coal fired plants Review state policies for energy efficiency and changes relative to ISO 14000

13 00 visit to Nashville Thermal Pant for lecture and demonstrations of trash-to-energy conversion

Evening travel to Chattanooga, TN Lodging Marriott Reed House

Tuesday, April 15

9 00 lecture tour and demonstrations at the Electric Transit Vehicle Institute in Chattanooga

11 00 visit to TVA's Missionary Ridge Center

14 00 depart Chattanooga for trip back to Knoxville [BS]

16 00 Czech faculty guests at the Fulbright Scholars dinner UT Faculty Club

Wednesday, April 16

9 00 Presentation and demonstration of MarketPlace management simulation teaching tool by author, Prof Ernie Cadotte and project research associates from Slovakia Tool in use in several universities in the Czech Republic, Poland and Slovakia and also in many US universities

13 30 meeting at UT Center for Industrial Services with staff on the Hazardous Waste Extension Program

Thursday, April 17

10 00 Visit to Knoxville's plant of Rohm and Haas Inc This firm produces resins emulsions and other industrial intermediates at a factory in central Knoxville near high density residential and commercial neighborhoods Plant tour and background on Rohm and Haas 'community linkage program '

12 00 attend regularly scheduled noon meeting of the 'Rohm and Haas Citizens Advisory Committee '

13 30 depart Rohm and Haas to Washburn Tennessee and the Narrow Ridge Center for Energy Efficiency

Purposes of the overnight visit a) to learn about alternative energy sources The Center has only self-contained solar dwellings some made of unusual materials (e g , straw bale construction) b) to experience social implications of living "off-the-electric-grid" based on holistic philosophy embracing conservation and simpler lifestyles c) to witness a "land trust" which buys land and imposes covenants under which no power lines may pass over or under the properties of the trust

18 00 supper at Narrow Ridge Center Begin wrap-up discussions for this current phase of the project

Lodging at Narrow Ridge Center in their energy efficient dormitory

Friday, April 18

9 00 depart Narrow Ridge for UT

10 00 Summary discussion for Project Phase 3 and planning for project Phase 4

12 00 lunch on University Center Plaza joining International Food Fest

depart for Knoxville airport for return flight to Czech Republic

PHASE 3 EVALUATION

On the last day of the Tennessee program, the nine Czech participants were asked to provide without self-identification, their overall evaluation of the program, rate the relevance of each of the 22 major components of the two week program, and whether each component should be included in future programs on energy efficiency Tabulated results for evaluation of the Curriculum Development phase are included in Appendix E

Overall evaluation

On a five-point scale which ranged from '*strongly agree*' to '*strongly disagree*'

* eight participants *agreed* (five *agreed strongly*) that "Overall, this program provided information that will be useful to the energy curriculum at my university "
* nine *agreed* (six *strongly agreed*) that "The content of this program was appropriate and clear "
* nine *strongly agreed* that "This program was well organized "

Relevance of content and pedagogy

Participants were also given the opportunity to provide their opinions on the relevance of

content and pedagogy for each of the 22 major activities or components in the two week program Components ranged from an hour in length up to one-half day
Categories of curriculum relevance offered on the Evaluation Form are

* This was mostly irrelevant
* I will probably use something
* I will use some content
* I will use much content
* I will use almost all of this content

Of course participant comments that matter to this project are the last two "I will use much " or "I will use almost all of this content " Examining participant responses note that

* all 22 program components were selected by at least three of the participants falling in category of "using much" or "use almost all" of the content
* 13 of 22 program components were selected by five or more of the nine participants

Said another way, every program element was found useful by at least one-third of the participants, and three-fifths of the program components will be used heavily ("much" or "almost all") by more than half of the Czech faculty

Program components with content that will be heavily used by at least two-thirds of the participants were

- briefings on the organization and management of UT Assessment Center
- the Energy Assessment exercise included in the visit to a local manufacturing plant
- the visit to the Opryland Hotel steam plant and engineering complex with demonstrations of energy efficiency and energy conservation techniques
- visit to the Tennessee Valley Authority Bull Run Steam Plant
- visit to Oak Ridge National Labs
- the afternoon and evening spent at the Narrow Ridge Center

Now add to these elements above, program elements with content that more than half (at least five) of the nine participants will use heavily

- engineering co-op program development
- distance education facilities briefing and actual class
- MarketPlace demo (Internet application of experiential education)
- UT Center for Industrial Services briefing on the Hazardous Waste Extension Program
- Rohm and Haas plant tour

Component inclusion in future programs

Program components found useful to fewer of the participants should not necessarily be dropped as irrelevant To help assess this dimension of program component relevance the Czech faculty were also asked to provide their advice about inclusion of elements in future energy efficiency programs For each of the 22 program components participants were asked to select one of the following statements

* I would definitely retain this module in any future programs in energy efficiency
* This activity was enjoyable or interesting, but peripheral
* This activity should probably be eliminated

Results

* 21 of 22 components were selected for retention by at least one-third of the participants
* 15 of 22 program components were selected by at least 5 of the nine participants as components for "definite retention "

That is nearly all the program was of value to a third of the participants and more than half of the participants were in agreement that 68% of the total content of the two week program should be retained in any future energy efficiency programs

DETAIL PHASE 4 - Implementation Support - May, 1997, in Liberec, Ostrava and Prague

Timing, Location and UT Team

The Implementation Support phase of the project took place in the Czech Republic from May 14 through Wednesday, May 28 1997 The UT Team visited Liberec, Ostrava and Prague to work directly with designated faculty and staff at each of the three Czech universities defined in this project Technical University of Liberec, Technical University of Ostrava and Czech Technical University (Phase 4 detail schedule included as Appendix F)

UT Staff for this phase included Dr Richard Jendrucko, Professor, Department of Mechanical Engineering, Dr Jerry Fryxell, Professor, Department of Management, Dr Robert Counce, Professor Chemical Engineering and Dr David Hake, Professor, Department of Management, all at The University of Tennessee

Schedule

UT group departed Knoxville for Prague on May 14 arriving late afternoon, May 15 Traveled by university-arranged van directly to Liberec Team spent Friday through Monday, May 19 in meetings with Technical University of Liberec (TUL) faculty and area officials Travel to Ostrava by van and train on Tuesday, May 20 Team spent Wednesday through Sunday morning with Technical University of Ostrava (TUO) faculty and area officials traveling by train to Prague Sunday evening Monday and Tuesday, May 26 and 27 included visits with Czech Technical University faculty and staff Team departed Prague Wednesday, May 28

The schedule was arranged so that two full weekdays were spent at each of the three sites Additional weekend days were spent in Liberec and Ostrava as these sites were less familiar to the UT team than Prague

Liberec Activities

Lodging was at Hotel Zlaty Lev near downtown Liberec During four days (two week-days) the principal time was spent with individuals from the TUL Faculties of Power Engineering, Mechanical Engineering and Economics Two or more selected faculty from these departments accompanied the UT team on each of the other visits and for all meals in order to maximize interaction and mutual learning opportunities Strategic visits to other sites were planned as well to illustrate the energy efficiency/environmental management problems and also for the Czech faculty to assess possibilities for case studies with support and suggestions from the UT team

These visits included a plant tour of DIAMO Co uranium mining recovery operation the Liberec Municipal Thermal Plant Crystalex Co plant and acid-rain damage sites in the Iser Mountains and elsewhere

Although the team met well over two dozen persons principal interactions were with the following faculty Dr Jiri Kratochvil Professor and Head, Department of Power Engineering (local coordinator) Dr Miloslav Olehla Professor and Head Dept of Applied Cybernetics Dr Jaroslav Sulc Senior Lecturer Dept of Power Engineering, Dr Hana Stranikova Senior Lecturer Dept of Power Engineering, Professor Jan Ehleman Dean Faculty of Economics and Prof David Lukas, Rector

Professor Stranikova, a participant in the January Workshop implemented the Commons Simulation in one of her classes this Spring semester This is an interactive classroom simulation designed to help students better understand business decision when use of common environmental resources are concerned It is also a pedagogical aid to increase student participation Prof Stranikova was highly pleased with the result and plans to continue using the tool in future classes

In addition Professors Kratochvil Sulc and Olehla indicated their intention to include several project ideas and pedagogies in courses for next academic year Other future outcomes included the following step-wise possibility that illustrates the possible future impact of this project 1) start with new curriculum material as illustrated at UTK in Prof Kratochvil's courses in Power Machines and Equipment Design and Heat and Operations Technology (course module designed at UTK between management and engineering), 2) extend from these courses to others in Power Engineering, 3) extend from Power Engineering to others of the 14 departments of Mechanical Engineering

To assist in development of the course module it is possible that a UTK doctoral student would spend a semester at TUL teaching a course plus developing a case around the brown coal-fired steam plants in Turow Poland and their companion plants just a few kilometers away in Germany These stacks were visible to us from the observatory at Jested Mountain Faculty exchange possibilities (Czech faculty coming to UT for extended periods) were discussed but are not possible due to extreme shortage of teaching faculty and resultant heavy teaching schedule for TUL faculty that remain Distance education possibilities are limited as well for technological reasons

Ostrava Activities

Lodging was arranged at student dormitories of Technical University of Ostrava During five days (two weekend days) the UT team met with several faculty of Power Engineering, had brief interactions with students and faculty from economics/management and other engineering faculties The UT team provided a brief on the energy efficiency/environmental management project to about forty faculty and students Two or more TUO faculty accompanied the UT team on each of several area visits to illustrate the energy efficiency / environmental management problems and also to assess possibilities for case studies and other future collaborations

Visits included trip to wood combustion site in Ostravice, excursion to OKD coal mine visit to Beskydy Mountains and an excursion and discussion with management of the Nova Hut power plant to assess possibilities for energy audit demonstrations as part of course curriculum

Principal interactions were with Dr Pavel Kolat Professor and Head of Department of Power Engineering (local coordinator), Dr Zdenek Toman Associate Professor Department of Power Engineering, Dr Leos Pchalek, Assistant Professor Department of Power Engineering, Dr Jindrich Kaluza, Vice Dean Faculty of Economics, Professor Tomas Cermak Vice Rector and Professor Vaclav Roubicek Rector

Several possibilities for curriculum reform exist at TUO We relate one of the strongest positive examples here

Prof Leos Pchalek described his own experience and excitement caused by immediate inclusion of new material and new teaching techniques in two of his classes upon return to Ostrava after the April 1997 Phase C in Tennessee He explained that he had decided not to incorporate new ideas since it was too late in the semester On his first day back in class a student asked what his impressions were about industry in America His lecture that day was on control systems He decided on the spot to elaborate his lecture with a verbal case study from his visit to the steam plant at Opryland Hotel in Nashville, Tennessee

As Prof Pchalek told his story, you could sense he was remembering the feeling he had in class that day His first example led to spontaneous use of a second and then a third, integrating his East Tennessee experiences between theory He said he lost track of time and when he noticed, he had run 2-1/2 hours for a two hour class He was stunned that the students had not reminded him of the time as they usually would He told us that normally the students were so bored that he dismissed class after 75 or 90 minutes of a 120 minute class Several students told him how much they had enjoyed the class and asked "would you do that again for the next lecture ?"

He did but the next lecture ran to almost three hours before he realized the time Again, the students did not complain He said he really prepared a new approach for the next several lectures and incorporated an interactive experiment designed to encourage questions and he hoped leading to a discussion with his students rather than the traditional lecture-only mode so common in Central and Eastern Europe

Prof Pchalek's description of the result just two classes later indicated that there had been a discussion between he and the students, and even among the students in the class again stimulated by pedagogical encouragement learned during this project He said this had been the first time in his teaching career that students actually took part in class, he saw them participate in their own learning

He explained how he had been recently recruited by industry to leave the university, to earn considerably more money He and his wife had discussed the situation They concluded that some things were worth more than money his recent experience with students in both his classes had strengthened his resolve to build his legacy through higher education

Prof Pchalek's experience also reminded those of us who heard this simple but moving explanation of our own higher ideals Are we teaching or are we taught? In this example I for one gained more than I felt I could offer in return witness to a change in perception

Vice Rector Cermak speaks persuasively on the role of technical education in the long term future of the Czech Republic Technical education lies at the heart of sustainable long term

development of the Czech economy Leadership at TUO is strong and has the capability to nurture and encourage develop more faculty like Prof Pchalek

Czech Tech Activities

Lodging at the Hotel Krystal Professors Jendrucko Fryxell and Counce spent Monday and Tuesday (May 26 and 27) at Czech Tech Prof Hake also spent Friday May 23 visiting with officials at Czech Technical University

Principal time of UT team at Czech Tech was spent with Dr Miloslav Nemecek Professor of Electrical Engineering, (local coordinator) Dr Jiri Tuma Vice-Dean for Research and Science and Professor Faculty of Electrical Engineering, Dr Jan Kyncl Assistant Professor of Electrical Engineering, Dr Karel Kabele Assistant Professor of Electorial Engineering, Dr Miroslava Vrbova, Professor of Applied Physics and Chair Department of Physical Electronics Faculty of Nuclear Sciences (she was Vice Rector when this project began), Helena Fialova, Associate Professor and Vice Dean, Economics Faculty, Marcela Pavlikova Vice Dean of Civil Engineering, Karel Papez, Head, Building Services Faculty, and Professor Vaclav Havlicek the current academic Vice Rector We also met with an official of SEVEn, Marie Havlickova the wife of Vice Rector Havlicek

Outcomes

Czech Tech Professors Tuma Kyncl and Kabele are each planning on integrating components learned in this project in their classes next Fall There is broad support for curriculum reform in many areas at Czech Tech as that university faces the market test of students The economics department is interested also in pursuing a decision-making simulation termed MarketPlace which their faculty team learned about while at University of Tennessee

Specifically, as a result of this project Prof Nemecek told of developing a new technology for co-generation to reduce summer heat/pollution problems to be incorporated in class material as soon as possible Professor Tuma plans to include cases in his courses next fall after witnessing the technique in the January Workshop and also visiting a case class while at UT in April Prof Kyncl initiated a collaboration with Prof Tomek in the management department to initiate a new course combining economy of production and consumption of energy with management of firms in the electrical industry We also learned that Czech Tech has just been asked to lead a new group on energy efficiency for the Association of Producers of Electrical Systems (APES)

Perhaps the most interesting immediate impact of this project was that related to the Energy Assessment Center Concept demonstrated at UT Professor Jendrucko teaches a semester long course utilizing The UT Energy Assessment Center (which he also directs) to help identify firms for the students teams to use as cases and provide a continuing infrastructure for energy efficiency promotion During the semester, student teams visit firms to perform energy audits under the guidance of Professor Jendrucko Teams prepare a report based on their visit showing their analysis of the technical information gained in the field noting areas of concern develop recommendations for improvements in energy efficiency / environmental management practices and strategies for implementation Each team presents their report to the rest of the class and also to the participating firm Several firms are used each semester The UT Energy Assessment Center is one of several federally funded centers in the nation

Upon his return from UT in late April Professor Karel Kabele told us that he decided to try to implement the Energy Assessment Center Concept at Czech Tech He said he realized however that the UT Center was federally funded and federal funding was not very likely any time soon in the Czech Republic He realized he had not only to find Czech firms that would be open to student team audits but also to find funds required to support the experience Enthusiastic but with understandable pessimism he told of calling Ekoplastic a firm of about 100 employees that manufactures plastic pipes for water supply systems in buildings He explained that he wanted them to open their firm to a team of his students to gather information on energy efficiency in their firm for educational purposes The firm would get a copy of their findings To his surprise the firm not only agreed but was enthusiastic about the idea They explained that they had a big waste heat problem but had not had the time to deal with it They would welcome collaboration with the university and would open their company to the student teams They asked how they could help Prof Kabele explained the financial situation and was again surprised when the official offered funds to help underwrite the project They agreed to accept the first student team in February 1998

Buoyed by the success, Prof Kabele called Vagner Plast, another small manufacturing firm which produces plastic bathtubs They also were interested in the energy efficiency assessment idea, agreed to accept a team of students and also to provide modest financial support With two firms and two successes Prof Kabele decided to share the results with university officials and seek their support for pushing ahead with required curriculum reform and potentially, a major new initiative for Czech Tech assisting small area firms in energy efficiency/environmental management

The UT team met with Prof Kabele, Karel Papez, head of Building Services (Kabele's department head) Marcela Pavlikova, Vice-Dean Civil Engineering (Kabele's dean) and Vice Rector Havlicek All were interested in the concept, asked many questions about the UT Assessment Center and declared support of the concept and of their support for Professor Kabele

There is every reason to believe that the Czech Tech Energy Assessment Center

* will proceed and serve as a continuing laboratory for future students,
* will be internally financed,
* will serve an unmet need for small manufacturing firms in the Prague
* and will accomplish these with long-term sustainability and have a long-term positive effect on energy consumption and the environment

Final US-AID Briefing

Prof Hake of the UT met with Mr Jan Pisko AID-Prague Project Specialist at the US Embassy before leaving Prague Also attending the briefing were Douglas McNeal First Secretary for Environment Science and Technology US Embassy and Deborah McGeehon, Second Secretary for Cultural Affairs US Embassy Following a briefing on the project Mr McNeal and Ms McGeehon were highly complementary about what had been accomplished in this project and the network put into place

APPENDIX A

Program from 1996 Prague AUDEM Conference

Alliance Members and Participating Universities

(Participating Organizations are listed on inside back cover)

Academy of Economic Studies Bucharest Romania
Academy of Physical Culture Poznan Poland
Academy of Physical Culture Wroclaw Poland
Agricultural University Godollo Hungary
Agricultural University Nitra Slovakia
Agricultural University Wroclaw Poland
Agricultural University Tirana Albania
American University in Bulgaria Blagoevgrad Bulgaria
Appalachian State University Boone North Carolina
Babes Bolyai University Cluj Napoca Romania
Berea College Berea Kentucky
Bowling Green State University Bowling Green Ohio
Brno Technical University Brno Czech Republic
Budapest University of Economics Budapest Hungary
Bulgarian Academy of Sciences
California State University Fresno California
Canisius College Buffalo New York
Central European University Press Budapest Hungary
Charles University Prague Czech Republic
Christian Brothers University Memphis Tennessee
Clemson University Clemson South Carolina
College of Communication and Media Warsaw Poland
Colorado State University Fort Collins Colorado
Comenius University Bratislava Slovakia
Czech Technical University Prague Czech Republic
Daghestan State University Daghestan Russia
Economics Academy Poznan Poland
Emporia State University Emporia Kansas
Eotvos Lorand University Budapest Hungary
Georgia State University Atlanta Georgia
Haynal University of Health Sciences Budapest Hungary
Higher Medical Institute Sofia Bulgaria
Jagiellonian University Krakow Poland
Jan Evangelista Purkyne University Usti nad Labem, Czech Republic
Janus Pannonius University Pecs Hungary
Kazan State University Republic Tartarstan Russia
Kiev Technical Institute Kiev Ukraine
Kiril and Metodij University Skopje Macedonia
Kliment Ohridsky University of Sofia Sofia Bulgaria
Kossuth Lajos University Debrecen Hungary
Liverpool John Moores University Liverpool England
Lucian Blaga University of Sibiu Sibiu Romania
Lviv Medical Institute Lviv Ukraine
Lviv Technical Institute Lviv Ukraine
Masaryk University Brno Czech Republic
Mississippi State University Starkville Mississippi
Murray State University Murray Kentucky
Northeast Louisiana State University Monroe Louisiana
Northwest Missouri State University Maryville Missouri
Ohio Dominican College Columbus Ohio
Oklahoma State University Stillwater Oklahoma
Palacky University Olomouc Czech Republic
Pazmany Peter Catholic University Budapest Hungary
Polytechnic Institute Cluj Napoca Romania
Polytechnic Institute Timisoara Romania
Polytechnic University Bucharest Romania
Rochester Institute of Technology Rochester New York
Safarika University Kosice Slovakia
School of Veterinary Medicine Kosice Slovakia
Semmelweis University of Medicine Budapest Hungary
Silesian Technical University Gliwice Poland
Silesian University Karvina Czech Republic
Slovak Technical University Bratislava Slovakia
Southern Illinois University Carbondale Illinois
Spiru Haret University Bucharest Romania
St Petersburg State University St Petersburg Russia
State University of New York College at Cortland Cortland New York
Strathclyde University Glasgow United Kingdom
Technical University of Brno Brno Czech Republic
Technical University Budapest Hungary
Technical University Gdansk Poland
Technical University Krakow Poland
Technical University Liberec Czech Republic
Technical University Lodz Poland
Technical University of Kocise Slovakia
Technical University of Zvolen Slovakia
Technical University Ostrava Czech Republic
Technical University Poznan Poland
Technical University Sofia Bulgaria
Technical University Tallinn Estonia
Technical University Wroclaw Poland
Texas A&M University College Station Texas
University of Bucharest Bucharest Romania
University of Cincinnati Cincinnati Ohio
University of Economics Bratislava Slovakia
University of Economics Prague Czech Republic
University of Gdansk Gdansk Poland
University of Georgia Athens Georgia
University of Kansas Lawrence Kansas
University of Ljubljana Ljubljana Slovenia
University of Lodz Lodz Poland
University of Louisville Louisville Kentucky
University of Medicine and Pharmacy Timisoara Romania
University of Memphis Tennessee
University of Michigan Ann Arbor Michigan
University of Mining and Metallurgy Krakow Poland
University of Miskolc Miskolc Hungary
University of Missouri Columbia Kansas City Rolla St Louis Missouri
University of New Orleans New Orleans Louisiana
University of Oklahoma Norman Oklahoma
University of Orebro Orebro Sweden
University of Ostrava Ostrava Czech Republic
University of Plovdiv Plovdiv Bulgaria
University of Silesia Katowice Poland
University of South Florida Tampa Florida
University of Suceava Suceava Romania
University of Tennessee Knoxville Tennessee
University of Transportation and Communication Zilina Slovakia
University of Utah Salt Lake City Utah
University of Vesprem, Vesprem, Hungary
U S Business School of Prague Prague Czech Republic
Vilnius Technical University Vilnius Lithuania
Warsaw School of Economics Warsaw Poland
Warsaw University of Technology Warsaw Poland
Warsaw University Warsaw Poland
Washburn University Topeka Kansas

Front Cover View of the end of the Charles Bridge Prague Photo by Dave Hake

PROGRAM FOR THE *Alliance of Universities for Democracy* SEVENTH ANNUAL CONFERENCE

November 3 - 6, 1996
PRAGUE, CZECH REPUBLIC

—— HOST UNIVERSITY ——
Czech Technical University, Prague

SUNDAY, NOVEMBER 3

12 00 Registration at the Hotel KRYSTAL*

14 30 First set of busses depart from KRYSTAL

15 15 Last busses depart from KRYSTAL

16 00 **OPENING SESSION Bethlehem Chapel****
Presiding Miroslava VRBOVA, Vice Rector, Czech Technical University in Prague and Member Board of Directors Alliance of Universities for Democracy

Official Welcomes
Message from Vaclav HAVEL, President Czech Republic
Jan SOLC Director of the Domestic Policy Department, Office of The President
Charles University Prague
Zdenek PERTOLD, Vice Rector for Education
Czech Technical University in Prague
Jan HLAVICKA, Vice Rector for Foreign Affairs
Alliance of Universities for Democracy
David HAKE, President, Alliance of Universities for Democracy

Introducing New Member Universities
Evans ROTH, Vice President-U S , Alliance of Universities for Democracy and Chair, Alliance Membership Committee

Keynote Address
International Cooperation Key Element in Educational Reforms
Andrzej WISNIEWSKI, Professor Wroclaw Technical University, Wroclaw, Poland, and John W SHUMAKER, President, University of Louisville Louisville, Kentucky

*Conference Hotel Hotel KRYSTAL J Martiho 2/407 160 41 Praha 6 Tel (42 2) 316-2761 Fax (42 2) 316 4215
**Betlemske namesti 5 Praha 1/(Bethlehem Square 5 Prague 1)

18 00 Reception and Buffet Supper Old Building of the Czech Technical University Husova Street, connected to the Bethlehem Chapel

Busses return to Hotel KRYSTAL

MONDAY, NOVEMBER 4 / Hotel KRYSTAL

Visit our EXHIBITOR Central European University Press, Budapest

PROGRAM PLANNING GUIDE
The Conference offers 81 titled presentations in 23 sessions, a Panel, Interest Group and a Workshop In addition the Town Meeting and Annual Business Meeting are open to all participants There are two major themes ***Reforming Higher Education*** (six related sessions) and ***Uses of the INTERNET*** (three sessions and seven Exercise Labs) Conference content is categorized in three broad tracks in an attempt to articulate the Alliance goal to enhance the role of education in promoting democratic institutions economic development and common moral and social values Based on content of scheduled presentations each session is assigned to one or more of three tracks as indicated behind each session title
TRACK A - University and Society - sessions predominantly dealing with values and motivations in democracies and the role of higher education institutions in the regional, national and local communities
TRACK B - Infrastructural Reform - sessions predominantly dealing with improving organizational effectiveness including national legal regulatory or financial reform, higher education restructure, assessment and accreditation and information access and technology
TRACK C - Curriculum Reform sessions dealing with problems and innovations in curricula for education in diverse fields, including philosophy and applied ethics, engineering, business medicine and journalism

ROOM LOCATIONS - meeting room for each session follows the Track designation
Rooms 175, 183, 184 and 186 are on the corridor to the left and behind the Main Auditorium Room 343, if needed, is down the same corridor, take stairs to the left and up two flights of stairs

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8 30 10 00 ***SESSION 1 - Human Values and Motivations in Democracies*** [Main Auditorium]
Presiding Evans ROTH Professor of Cell Biology, The University of Tennessee Knoxville Tennessee
After The Wall, What Have We Learned?
Michael THOMAS, Professor of Marketing Strathclyde University Glasgow United Kingdom
The Role of the Individual in a Democracy
Petr POKORNY Professor Evangelic Theological Faculty Charles University Prague

The Impact of Transitional Changes of Value Systems in Post-Communist Europe Implications for Higher Education Reform
Janek HUSEK Vice Rector, University of Ljubljana Ljubljana Slovenia

10 00-10 30 BREAK

10 30 11 45 ***SESSION 2 -- Human Connectivity and INTERNET***
[Main Auditorium]
Presiding Miroslava VRBOVA Vice Rector Czech Technical University in Prague
INTERNET Strengthening Local and Global Communities
Greg COLE Director Center for International Networking Initiatives The University of Tennessee Knoxville Tennessee
Human Values Doing the Right Things in Cyberspace
Donald RIGGS, Dean, University Library University of Michigan Ann Arbor Michigan

12 00 LUNCHEON Hotel Krystal

13 00-14 00 ***SESSION 3A -- Dimensions of Democracy***
[Track A / Room 175]
Presiding Ryszard POHORECKI Alliance Vice President-Europe and Professor of Chemical Engineering, Warsaw University of Technology, Warsaw, Poland
Democracy Versus Excellence?
Iva PYCHOVA Vice Rector University of Ostrava Ostrava Czech Republic
Democracy and Local Political Elite in Russia
Midkhat FARUKSHIN, Professor and Head, Political Science Department Kazan State University, Kazan Russia
The Development of Civil Society and Higher Education The Case of Romania
Vlad CONSTANTIN Professor Department of International Relations Spiru Haret University Bucharest Romania
Progress in Teaching Business Ethics
Lidmila NEMCOVA Docent Department of Management University of Economics Prague Czech Republic

13 00 14 00 ***SESSION 3B -- Higher Education Reform - I***
[Track B / Room 184]
Presiding Julia WATKINS President American University in Bulgaria Blagoevgrad Bulgaria
Financial Aspect of Reforming Higher Education in Hungary
Andras BENCZUR Professor Institute of Informatics Eotvos Lorand University Budapest Hungary

Starting a Transferable Credits System under EC Supervision
Gheorghe LAZEA Rector Vasile IANCU Vice Rector and Ioan Adrian VIOREL Professor Technical University of Cluj-Napoca Romania

University of Sofia in the Period of Reform
Panayot R BONTCHEV Vice Rector Professor of Chemistry Kliment Ohridsky University of Sofia Bulgaria

13 00 14 00 ***SESSION 3C -- Management and Economic Education and Training*** [Track C / Room 186]
Presiding Ken NASH, Director Office of International Partnerships Rochester Institute of Technology, Rochester, New York

Contemporary Business Challenges for Managerial Education
Jerzy DIETL Chairman Lodz Educational Foundation and Professor of Marketing University of Lodz

The US Business School of Prague An Innovative Approach to MBA Education
Michael VERNARELLI Chair Economics Department Rochester Institute of Technology Rochester New York and Vaclav PROSSER, Dean, U S Business School of Prague, Czech Republic

14 00 BREAK

14 15 15 45 ***SESSION 4A -- INTERNET Uses - I***
[Track A / Room 186]
Presiding Peter CENEK Professor, Faculty of Management Science and Informatics, The University of Transport and Communications Zilina, Slovakia

Friends and Partners
Natasha BULASHOVA Pushchino State University, Pushchino, Russia and Sasha OVCHINNIKOV Research Associate Center for International Networking Initiatives The University of Tennessee, Knoxville Tennessee

The Internet at Russian Universities from Kaliningrad to Vladivostok
H Juergen HESS Public Relations Director Regional Internet Program Open Society Institute Soros Foundation New York New York

Friends and Partners China
Greg COLE Director Center for International Networking Initiatives The University of Tennessee Knoxville Tennessee

Partnership on INTERNET New Opportunities and Trends of Development
Manuella KADAR Head, Foreign Relations Department 1 December 1918 University of Alba Iulia Alba Iulia Romania

Report on AUDEM Website
Evans ROTH Professor of Cell Biology The University of Tennessee Knoxville Tennessee

14 15 15 45 ***SESSION 4B -- Supporting the Higher Education Customer*** [Track B / Room 175]
Presiding David PAYNE, Vice President for Academic Affairs Emporia State University , Emporia, Kansas

Types of Student Advising in American Universities
Robert GOLTRA Director of Student Advising Emporia State University

Intrusive Student Advising at Emporia State University
Robert GLENNEN, President Emporia State University

Funding International Programs for Students in Higher Education A Creative Look
Robert L STANELLE, Career Counselor College of Agriculture University of Tennessee, Knoxville

Reforming of Higher Education to Better Adapt to National Needs
Algirdas VALIULIS, Vice Rector Vilnius Gediminas Technical University, Vilnius, Lithuania

14 15-15 45 ***SESSION 4C -- Innovations in Higher Education***
[Track C / Room 184]
Presiding Jacek GRODZICKI Faculty of Social Sciences, University of Gdansk Gdansk Poland

Western-style Journalism Education in Warsaw An Update
Marek SZOPSKI Director of Curriculum, College of Communication and Media, Warsaw, Poland

New Approach Towards the Education in Media and Journalism in Poland
Teresa SASINSKA KLAS Professor and Head, International School of Journalism Jagiellonian University , Krakow Poland

The Promise of Media Technology in a Democratic Society
R W CARSTENS, Professor, Political Science Ohio Dominican University, Columbus Ohio

Electronic Information Services at the University of Economics
Jiri IVANEK, Vice Rector for Informatics, University of Economics, Prague

15 45 BREAK

16 00 18 00 ***SESSIONS 5A 1 and 5A 2***

16 00-17 00 **5A 1 - PANEL** ***Role of the University in Civic Education Building for Democracy*** [Track A / Room 184]

Panelists
Moderator **Henry STECK** Professor of Political Science State University of New York College at Cortland Cortland New York
Laszlo VASS, Professor of Political Science Budapest University of Economic Sciences Budapest Hungary
David ROBERTSON, Professor Liverpool John Moores University, Liverpool, United Kingdom
John RYDER, Dean, Arts and Sciences State University of New York College at Cortland Cortland New York

17 00 18 00 **5A 2 - Special Interest Group** ***Open Discussion on Organizing Faculty and Student Exchanges between Western and Eastern Universities Problems and Solutions*** [Room 184]
Moderator John RYDER, Dean Arts and Sciences State University of New York College at Cortland Cortland New York

16 00-17 30 ***SESSION 5B -- Higher Education Reform - II***
[Track B / Room 186]
Presiding Tadeusz GRABOWIECKI, Lecturer Faculty of Automatic Control, Silesian Technical University and Chairman, Gliwice City Council Gliwice, Poland
New Programs of Development at UTC and Their Influence on Society
P CENEK I CAP M DADO M DZIMKO Š HITTMAR V HRABOVCOVA Professors, The University of Transport and Communications Zilina Slovakia
Information Technology Curriculum Reform
Jiri ZLATUSKA Dean Faculty of Informatics, Masaryk University, Brno Czech Republic
A New Academic Program for Technical Universities Professional Communication
Alexandru NICHICI, Scientific Advisory and Professor of Mechanical Engineering University Polytechnica of Timisoara, Timisoara Romania
Experience with New Faculty Formation
Marian BABIAK and Stanislav KURJATKO Technical University of Zvolen Zvolen Slovakia
Economic Development and the Position of University Teaching in Hungary
Eugene VARALLJAI Professor and Head Department of Sociology Pazmany Peter Catholic University Budapest Hungary

16 00 17 30 ***SESSION 5C -- WORKSHOP*** ***Business Simulation Over the INTERNET An Integrative Management Training Tool***
[Track C / Room 183]

Coordinator Ernest CADOTTE Professor of Marketing The University of Tennessee, Knoxville Tennessee
Market Place Personal Computer-Based Simulation of New Business Venture
Ernest CADOTTE, author of *Market Place* and Peter MATIS Research Associate, University of Transport and Communications, Zilina Slovakia

18 15 SUPPER Hotel Krystal

20 00-21 15 ***SESSION 6 -- Town Meeting at the Main Auditorium***
An open discussion, questions and comments from all participants, visitors and guests
Moderator Michael THOMAS, Professor of Marketing Strathclyde University, Glasgow United Kingdom

TUESDAY, NOVEMBER 5 / Breakout Rooms, Hotel KRYSTAL

7 00-7 50 ***EARLY BIRD -- INTERNET Exercise Lab - I***
[Room 183]
Exercise labs are open to Conference participants at seven different times today and tomorrow for assisted or independent experimentation / discovery One or more of the following volunteers will be there to assist you during these labs
* Natasha BULASHOVA Pushchino State University Pushchino Russia,
* Sasha OVCHINNIKOV Research Associate Center for International Networking Initiatives, The University of Tennessee,
* Angie CROFT, Research Assistant, Center for International Networking Initiatives The University of Tennessee and
* Greg COLE, Director, Center for International Networking Initiatives, The University of Tennessee

8 00 9 00 ***SESSION 7A -- INTERNET Uses - II***
[Track A / Room 175]
Presiding Sandor FRIDLI Professor Department of Numerical Analysis Eotvos Lorand University Budapest, Hungary
Development of the Information System at Technical Institute of Ostrava Uses of Internet
Premysl TICHY Head of Computer Center Technical University of Ostrava Ostrava-Poruba Czech Republic
Academic High Speed Networking in the Czech Republic
Ludek MATYSKA Research Director Institute of Computer Science Masaryk University Czech Republic

Romanian Academic Computer Network Expectations, Achievements and Open Issues
Ioan JURCA Professor of Computer Science University Polytechnica of Timisoara Timisoara Romania

8 00-9 00 ***SESSION 7B -- Implications of Technology***
[Track B / Room 184]
Presiding Alexandru NICHICI, Scientific Advisory and Professor of Mechanical Engineering University Polytechnica of Timisoara Timisoara Romania
Rapid Technology Implementation A Socio-technical Systems Approach
Ronald T MILLER, President, Automation Management Inc , Asheville North Carolina and Robert K RAMERS, President, Resellers Resources, Inc , San Francisco, California
COMPACTDISK Project The Way for Future Development of Bulgarian Libraries
Alexander DIMCHEV, Research Associate University Library St Kliment Ohridsky University of Sofia Sofia Bulgaria
The Role of a University in a Virtual Organization
Myrna CORNETT DeVITO Kansas International Trade Coordinating Council and Raffaele DeVITO, Professor School of Business Emporia State University Emporia Kansas

8 00-9 00 ***SESSION 7C - Empowering the Consumer***
[Track C / Room 186]
Presiding Oscar FOWLER Associate Professor and Head, Department of Management, College of Business Administration University of Tennessee Knoxville
Learning Opportunity for 'Consumer Report' in Romania
Anghel TAROATA Professor of Marketing Polytechnic University of Timisoara Timisoara Romania
Customer Value for Lipstick Products
Mihaela MAIER Student, Polytechnic University of Timisoara Timisoara Romania
Customer Value for Wristwatch Products
Cataliu BALASESCU, Student, Polytechnic University of Timisoara Timisoara Romania

9 00 9 15 BREAK

9 15 10 45 ***SESSION 8A -- Impediments to a Free Media Is the Honeymoon Over in Central and Eastern Europe?***
[Track A / Room 175]
Presider Frank AYCOCK Associate Professor of Communication Appalachian State University, Boone North Carolina
Is the Honeymoon Truly Over? an Overview
Frank AYCOCK Appalachian State University

Media and Politics in Poland Games without Rules
Tomasz GOBAN KLAS Professor of Management and Social Communication Jagiellonian University Cracow Poland
Media and the Public Sphere in the Post Communist Europe
Teresa SASINSKA-KLAS Professor and Head, International School of Journalism, Jagiellonian University , Krakow Poland
We Have Met the Enemy and He Is Us New Threats to Freedom of Expression in Slovakia
Jan George FRAJKOR, Professor of Communication Comenius University, Bratislava Slovakia

9 15-10 45 ***SESSION 8B -- INTERNET Uses III Using Technology in Instruction*** [Track B / Room 184]
Presiding Robert GLENNEN, President, Emporia State University, Emporia, Kansas
Offering Instruction Over the Internet
Russell MEYER Chair, Division of English and Ed McGlone Dean Continuing Education Emporia State University
Using Hyper Media in the Classroom
Mark CHILDRESS Assistant Professor of Instructional Technology Emporia State University
The Future of Academic Library User Expectations and Demands
Wanda PINDEL, Professor of Libraries, Jagiellonian University Krakow Poland
Preparing Faculty to Use Technologies in Instruction
David PAYNE Vice President for Academic Affairs Emporia State University
Planning and Managing Courses on the Internet A Case Study
Suzanne ACHLEITNER Director of Credit Programs Office of Continuing Education, Emporia State University and W Conkling BUCKLEY, Director of Technology Support School of Library and Information Management, Emporia State University

9 15-10 45 ***SESSION 8C -- INTERNET Exercise Lab - II***
[Room 183]

10 45-11 00 Break - without refreshments

11 00-12 00 ***SESSION 9A -- University and Society***
[Track A / Room 175]
Presiding Tamas MESZAROS Vice Rector Budapest University of Economic Sciences Budapest Hungary
The Global Library Let's Not Forget the Have-Nots
Donald RIGGS Dean University Library University of Michigan Ann Arbor Michigan

Partnerships with the Business Community
Larry McKIBBIN, Dean College of Business Administration Washburn University Topeka, Kansas
The University in the Community Case Study
Dorin STOICESCU Professor Lucian Blaga University of Sibiu Sibiu, Romania

11 00 12 00 ***SESSION 9B -- Organizational Changes to Encourage Research*** [Track B / Room 186]
Presiding Panayot BONTCHEV Vice Rector, Kliment Ohridsky University of Sofia Sofia Bulgaria
Developing a Specific Research Activity Under a JEP
Gheorghe LAZEA Rector, Vasile IANCU, Vice Rector and Ioan Adrian VIOREL, Professor Technical University of Cluj-Napoca Romania
Problems Of University, Science and Industry Co-operation In Transition Period
Edward RYBICKI, Vice Rector International Co Operation and Janus TUROWSKI, Professor and immediate past Vice-Rector International Co Operation University of Lodz, Lodz Poland
Contemporary Scientific Interdisciplinary Complexes as Background of the Higher Education Renovation
Stefan COSTEA Professor of Sociology Spiru Haret University, Bucharest, Romania
New Faculty Creation to Enhance Interdisciplinary Research
Maria CHICAGO Professor Faculty of Social Communication Jagiellonian University Krakow, Poland

11 00-12 00 ***SESSION 9C -- INTERNET Exercise Lab - III***
[Room 183]

12 15 LUNCHEON Hotel KRYSTAL

13 15-14 45 ***SESSION 10A -- Higher Education Reform - III***
[Track B / Room 175]
Presiding Ioan JURCA Professor, University Polytechnica of Timisoara Timisoara Romania
CTU and the Information Society of the Future
Jan HLAVICKA Vice Rector for Foreign Affairs Czech Technical University in Prague
Distance Education in Russia
Alexander A POSTNIKOV Rector International Academy of Modern Knowledge Obninsk Russia
Reform Program of Higher Education and Institutional Development
Florea VOICULESCU Vice Rector 1 December 1918 University of Alba Iulia Alba Iulia Romania
Quality Management in Higher Education
Dorin DRAMBAREAN Professor Lucian Blaga University of Sibiu Sibiu Romania

Problems of Quality Management in Higher Education
Helena VOMACKOVA Professor J E Purkyne University Usti nad Labem Czech Republic

13 15 14 45 ***SESSION 10B -- Curriculum Reform -I***
[Track C / Room 186]
Presiding Eva PYCHOVA, Vice Rector, University of Ostrava Ostrava Czech Republic
Starting a New Program in Slovenia
Kenneth NASH Director, Office of International Partnerships Rochester Institute of Technology Rochester New York
Intelligent Transportation Systems Economic Integration and the Role of Higher Education
Z Andrew FARKAS Professor Center for Transportation Studies Morgan State University, Baltimore Maryland
The DIAL Program at the New School for Social Research
Tim PREWITT, Fulbright Scholar, Babes-Bolyai University Cluj Napoca, Romania
Partners in an International Master's Degree in Library and Information Science
Faye VOWELL Dean and Herbert ACHLEITNER Associate Professor School of Library and Information Management Emporia State University Emporia Kansas
Issues in Journalism Education in Hungary
Antal LEISEN, Professor of Communications Pazmany Peter Catholic University Budapest, Hungary

13 15 14 45 ***SESSION 10C -- INTERNET Exercise Lab - IV***
[Room 183]

15 15 GROUP EXCURSION Busses depart from Hotel KRYSTAL

19 00 Reception and Banquet - STRAHOV MONASTERY (near the main entrance to the Castle)

Busses return to Hotel KRYSTAL

WEDNESDAY, NOVEMBER 6 / Hotel KRYSTAL

7 00 7 50 ***EARLY BIRD -- INTERNET Exercise Lab - V***

8 00 8 45 ***SESSION 11 - Annual AUDEM Business Meeting***
open to all participants and visitors - [Room 175]
Presiding David A HAKE, President Alliance of Universities for Democracy
Reports
Membership Committee Report
Financial Reports Fiscal Year 1995 Fiscal 1996 Budget

Program Report 1996 Program, 1997 Site
Nominating Committee - election of new members of Board of Directors
Other Business
Adjournment

8 45 Break with refreshments

9 00 10 30 ***SESSION 12A -- Curriculum Reform - II***
[Track C / Room 186]
Presiding Dan STEGAROIU Professor Chair, Public Administration Babes Bolyai University Cluj, Romania

A Joint Program with University of Minnesota on Environmental Management
Gheorghe LAZEA, Rector Vasile IANCU, Vice Rector and Ioan Adrian VIOREL, Professor Technical University of Cluj Napoca Romania

Environmental Management Education The Cases of the Danube Delta and Prahova Valley
Alexandru ZANFIR Professor of Marketing and Chair of the Management Council, Spiru Haret University Bucharest Romania

Tasks and Regional Function of the Faculty of Environmental Studies
Vlastimil NOVOBILSKY Rector and Professor, Department of Chemistry J E Purkyne University Usti nad Labem, Czech Republic

Merits and Limits of an MBA in a Polytechnical Environment
Mihnea CONSTANTINESCU Assistant Professor of Nuclear Engineering, Polytechnic University, Bucharest Romania

9 00 10 30 ***SESSION 12B -- INTERNET Exercise Lab - VI***
[Room 183]

10 30 Break without refreshments

10 45-12 00 ***SESSION 13A -- Potpourri of Ideas***
[Track B / Room 175]
Presiding Ray RUSSELL Consultant (Friend of AUDEM, Citizen of the World) Deubach Germany

Bridges for Education Programs in Poland, Lithuania, Ukraine, Bulgaria and Slovakia
Beth CIESIELSKI, Executive Director and Founder Bridges for Education Buffalo New York

Trans World Keypals
Grettle PAYNE Board of Education Emporia Unified School District Emporia Kansas

Extinguishing Ancient and Dormant Real Property Claims
Robert CROLEY President Tennessee Valley Title Insurance Company Knoxville Tennessee

Beyond the Veil of Education The Importance of Interdisciplinary Graduate Programs
Radoslav KOTOROV Chief Financial Officer DeBacker Management Company, Sylvania Ohio

10 45 12 00 ***SESSION 13B -- A Four University Energy Efficiency / Environment Project*** [Track A / Room 186]
Presiding David HAKE Professor of Management The University of Tennessee Knoxville

Energy/Environment Issues at Technical University of Liberec
Jiri KRATOCHVIL Professor and Head Department of Power Engineering Equipment Technical University of Liberec Liberec, Czech Republic

Energy/Environment Opportunities at Technical University of Ostrava
Pavel KOLAT, Professor and Head, Department of Power Engineering, Technical University of Ostrava, Ostrava Czech Republic

The Future Education Schedule of CTU Prague Focussed on Energy Efficiency
Miloslav NENECEK Professor of Electrical Engineering J Kyncl and J Tuma, Professors Czech Technical University in Prague

Problems and Opportunities in Energy / Environment at UT
Richard JENDRUCKO, Professor and Director Industrial Assessment Center, College of Engineering The University of Tennessee Knoxville

Outline of the Energy Efficiency Project
David HAKE, The University of Tennessee

10 45-12 00 ***SESSION 13C -- INTERNET Exercise Lab VII***
[Room 183]

12 15 Concluding Luncheon Hotel KRYSTAL

Thanks for coming and have a safe trip home!

Mark your calendar for
The Eighth Annual *AUDEM* Conference
November 2-5, 1997
Warsaw, Poland
HOST UNIVERSITY
The Technical University of Warsaw

APPENDIX B

Participant Manual for Workshop

Technical Training and Municipal/NGO/University Networking for Energy Efficiency

Energy Efficiency Workshop
January 11-15, 1997
Prague, Czech Republic

Participating Universities

The Czech Technical University in Prague
Technical University of Liberec
Technical University of Ostrava

The University of Tennessee, Knoxville, TN USA
Electrotek, Inc , Knoxville, TN USA
US AID-Prague, CZ

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		Roles of universities	7
		Overview of curriculum issues related to energy	10
		Proposed framework for training	12
Module II	10 45-12 15pm	Linkages to environmental management	14
		Teaching in an open society	18
Module III	1 30-4 00pm	The "Commons Game"	33
		Sunday, January 12, 1997	
Module I	9 00-10 30am	Historical evolution of US environmental and energy laws	48
		Impact on industry and engineering profession	53
Module II	10 45-12 15pm	Role of case studies in environmental and energy laws	60
		Ocean Spray Cranberries, inc	61
Module III	1 30-4 00pm	"Double Death"	67
		Monday, January 13, 1997	
Module 1	9 00-10 30pm	Identification of energy measures	73
		US government programs	77
		Power plant issues	80
Module II	10 45-12 15pm	Financial analysis of selected efficiency measures	82
		Identification of funding sources & financing models	84
Module III	1 30-4 00pm	Opportunities for practice-oriented student training	91
		Overview of UT Industrial Assessment Center Program	92
		Tuesday, January 14, 1997	
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		Next phase scheduling	139
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Toward a sustainable world 145

The tragedy of the commons 153

Statistical measures for management oversight to achieve continuous improvement at Monsanto Chemical Company 168

What leaders really do 175

Management 581 Issues in Environmental Management, Fall 1996 181

Saturday, January 11, 1997

Module I

Introduction of instructors

Roles of universities in promoting energy efficiency and environmental management

US higher education model

Overview of curriculum issues related to energy efficiency and the environment

Training course objectives

Table I: Proposed framework for training

Training Course on Energy Efficiency/Curriculum
Prague, January 11-15, 1997

Instructors

Richard J Jendrucko, Ph D , Professor
Department of Mechanical and Aerospace Engineering and Engineering Science
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The University of Tennessee
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RICHARD JOHN JENDRUCKO 458 Hillvale Turn East, Knoxville, TN 37919, (423)523-7323

Personal Citizenship U S A, S S No 051-36-7508, Excellent health

Current Position Professor, Department of Mechanical and Aerospace Engineering and Engineering Science, University of Tennessee, Director, Industrial Assessment Center, University of Tennessee

Professional Interests Industrial Waste Minimization, Industrial and Building Energy Conservation and Systems Engineering

Education

Ph.D , Biomedical Engineering University of Virginia-1972, M Ch.E , Chemical Engineering, University of Virginia-1968, B Ch.E Chemical Engineering, Manhattan College-1966

Recent Special Training

U S Department of Energy Electric Motor System Performance Optimization Service Technical Training Course, University of Wisconsin, Madison, WI, February 7-9, 1995

Environmental Regulation Training Course, The University of Tennessee Center for Industrial Services, Waste Reduction Assistance Program, Knoxville, TN, October 18, 1994

Pollution Prevention Opportunity Assessment Performance-Based Training Course, Allied Signal Aerospace, Kansas City, Missouri, August 31 - September 1, 1994

Professional License and Certification

Registered Professional Engineer, Texas, No 37133
Tennessee Energy Authority, Energy Auditor Certification, No 79-KN-A11
Association of Energy Engineers, Certified Energy Manager, No 1488

Highlights of Professional Experience

Professor, Department of Mechanical and Aerospace Engineering and Engineering Science, University of Tennessee, 1985-present

Director, U S Department of Energy-sponsored University of Tennessee Industrial Assessment Center (formerly Energy Analysis and Diagnostic Center), September 1983-present, Staff Engineering Auditor, 1979-1983, Conducted over 300 energy and waste audits of small-and medium-sized industrial manufacturers

Director, U S Environmental Protection Agency-sponsored University of Tennessee Waste Minimization Assessment Center, July 1988-1993

Selected Recent Honors and Awards

American Society for Engineering Education Certificate of Recognition for exceptional contributions to the Society, The Energy Conversion and Conservation Division, and the profession of Engineering, 1993

Commendation in recognition of 8 years of service in industrial energy conservation as Director of the University of Tennessee Energy Analysis and Diagnostic Center, U S Department of Energy, June 28, 1991

Society Memberships

Association of Energy Engineers, Senior Member, 1986-present
American Society for Engineering Education.
Chairman, Energy Conversion and Conservation Division, 1990-1991
Vice Chairman, Energy Conversion and Conservation Division, 1989-1990
Secretary-Treasurer, Energy Conversion and Conservation Division, 1988-1989
Program Chairman, Energy Conversion and Conservation Division, 1987-1988

International Experience

Lecturer, Seminar on Energy Conservation and Management, sponsored by the Energy Committee of the Republic of China Ministry of Economic Affairs, Taipei, Taiwan, December 15-19, 1980

Participant, Republic of China-USA Joint Workshop on Industrial Energy Conservation, Taipei, Taiwan, May 5-9, 1980

Selected Recent-Year Publications

Thomas T, Jendrucko, R and J Peretz, "The Distribution of Industrial Waste Generation and Energy Use Characteristics in Available Federal and State Databases," Chapter 3 in Competitive Energy Management and Environmental Strategies, Association of Energy Engineers Books, Atlanta, Georgia, 1995

Jendrucko, R. J, Coleman, T N and T M Thomas, "Waste Reduction Manual for Lithographic and Screen Printers," Training Manual published by the Tennessee Valley Authority for the University of Tennessee Center for Industrial Services, August 1995 (78 pages)

Jendrucko, R. and J G Overly, "Comparison of Energy and Waste Management Costs and Associated Measures for Cost Reduction in Small and Medium-Sized Manufacturing Plants," submitted for presentation at the 18th World Energy Engineering Congress, Atlanta, GA, November, 1995

Additional Recent Professional Activities

Administration and Lecturer, Industrial Energy Conservation and Waste Reduction Workshops, Hazard, Kentucky, March 20, 1996, Nashville, Tennessee, February 28, 1996 and Knoxville, Tennessee, November 29, 1996

Lecturer, Industrial Workshops on Waste Reduction for Lithographic and Screen Printers in Tennessee Knoxville, July 13, 1995, Chattanooga, July 12, 1995, Nashville, July 11, 1995 and Memphis, July 10, 1996

Lecturer, U S Department of Energy, Energy Analysis and Diagnostic Center, Waste Reduction Training Courses, Knoxville, TN, December 6-7, 1993, , Washington, D C , August 9-12, 1994, Baltimore, MD, August 11-13, 1995

GERALD E FRYXELL

PERSONAL INFORMATION

Assoc Professor, Department of Management
408 Stokely Management Center
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Knoxville, Tennessee 37996

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Fax (423) 974-3100
E-mail jfryxell@solar rtd utk edu

Languages Familiarity w/ Spanish, Romanian & Swahili

EDUCATION

Ph D -- Management (Business Policy) 1986
Indiana University--Bloomington, Indiana

M B A 1979
Seidman Graduate School of Business Administration
Grand Valley State Colleges--Allendale, Michigan

M T (ASCP) 1971
Quad-City Hospital's School of Medical Technology--
Davenport, Iowa

EXPERIENCE

University of Tennessee--Knoxville 1986-Present
Director of Strategic Management Group
Core Faculty in Tennessee Institute for Management of Environment
Executive training (Romania, CSFR & Poland under various USIA funded proj)
ISO14000 workshops

Academie Studii de Economice (ASE)-- Bucharest, Romania 1993-1994
TEMPUS program (EU supported program)
Coordinator/Advisor for ASEBUSS (USAID supported business school)
Executive programs w/ International Marketing and Management Institute
throughout Romania

Eastern and Southern African Management Institute--Tanzania 1989-1990
Executive programs in Tanzania & Kenya
Regional training needs assessment study w/ AMTIESA
(an umbrella organization of management training institutes)

Mercy Hospital--Muskegon, Michigan 1972-1979
Clinical Bacteriology, Virology & Chemistry

PUBLICATIONS

Twenty referred articles Academy of Management Journal, Business & Society, Journal of Management, Organization Studies, Journal of Business Ethics
Plus numerous book chapters, reviews and other publications

EXTERNAL GRANTS

United States Information Agency, "Enabling efficient and autonomous action in local governments of four Transylvanian Judets " [$150,000]--Dec, 1995 to Nov , 1996
Funding for strengthening local governments in four Romanian cities and to help mitigate dependency on central administration in Bucharest

National Science Foundation, "Justice norms and productivity in the biotechnology firms" [$25,000]--June, 1992 to May, 1993
Funding for qualitative research in 8 biotechnology firms in the S E and California in order to understand how successful firms reconcile the need to reward scientists as indivuduals while at the same time creating a climate of teamwork

PRESENTATIONS

Twenty eight presentations at national meetings of academics and practioners in the United States, Europe, and Africa

Charles E. Bamford

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Maryville, TN 37803
(423) 983-0802 - Home
Email - Bamford@utkux utcc utk edu
(423) 974-3163 - Fax

Education

The University of Tennessee - Knoxville, TN

- **Ph D** - Final Dissertation Defense - February, 1997
  Major Strategic Management
  Support Areas Environmental Management/ Entrepreneurship

Virginia Polytechnic Institute & State University - Blacksburg, VA

- **M B A** - (Management/MIS) (1993)

University of Virginia (McIntire School of Commerce) - Charlottesville, VA

- **B S** Commerce - (Management/Marketing) (1981)

Northern Virginia Community College - Annandale, VA

- **A S** Business Administration - Summa Cum Laude (1979)

Experience

Teaching

Instructor, The University of Tennessee, Knoxville, TN 1983-Present
Undergraduate - Business Policy and Strategy
Graduate - Environmental Management/New Venture Management

Executive Trainer, Dominion Bankshares Corporation, Roanoke, VA 1985-1988
Adjunct Professor, Roanoke College, Salem, VA 1983-1986
Instructor, Virginia Western Community College, Roanoke, VA 1983-1985

Business

Manager (VP), Business Analysis, Dominion Bankshares Corp 1989-1993
Manager, Corporate Training, Dominion Bankshares Corp 1985-1988
Consultant, Micro Systems Management, Roanoke, VA 1983-1986
Systems Analyst/Programmer, Commercial Union Ins Co , Boston, MA 1981-1983

Publications/Consulting

Three publications authored for the Department of Energy on Environmental Restoration
One publication in refereed journal
Multiple Research projects funded by Lockheed-Martin & DOE regarding environmental technologies/remediation/characterization

Presentations

Seven referred presentations at various conferences

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ROBERT L STANELLE

2521 Kingston Pike #310 Knoxville TN 37919 (423) 673-3224

SKILLS

- Expertise in both the educational and corporate worlds of human resources career services, recruiting, teaching and counseling
- Outstanding presentation skills, leading workshops and seminars worldwide
- Recognized skills in training, counseling and developing effective leaders
- Proven well-rounded and diversified business manager and administrator
- Extensive travel and cross-cultural knowledge

EDUCATION

UNIVERSITY OF TENNESSEE Knoxville TN
Doctor of Education Leadership Studies, May 1996 est Currently ABD
Concentrations in Higher Education and International Education

UNIVERSITY OF TENNESSEE Knoxville, TN
Master of Science, College Student Personnel, August 1994

BALL STATE UNIVERSITY Muncie, IN
Bachelor of Science in Education, June 1965

WORK EXPERIENCE

UNIVERSITY OF TENNESSEE Knoxville, TN

8/93 present *Graduate Assistant, Career Services*

8/94 - 9/95 *Career Development Advisor, Lady Vols*

1/94 - 5/94 *Practicum, Liberal Arts Advising Center Counselor*

8/93 12/93 *Practicum, MBA Advising Counselor*

1992 - 93 **JACKSON COUNTY & THE JOB COUNCIL** Medford, OR
Teacher

1990 - 92 **LOONEY BIN, INC** Tempe, AZ
President

1985 - 90 **REAL ESTATE AGENT** Scottsdale, AZ
Realtor

1984 **CONTINENTAL AIRLINES** Houston, TX
Director of Employment

1983 - 84 **GENERAL DYNAMICS SERVICES COMPANY** San Diego, CA
Manager of Employment

1975 - 83 **DRESSER INDUSTRIES - OILFIELD SERVICES** Houston, TX
Manager, Recruitment and College Relations

ADDITIONAL INFORMATION

Training in Teaching English as a Second Language (TESL/TEFL)
Speak basic conversational Spanish
U S Passport H529847, expires 15 November 1997

Roles of Universities in Promoting Energy Efficiency and Environmental Management

1 Education of Enrolled Students

- Training in the methods of improvement of efficiency in the operation of combustion, mechanical and electrical systems

  Topical Subject Examples
  - Efficient combustion burner design
  - Automatic systems for air/fuel ratio control
  - Minimization of electric motor energy losses
  - Design of variable speed drive systems
  - Minimization of electrical distribution system losses

- Development of a general knowledge base and awareness of

  - The relative availability of natural resources (fuels and manufacturing materials)

  - The increases in energy cost related to availability and user demand

  - The achievement of energy conservation by

    Utilizing state-of-the-art equipment

    Optimal equipment operation and maintenance for achieving peak efficiencies

  - The detrimental environmental effects of energy use in society

  - The need for and development of international and local laws to protect environmental quality

2 Provision of Guidance to Governmental Bodies

- Research results to guide energy and environmental management policy development

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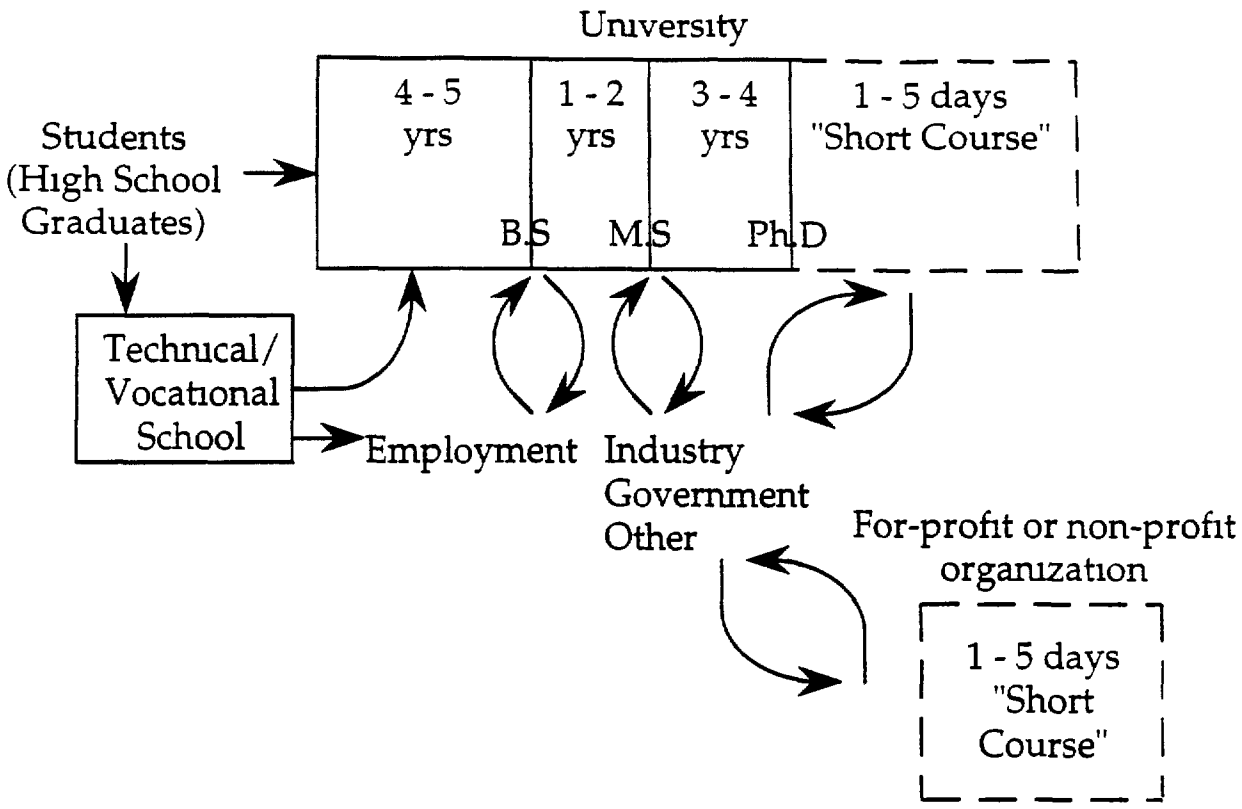
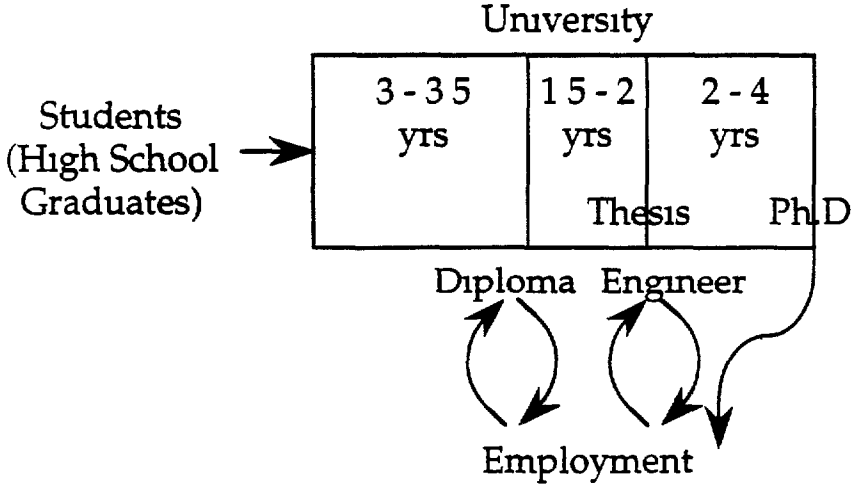
3 Education of the Public

- Awareness of the finite availability and costs of dwindling energy resources
- The degrading effects of energy use on the environment
- Their direct role in
    - Minimizing personal energy use (e g home insulation, use of public transportation)

U S HIGHER EDUCATION MODEL



EUROPEAN HIGHER EDUCATION MODEL



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Overview of Curriculum Issues Related to Energy Efficiency and the Environment

1 Which energy-efficiency-related topics not uniformly included in engineering curricula should be considered for inclusion?

- Resource management assuring materials and energy availability the importance of energy efficiency and environmental management
- Laws having a major impact on the current-day practice of engineering (e g environmental laws)
- The financing of complex energy projects

2 How can such topics be incorporated into curricula not presently containing them?

- Reconfigure a selected set of existing courses to contain the new topical material, the modified curriculum may have the same or a greater number of required courses
- Develop a selected set of new courses treating the new material specifically, offer new courses as
  - electives (students to choose from among offerings) or
  - required new courses (increased number of required courses in curriculum)

3 How can the instruction of students in the indicated non-traditional areas be accomplished most effectively?

- Develop novel educational methods and tools

Training Course Objectives

1 To provide participants with information on a set of subjects needed for the enhancement of technical curriculum course content in the areas of energy efficiency and environmental management including

- Linkages between energy efficiency enhancement and environmental management
- Evolution of energy and environmental laws in developing countries illustrated by the historical evolution of relevant U S laws
- Development of government-sponsored programs for the achievement of energy efficiency and environmental management at the national level illustrated by the description of relevant U S programs
- Generalized methods for the systemic identification and prioritization of energy efficiency enhancement actions
- Economic analysis of proposed energy efficiency measures and approaches for the securing of major energy project financing in developing economies

2 To present and discuss the use of a variety of effective methods for enhancing student training in the fundamentals of energy efficiency improvement and environmental management including

- In-classroom activities
  - Analysis of case studies
  - Simulation exercises
  - Cooperative projects with industry
  - Short courses for industry professionals skills updating
- Supplementary educational activities
  - Industrial internships
  - Government-sponsored outreach activities

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TABLE 1
Proposed Framework for Training
Energy Efficiency Curriculum/January 1997

	Saturday 1/11	Sunday 1/12	Monday 1/13	Tuesday 1/14	Wednesday 1/15
MODULE I 9 00- 10 30 A M	• Introductions • Roles of universities • Overview of curriculum issues related to energy (J sb&f)[a]	• Historical evolution of U S energy and environmental laws • Impact on industry and engineering profession (J)	• Identification of energy measures • US government programs • Power plant issues (J)	• Total quality environmental management (TQEM) (F&b)	• Networking and information exchange (J&S) • Resources (J)
MODULE II 10 45 A M - 12 15 P M	• Linkages to env management (J&b) • Teaching in an open society (S)	• Role of case studies in env management curricula • Case study (B&f)	• Financial analysis of proposed energy efficiency measures • Identification of funding sources & financing models (J)	• ISO 14000 and environmental management systems (F)	• Guidance in course design (Sj&f) • Energy course and outreach program design/marketing (J&s)
	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
MODULE III 1 30 - 4 00 P M	• The "Commons Game" -- (an experiential exercise demonstrating Hardin's thesis and gen approaches to mitigation of env degradation (F&b)	• "Double Death" -- a negotiation exercise associated with resolving an environmental problem (B&f)	• Opportunities for practice-oriented student training (S) • Overview of UT Industrial Assessment Center Prog (J)	• "Play-Doh Simulation" (demonstrates waste minimization in context energy) (B&f)	• Leadership/ Management • Concluding discussions • Next phase scheduling (Visit in March/ April) • Course evaluation (Fjb&s)

[a] Parenthetical letters correspond to session responsibility Capital letter denotes primary responsibility small letter denotes key support role

Saturday, January 11, 1997

Module II

Relationships between energy efficiency and environmental management

Teaching in an open society

- Freedom
- Developing students in higher education
- Cross of life
- Champion creed
- leadership
- Live creatively
- On teaching
- Pedagogical thoughts for teachers in an open society
- The six key questions asked by effective teachers
- Commandments for teaching
- Supplemental material

Relationships Between Energy Efficiency and Environmental Management

1 Energy Harvesting

- Drilling for petroleum, natural gas or geothermal sources
  - Control of leaks, spills, fugitive emissions
  - Non-producing site remediation
- Mining for coal and uranium ore
  - Control of erosion and contamination of land
- Construction of wind-turbine or photo-voltaic farms
  - Minimization of land areas utilized

2 Primary Energy Conversion (Power plants)

- Plant effluents
  - Minimization of stack gas emissions
  - Minimization of thermal pollution (Waste heat)
  - Safe disposition of spent nuclear fuel
- Standards imposed by
  - Lenders
  - Local government
  - International agreements

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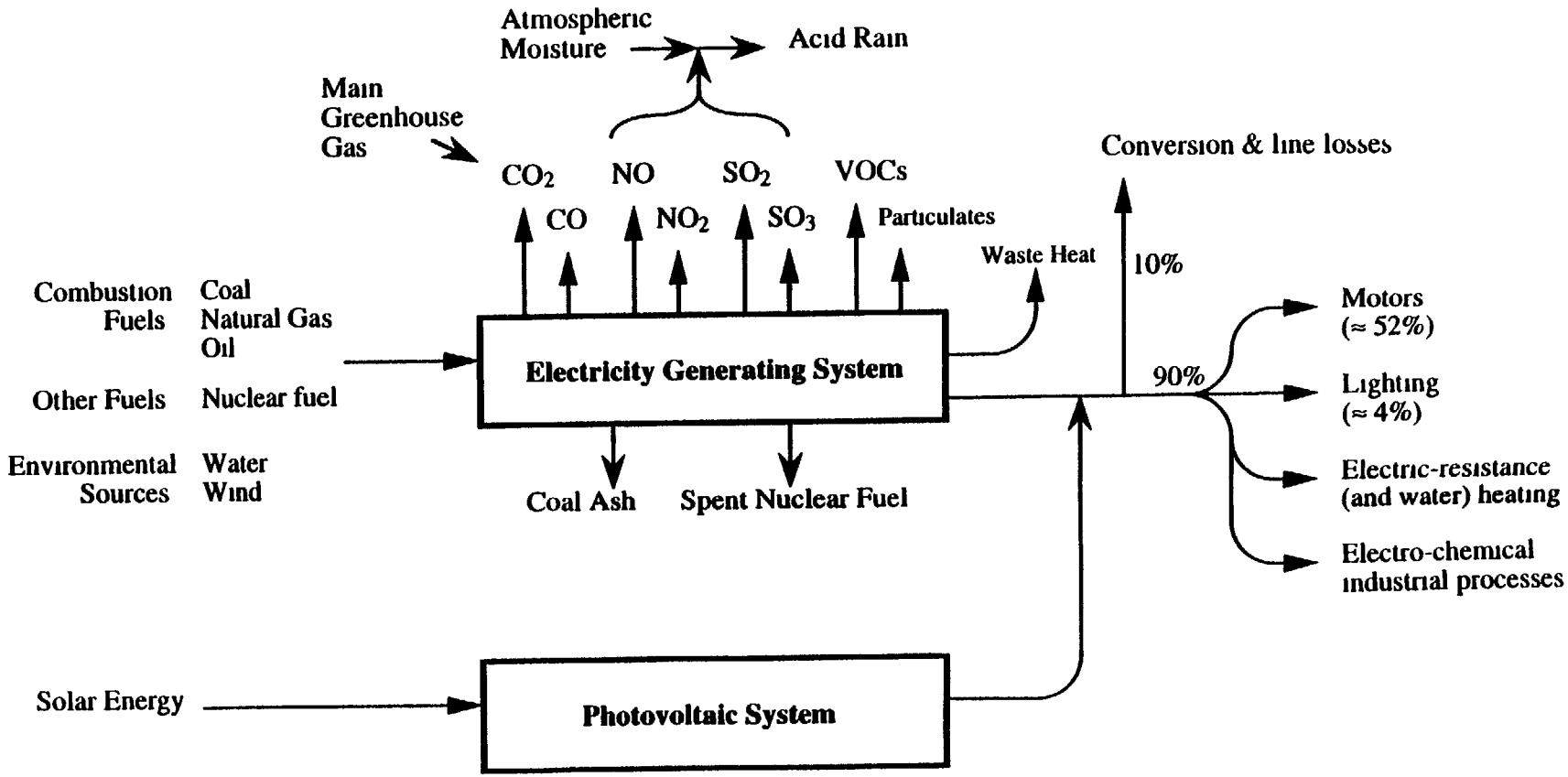
3 Energy Distribution to Points of End-use

- Petroleum liquid and gaseous fuels pumping systems
  - Prevention of piping system leaks
- Coal and nuclear fuels
  - Minimization of losses of radioactive material

4 End-Use of Energy

- Air emissions from combustion of fossil fuels (industrial furnaces and boilers)
  - Maximization of combustion efficiency
- Production of radioactive/hazardous waste

Schematic Diagram of Energy Conversions and Environmental Releases



Examples of Energy Conservation and Waste Minimization Interactions

Measure	Primary Measure of Saving	Secondary Effect
Utilize waste wood in boiler	Displace purchased fossil fuel	Minimize wood waste
Utilize synthetic lubricants	Increase mechanical efficiency	Reduce quantity of discarded oil
Improve lighting efficiency and delamp	Reduce electricity use	Reduce number of failed tubes discarded
Tune-up boiler and maintain efficiency of steam distribution system	Reduce fuel use rate	Reduce unburned hydrocarbons in stack gas
Recover solvent from paint drying oven stacks	Reduce solvent purchases	Reduce consumption of hydrocarbon fuels used to incinerate solvent vapors
Cover heated solvent tanks	Reduce heating energy consumption	Reduce solvent evaporative loss
Minimize product rejects	Minimize product waste	Reduce manufacturing energy

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FREEDOM

"YOU ARE FREE

AND THAT IS WHY

YOU ARE LOST"

(Franz Kafka)

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DEVELOPING STUDENTS IN HIGHER EDUCATION

Gardner's Multiple Intelligences

Linguistic, Musical, Logical Mathematical, Spatial, Bodily-Kinesthetic, and Personal intelligences

Bloom's Taxonomy (Cognitive Domain)

Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation

Alverno Competency Outcomes

Communication skill, Analytical skill, Problem Solving skill, Making Value Judgements, Understanding Interaction, Understanding World Events, and Arts and Aesthetic Awareness

Ewell Model

Cognitive development, Skills development, Attitudinal development, and Behavior after college

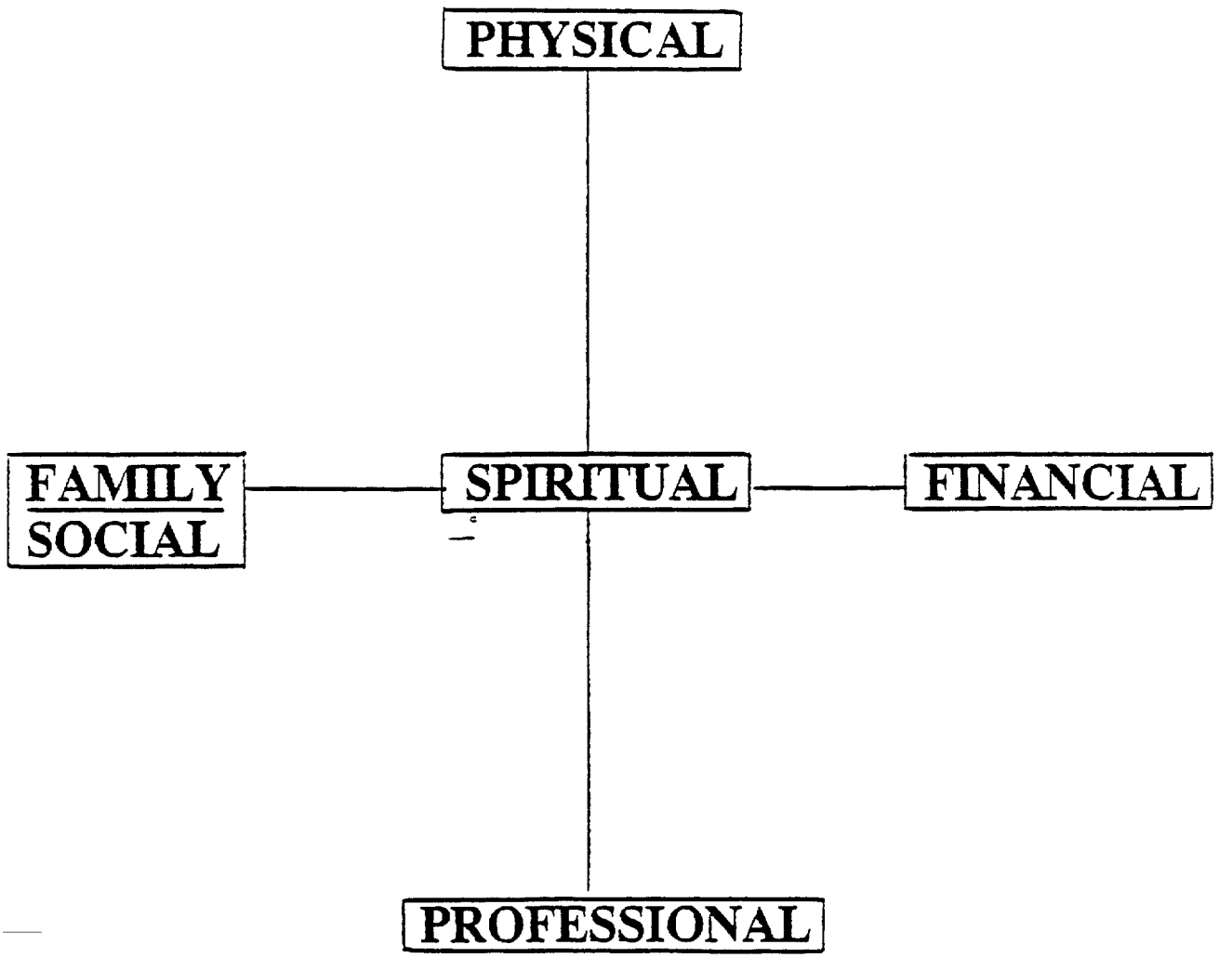
Astin Model

Self Concept, Values, Attitudes, Beliefs, Knowledge, Critical Thinking, Basic Skills, Personal Habits, and Interpersonal Skill

STANELLE'S MODEL FOR LIFETIME SUCCESS OF A UNIVERSITY GRADUATE

Positive work attitudes
Moral values and beliefs
Broad range of knowledge
Specific knowledge in at least one area
Written and oral communication skills
Analytical skills
Problem solving skills
Understanding interrelationships/interaction
Critical thinking and evaluation
Interpersonal skills

CROSS OF LIFE



KEEP YOUR OWN CROSS IN BALANCE

CHAMPION CREED

I AM NOT JUDGED BY THE NUMBER OF TIMES I FAIL, BUT BY THE NUMBER OF TIMES I SUCCEED. AND THE NUMBER OF TIMES I SUCCEED IS IN DIRECT PROPORTION TO THE NUMBER OF TIMES I CAN FAIL AND KEEP TRYING.

LEADERSHIP

Leadership in a civilized society consists of three stages to reach maturity:

1) The mature leader knows the right and responsible thing to do

2) And they do it

3) Even when it is not the easy thing to do

The mature leader knows what they have to do (the right and responsible thing) and they do it, even when it is not the easy thing to do!

Are you a leader?
Do you meet all three criteria?

LIVE CREATIVELY

Be brave enough to live life creatively. The creative is the place where no one else has ever been. You have to leave the city of your comfort and go into the wilderness of your intuition. You can't get there by bus, only by hard work and risk, and by not quite knowing what you are doing. What you'll discover will be wonderful. What you'll discover will be yourself.

(Alan Alda)

ON TEACHING

One can search numerous references on teaching and find unlimited descriptions and definitions of the word "teacher " My favorite is found in one word, "coach " On a daily basis, in the classroom, the techniques of a coach are essential to student learning

Although one could argue all effective teaching involves progression in steps, building on previous knowledge, this is especially true in coaching In baseball, for example, we learn a batting stance, then to swing a bat at an imaginary ball, then a slowly tossed ball, then a faster and faster ball, varying speeds and throwing curves Each added skill is built on the previous foundation, allowing the player to perform well at each new level The coach continually watches for, and takes advantage of, the "teachable moment," feeding needed information and appropriate suggestions at each level, allowing for the attainment of one skill or behavior before moving on, all the while encouraging each player as an individual and fostering confidence at each success The classroom is much like the practice field of the athlete, where each is coached in the techniques that they take into the game As educators, we coach techniques that are taken into the game of life Coach well and each players chance of success is greatly increased, whatever the game

The coach must also serve as the team leader One key to team leadership is the ability to analyze individuals and "match" them to situations in which they can have their best chance for personal success and fulfillment In practice, this means the ability to utilize a variety of teaching methods as appropriate to the individual and the teachable moment The good coach sees each student as bringing with them certain talents, not needing to be taught in the traditional sense, but "coached" in an encouraging environment,

building on their respective talents and allowing them to grow as individuals The coach utilizes analytical ability, situational leadership and the instructional needs of the moment

Individuals learn in many different ways, utilizing one of Gardner's Multiple Intelligences singly or in combinations Learning is often both an intellectual and physical experience, we learn by doing, by taking advantage of the moment, by involving our entire being in the project How each student acts in any situations is a result of their own thoughts, their own needs, their own learning over time, and what they have evolved into being along the way Thus, the effective teacher/coach must recognize and utilize the appropriate technique for the situation before them, always placing concepts and ideas in a context the team or individual player can best identify with It is critical to student learning that practical applications of knowledge are demonstrated, utilizing specific examples of how classroom concepts can be converted to "real life" situations A good coach utilizes a variety of illustrative techniques as appropriate for the moment

In summary, each student is an individual made up of their own unique experiences They learn and grow at their own rate It thus becomes essential to provide education in developmental sequences, allowing room for individual differences, while providing a firm broad-based foundation that fosters understanding of the inter-relationships and multiple applications of concepts and ideas This is the challenge as a teacher and as a coach You can give a young adults a ball and "feed" them for a day, but teach them to play ball and you "feed" them for life Teach them the strategy and inner workings of the ballgame and you create winning players for life and, most importantly, the next generation of coaches

PEDAGOGICAL THOUGHTS FOR TEACHERS IN AN OPEN SOCIETY

1- The best leaders coach Coaching is a leadership imperative

2- Leadership is much like holding a dove

3- Teachers too often want to direct and control They want to be out front rather than coach from behind the scenes

4- The skills required to teach in an open society, in turbulence, are different than the skills that are taught and used in a more closed society In an open society you have to be flexible, adaptive, have a broader perspective, and value and use diversity effectively

5- Teachers must be impersonators, actors, and not just lecturers You must give a multi-layered performance

6- Are your classes a respite? Are you an object that is valuable to encounter? Do students look forward to your class? Or are your classes merely an exercise in intellectual authority? Are you known for giving "a speech without end"?

7- Are you a model for students in how to handle oneself in your claim to position? Or do you simply claim position?

8- Remember, progress and growth are impossible if you always do things the way you have always done things

9- Your definition of who you are, what you are, and how you must do things is your own prison You have built the bars You can choose to set yourself free at any time

10-Courage is the first of all human qualities, because it is the only quality that guarantees all others (Churchill)

11-Teaching with absolute certainty is fine if a teacher can be certain their wisdom is absolute

12-The measure of a teacher is not that they have a difficult task, but how they react to that task

13-What a person can do is entirely different from what a person will do

14-There are only three types of people those who make things happen, those who watch things happen, and those who say, "What happened?" What type are you?

15-Remember the cost of failure versus the rewards of success

THE SIX KEY QUESTIONS ASKED BY EFFECTIVE TEACHERS

"How do you feel about .....?"

"What do you think about .....?"

"Compare ..... versus .....?"

"Tell me about .....?"

"Tell me more?"

"Why?"

The most effective teachers use questions that can never be answered simply "yes" or "no." These teachers ask questions as above that require thought and logic on the part of the individual student, and promote open discussion and creative thinking on the part of the entire class.

COMMANDMENTS FOR TEACHING

THOU SHALT REMEMBER THAT WE TEACH FOR THE STUDENTS

THOU SHALT DEMONSTRATE THE RELEVANCY OF LEARNING

THOU SHALT REMEMBER TO ANSWER THE "WHY" QUESTION

THOU SHALT SET THE GOAL HIGH

THOU SHALT REMEMBER THAT DIAMONDS COME FROM COAL

THOU SHALT REMEMBER THAT LITTLE THINGS MAKE A BIG DIFFERENCE

THOU SHALT REMEMBER TO ERASE ALL QUESTION MARKS

THOU SHALT REMEMBER THAT THE VERY BEST TEACHERS ARE ALWAYS LEARNING

THOU SHALT REMEMBER THE POWER OF COMMUNICATION

THOU SHALT REMEMBER THE POWER OF THE POSITIVE ATTITUDE

THOU SHALT REMEMBER THAT THE TEACHER WINS ONLY WHEN THE STUDENTS WIN

EVERY MORNING IN AFRICA
A GAZELLE WAKES UP.
IT KNOWS IT MUST RUN FASTER THAN
THE FASTEST LION OR IT WILL BE KILLED.

EVERY MORNING IN AFRICA
A LION WAKES UP.
IT KNOWS IT MUST OUTRUN THE SLOWEST
GAZELLE OR IT WILL STARVE TO DEATH.

IT DOESN'T MATTER WHETHER YOU
ARE A LION OR A GAZELLE:
WHEN THE SUN COMES UP,
YOU'D BETTER BE RUNNING.

THE WISEMAN AND THE MAGICIAN

You ask will you succeed? Will you win? Let me tell you a story about a mighty King's adviser, a wise old man whose position and stature was envied by the court magician.

Ond day the sorcerer set a trap for the wise old man. He displayed a little white bird to the King and all the lords and ladies of the court. Then he put the bird in his hands and behind his back.

He turned to the wise old man with triumph in his voice and said, "If you are so wise, is the bird dead or alive?"

The wise man knew if he said alive, the magician would crush the bird in his hands. If he said dead, the magician would let the bird fly away.

The wise man simply replied, "As with any other man, the decision lies in your own hands."

Saturday, January 11, 1997

Module III

COMMONS SIMULATION

COMMONS SIMULATION

SATURDAY--MODULE III

LIST OF MATERIALS
1) PLAYER S MANUAL
2) PROFIT/LOSS TALLY SHEET

PARTICIPANTS STOP AFTER READING 1&2

3) COPIES OF OVERHEADS

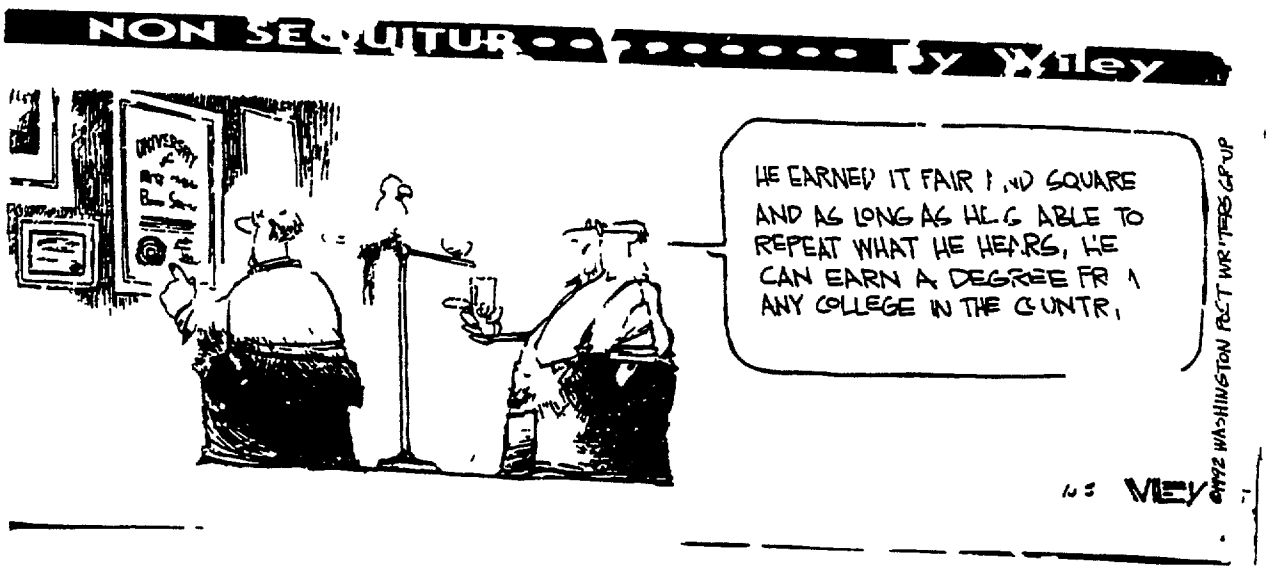


Exhibit 2

PARTICIPANT'S P/L ACCOUNT

TRIAL	CHOICE	SCORE	ADJ	TOTAL FOR TRIAL	CUMULATIVE SCORE
ONLY BLACK, RED OR YELLOW CHOICES IN FIRST 7 ROUNDS*					100pz
1	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____
ALL CHOICES AVAILABLE					
8	_____	_____	_____	_____	_____
9	_____	_____	_____	_____	_____
10	_____	_____	_____	_____	_____
11	_____	_____	_____	_____	_____
12	_____	_____	_____	_____	_____
13	_____	_____	_____	_____	_____
14	_____	_____	_____	_____	_____
15	_____	_____	_____	_____	_____
16	_____	_____	_____	_____	_____
17	_____	_____	_____	_____	_____
18	_____	_____	_____	_____	_____
19	_____	_____	_____	_____	_____
20	_____	_____	_____	_____	_____

Note Cumulative score can go negative up to -50 pazoozas Plants with cumulative balances less than -50 will be closed down pending a review of their financial viability

* Once the yellow option is used, it cannot be selected again -2 points should can be added to all following trails under 'adjustments'

BEST AVAILABLE COPY

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PLAYERS MANUAL
COMMONS SIMULATION

RULES

(1) YOU MAY TALK FREELY TO THE OTHER MANAGERS IN YOUR PLANT BUT DO NOT TALK TO MANAGERS FROM OTHER PLANTS UNLESS GIVEN EXPLICIT PERMISSION!!!

(2) STAY ON THE SAME TRIAL AS EVERYONE ELSE!

(3) FILL IN ALL THE INFORMATION ON YOUR TALLY SHEET

OBJECTIVE

You (and your team members) comprise the top management team of a sizable manufacturing facility in Kivulini-- a country which is expected to experience rapid industrialization because of its low-wage structure and loose regulations You and your team are somewhat troubled because you know that the financial performance of your plant has been discussed at headquarters and they have quite bluntly informed you that they expect higher returns on their invested capital You are uncertain about whether the plant will be closed if your plant's profitability doesn't improve, but you are quite sure that your own compensation and career track in the company are related to the financial performance of the plant Currently your team has 100 pazoozas--the currency of Kivulini--in uncommitted funds

Your plant along with a number of other plants, is located on a large inland freshwater lake, Lacul Gunoi upon which there are two cities (Porto Deano and Mji ya Ian) with a combined population of about 200,000 people Importantly, all the plants (and the cities) desire a continuous, unpolluted source of water for their manufacturing processes (and quality of life as all of you live nearby the lake) Currently, while water quality has deteriorated noticeably in the last few years, the water is still acceptable The lake has a restricted outlet and does replenish itself, but within limits

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Unfortunately while each plant needs a good source of water, each releases a number of toxic pollutants into the lake Currently, neither the national nor local governments regulate either the amount of water taken from the lake or the amount of waste released into it Consequently, the condition of the lake is determined mainly by the plants themselves

PROBLEM

In sum the problem facing you as a plant management team is, "How do we profitably operate our plant when our process is dependent on the lake as a public resource?

PROCEDURE

You will be confronted with a series of decision opportunities (trials) in which you must choose a course of action regarding your use of the lake water Your management team may choose among five options prior to each trial (among three options initially)

(1) RED--you continue to use the lake water as you've always used it--releasing the toxic byproducts into the lake

(2) BLACK--recognizing the deterioration of water quality, you limit pollution into the lake (e g by storing it treating it, cutting back on production, or subcontracting its removal) Should the opportunity present itself to discuss this problem with other plant managers, choosing black implies compliance with any agreements or understandings to reduce levels of lake pollution

(3) YELLOW --you take unilateral, technical measures to make your process less dependent on lake water and, as a result, less dependent on the actions of the other plants

(4) BLUE (Available only after round 7)--you expend financial resources to enable a third party or agency to institute fines for polluters in the next trial (i e , those choosing red)

(5) ORANGE (Available only after round 7)--you use financial resources to enable an association to reward the most cooperative team in the next trial (i e , the team which has chosen black most often)

Note that only black, red and yellow choices are available during the first 7 trials

Each choice has financial outcomes

RED and BLACK. Financial outcomes associated with black and red choices depend on how many plants used those approaches For example, if all plants on the lake limit their pollution (i e , by choosing black), every plant will benefit by having cleaner water However if a single plant reduces pollution while all other continue to pollute (i e by choosing red), that single plant would incur the costs of reducing pollution with little benefit Conversely, if all plants but one reduce their pollution by choosing black, the one rogue plant which continues to pollute by choosing red will accrue benefits from being a "free rider

In addition to being dependent on the pattern of choices, payoffs are also dependent on the quality of the river Of course, as the water quality deteriorates all plants production processes will suffer Conversely, as water quality improves all benefit

Red choices will cause degradation of water quality The facilitator will announce how many peg movements downward will attend each red choice (usually one or two, depending on the size and composition of the group) Black choices, on the other hand, neither degrade nor improve water quality Water quality is only improved by natural processes, the lake water is flushed out by the annual, and often heavy, Spring rains

The status of the lake will be shown by the location of a marker on a board, strip or blackboard The marker will move up or down as the status of the lake changes Every five trials, the peg will be moved up as a consequence of the natural restoration of the lake

These two influences (i e , the number of plants polluting and water quality) are incorporated into different payoff matrices) The facilitator will display the correct payoff matrix corresponding the condition of the lake prior to each decision period (the simulation begins with the payoff matrix "0" (which represents water that is just "adequate" for your production processes The payoff matrix will be changed as water quality either improves or deteriorates) For example assume that water quality has deteriorated somewhat over a number of trials so that water quality is "-2 " In this event the "-2" matrix would be displayed for the next decision and would then be used to calculate the payoffs for those plants selecting either the red (pollute) or black (cooperate) options

YELLOW The yellow alternative (reduced dependence) costs a fixed amount of 20 pazoozas in the trial it is chosen However this choice adds 2 pazoozas onto whatever you earn or lose for the remainder of the simulation This return takes effect three trials after the investment The reasoning is that R&D used to develop a process which is less dependent on lake water will cost the company initially in the developmental phase but have a future payoff after an implementation phase Yellow may only be chosen once, however after three implementation trials the 2 pazooza payoff from choosing Yellow continues throughout the game (While there is some inconsistency in playing red after choosing yellow, for simplicity--at least during the first few attempts at conducting this simulation--this bonus is best granted regardless of the option selected)

BLUE & ORANGE The blue alternative (fines) and orange (reward) alternative each cost 3 pazoozas (i e , the resources expended by your plant to initiate a third party agency, or association which enforces the fines and to gives rewards) in each trial it is chosen The effect of the blue choice (i e , the fine) is that it takes away all pazoozas that red choosing firms would have had if the fine had not been imposed and imposes a 5 pazooza fine However, just as in the real world not all polluters

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are caught In this case polluters are caught about 25% of the time (actually a very high rate of enforcement effectiveness) Consequently, enforcement will be determined by double coin toss by the facilitator, with two consecutive heads required to catch the polluting factory Those who are caught will have their identity made public by the facilitator (those not detected keep their anonymity) To keep things simple in the event that two or more teams choose blue, we maintain the 25% catch rate arguing that the extra resources are used up in 'administrative overhead '

The orange choice rewards the cleanest plant by adding 5 pazoozas onto the pazoozas already earned by the plant that has chosen black the most often at that point in the simulation In addition they will receive the "Green Award ' which they can proudly display until the next time it is awarded The facilitator will announce the winner of the award Ties between two or more teams will be resolved by a coin toss lottery or by placing the resources in a pool for future use (in the event there are no ' stand outs" as determined by the facilitator)

The effect of these choices is summarized below

"Commons" Game

Costs & Earnings Schedule

Color	Earnings/Costs for Team	Consequences for Other Plants	Lasting Effects
Red	See Payoff Matrix	—	—
Black	See Payoff Matrix	—	—
Yellow	20 Pz	—	+2 to Team starting 3 trials after investment
Blue	3 Pz	Red" Plants 5 Pz fine & loss of payoff*	
Orange	3 Pz	Most Exemplary Plant +2	

*If caught (determined by double coin toss)

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SPECIAL TRIALS

At round 5 an appeal to conscience is recommended Such an appeal will consist of the government of Kivulini stating that they have become aware of a pollution problem on Lacul Gunoi and asking all plants on the lake to please reduce their pollution levels It is important to point out that such an appeal implies no consequences or enforcement whatsoever

Before round 8 a conference will be permitted among the plant representatives [NOTE The form of these conferences may vary based on the preferences of the facilitator It is also possible to double the payoffs if desired to place additional pressure on the groups to devise a solution The facilitator will announce if any options are in effect] Other conferencing trials are indicated on the instructor s log sheet

INDICATING YOUR CHOICE

Your management team will indicate your choice when the facilitator or assistant comes by your plant (a color chip is stapled in your simulation folder—you may choose to point to the color of your choice) The simulation will continue until it is terminated by the facilitator

RECORD KEEPING

Each plant's management team will be given a profit/loss statement for recording the payoff obtained for each trial and for keeping track of their cumulative gain (or loss) A copy of this profit/loss sheet is provided in Exhibit 2 At the beginning of the simulation, the cumulative score is set at 100 which reflects the amount of pazoozas you have available

"Commons" Game

Posting Results

PLANT #	CUMULATIVE SCORE (pz)	#BLACK	#RED	#ORANGE	#BLUE	#YELLOW

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PLEASE!

DO NOT TURN
THIS PAGE UNTIL
AFTER
COMPLETING THE
SIMULATION

THE TRAGEDY OF THE COMMONS
(Hardin, 1968)

Each man is locked into a system that compels him to increase his head without limit-- in a world that is limited Ruin is the destination toward which all men rush each pursuing his own best interest in a society that believes in freedom of the commons Freedom in a commons brings ruin to all

Hardin G 1968 Tragedy of the Commons
Science 162. 1263-48

- WHAT IS A COMMONS?
  - EXAMPLES?
  - WHAT IS COMMONS IN SIMULATION?
  - EXAMPLES RELATED TO ENERGY?
- WHAT HAPPENED TO THE COMMONS?
- WHY DID THIS HAPPEN?
- UNDER WHAT CONDITIONS?
  - PROSPECT OF INDIVIDUAL GAIN FROM EXPLOITING COMMONS EXCEEDS COSTS WHY?
  - INDEPENDENT CALCULUS WITH INTERDEPENDENT USAGE
  - ROLE OF DEVELOPMENT >>> see OVH
  - ABSENCE OF "MUTALLY COERCIVE' MECHANISMS AGAINST
- ARE TECHNICAL SOLUTIONS THE ANSWER TO COMMONS PROBLEMS?
- WHAT OTHER TYPES OF SOLUTIONS ARE POSSIBLE?

CONDITION OF COMMONS	PERCEIVED INDIV BENEFITS	PERCEIVED INDIV COSTS	SHARED SOCIAL COSTS
4			
3			
2			
1			
0			
1			
-2			
-3			
-4			
-5			
-6			
7			

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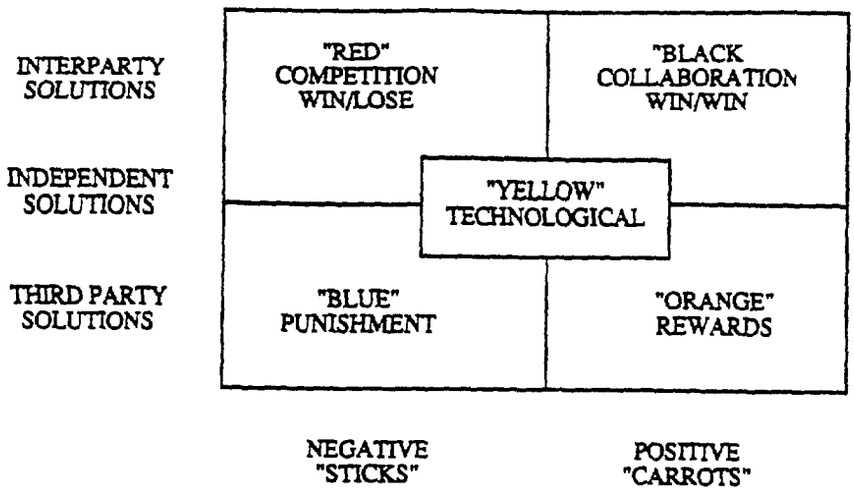
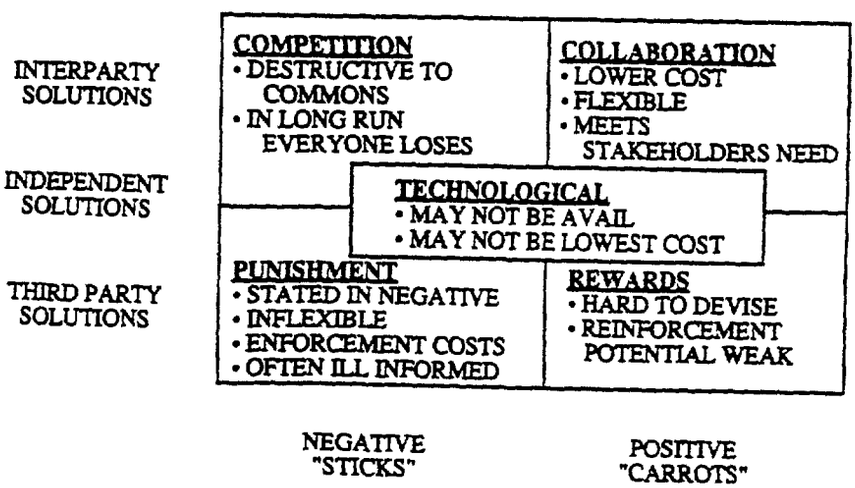
Interorganizational Postures in Commons Simulation



Merits of Various Approaches to Commons Problem



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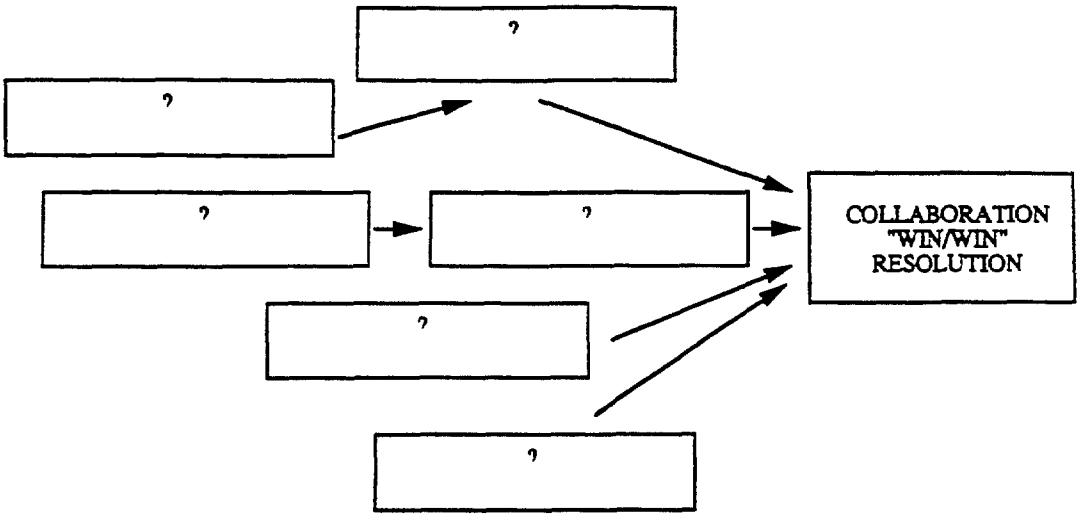
A MODEL PREDICTING COLLABORATION
FOR MAINTAINING THE "COMMONS"



REVIEW OF STRATEGIES FOR SAVING THE COMMONS

- PRIVATISATION -- Make it not a commons
- SUBSIDIZATION -- Public pays to mitigate social costs
- LEGAL RESTRICTIONS -- Limit access/use of commons)
  STATUTORY LAW
  ADMINISTRATIVE LAW
- MARKET INTERVENTIONS -- Incorporate social costs into economic calculus
- BEHAVIORAL CHANGE -- Educate people re social costs, interdependence, & moral and ethical obligations
- INSTITUTION BUILDING -- Institutional arrangements to promote collaboration (e g , industry associations, changes in corporate governance, stakeholder management; voluntary consensus standards)

Sunday, January 12, 1997

Module I

Historical evolution of US energy legislation

Provisions of the Energy Policy Act (1992)

Historical evolution of US environmental law

Provisions of the Clean Water Act (1972, 1977, 1987)

The provisions of the Resource Conservation and Recovery Act (1976, 1984)

Provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (1980, 1986)

The provisions of the Clean Air Act (1990)

Material safety data sheet

Impact of environmental laws on industry

Historical Evolution of U S Energy Legislation

1873 Coal Lands Act
This act outlines the terms by which the government will buy lands containing coal from private owners

1910 The Bureau of Mines Act
This act establishes within the Department of Interior a bureau of mining, metallurgy and mineral technology The bureau is responsible for investigating the preparation, treatment and utilization of mining materials and increasing the safety, efficiency and economic impacts of this industry

1920 Federal Water Power Act (Federal Power Act)
This act created the Federal Power Commission and grants it the authority to investigate the utilization of water resources and issue licenses for the construction of dams, conduits and reservoirs

1935 Federal Power Commission
This act imposes regulations on utility companies to improve their management structure and to monitor their economic situation

1938 Natural Gas Act
This act allows the government to set pricing rates for the natural gas industry and to review the natural gas companies to improve their business operations

1946 Atomic Energy Act
This act provides for the use of atomic energy for peaceful and military purposes and to oversee the facilities involved in the processing and utilization of atomic energy

1975 Energy Policy and Conservation Act
This act creates a Strategic Petroleum Reserve that reduces the effect of severe energy supply interruptions It promotes increasing the energy efficiency of motor vehicles and major appliances and conserving water through improving plumbing products and appliances The measure also outlines the need to conserve natural gas supply by depending more heavily on coal resources

1976 Energy Conservation Standards for New Buildings Act
This act identifies the wasteful consumption of energy used for heating, cooling, ventilation and providing hot domestic water in newly constructed buildings that lack adequate energy conservation features The measure explains federal standards that can reduce unnecessary energy consumption and holds residential and commercial buildings responsible for implementing these recommendations

1987 National Appliance Energy Conservation Act
This act applies the policies and standards of the Energy and Conservation Act to residential appliances

1988 Federal Energy Management Improvement Act
This act initiates a survey of government buildings and provides for the improved maintenance and operation of these facilities to reduce associated energy consumption

1989 National Energy Policy Act (National Energy Conservation Policy Act)
This act implements a program that includes site visits and technical briefings to inform the government about the implementation of conservation measures

1989 Renewable Energy and Energy Efficiency and Technology Competitiveness Act
This act introduces a national program to ensure the stability of a future energy supply The program includes making technology cost competitive, allowing for long-term federal research programs, motivating private sectors to use new technology and beginning research and development programs in the private sector

1991 National Energy Policy Act (National Energy Conservation Policy Act)
This act promotes the use of energy efficient lighting and more efficient means of heating, cooling and solar space conditioning This measure also provides for the use of demonstrations, new employees and managers to successfully implement these requirements

1992 National Energy Conservation Policy Act
This act expands upon the National Energy Conservation Policy Act of 1991 by offering detailed suggestions and policies for certain facilities and industries

Provisions of the Energy Policy Act (1992)

- Building Energy Efficiency Standards (new federal, commercial and residential buildings)
  - Building shell insulation requirements
  - Heating and cooling system operating efficiencies
  - High R-factor windows
  - High-efficiency appliances

- Lighting
  - Raises the minimum allowable efficiency (particular sources)
  - Fosters training, education and research (Energy Efficient Lighting and Building Centers)
  - Reduces the taxability of utility rebates
  - Labeling (Lamp efficiency)

- Mortgages for Energy Efficiency Improvements
  - The Department of Housing and Urban Development can make 100% home loans for financing the installation of energy efficiency improvements (including insulation, windows and doors, heating and cooling systems)

- Appliances and Motors (Efficiency standards and labeling rules)
  - Electric motors
  - Electric water heaters
  - Electric air conditioners and heat pumps
  - Furnaces and boilers

- State Programs
  - Energy conservation program

- Federal Energy Management Program

- General Services Administration
  - Energy management in leased space

- Performance Contracting for Energy Efficiency Improvements
  - Provides the legal framework to facilitate federal agencies in the securing of private sector financing via "energy savings performance contracts", costs for improvements obtained from energy savings

- Alternate Fuels
  - Natural gas-powered vehicles
  - Electricity-powered vehicles

- Electricity Policy (Utilities)
  - Promotion of energy efficiency
  - Integrated resource planning
    - new generating capacity
    - power purchases
    - energy conservation and efficiency
    - cogeneration and district heating and cooling applications
    - renewable energy resources
  - Life cycle costing
  - Demand side management

- International Issues
  - Markets
  - Renewable energy
  - Global warming

- Taxes and Revenue Provisions
  - Energy conservation and production incentives
  - Utility subsidies
  - Clean fuel vehicle deduction
  - Solar and geothermal property investment credit
  - Local furnishing of electric energy or gas
  - Electricity produced from wind and closed-loop Biomass
  - Alcohol fuels
  - Employer-provided transportation benefits
  - Depletion/intangible drilling costs
  - Other incentives

- Industry and Economic Growth
  - Promotion and commercialization of attractive new emerging energy technologies via
    - Research and development
    - Application and demonstration programs

Historical Evolution of U S Environmental Law

1910 Insecticide Act (Ineffective products)

1947 Federal Insecticide, Fungicide, and Rodenticide Act (Registration and labeling) amended 1972 Federal Environmental Pesticides Control Act (Health and environment), 1975, 1978, 1980, 1988

1967 Air Quality Act (Air emissions) amended 1970, 1977, 1990 (Clean Air Act)

1969 National Environmental Policy Act (Need for national policy)

1970 Establishment of the Environmental Protection Agency

1970 Occupational Safety and Health Act (Occupational exposure to hazardous environments)

1972 Federal Water Pollution Control Act (Wastewater) amended 1977, 1987

1974 Safe Drinking Water Act (Drinking water)

1976 Resource Conservation and Recovery Act (Hazardous waste management) amended 1984, 1992 Federal Facility Compliance Act (Requirements for government)

1976 Toxic Substances Control Act (Toxic chemicals) amended three times (Asbestos, Radon, Lead-based paint)

1978 Uranium Mill Tailings Radiation Control Act (Remedial action to control tailings)

1980 Comprehensive Environmental Response, Compensation and Liability Act (Superfund - Inactive hazardous waste sites) amended 1986 Emergency Planning and Community Right-To-Know Act (Emergency preparedness, Hazardous chemical information dissemination)

1982 Nuclear Waste Policy Act (Development of disposal repositories)

1990 Oil Pollution Act (Oil spills)

1990 Federal Pollution Prevention Act (Strategy to promote source reduction)

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Provisions of the Clean Water Act
(1972, 1977, 1987)

- Prohibition of discharges, except as in compliance with the Act
- Permit program authorizing and regulating certain discharges
  - National Pollutant Discharge Elimination System (NPDES) Permit Program
    - Permits issued by EPA or authorized states
    - Required for discharge of a pollutant from a point source (e g industrial process water, non-contact cooling water, storm water runoff) to waters of the U S
  - Self-monitoring
- System for determining the limitations to be imposed on regulated discharges
  - Requirement to meet treatment levels based on the capabilities of treatment technologies that are technologically and economically achievable in the discharger's particular industry
  - More stringent requirements may apply when necessary to achieve water quality goals for a particular body of water
- Municipal Wastewater Treatment Programs
- The Dredge and Fill Permit Program
- System for preventing, reporting, and responding to spills
- Process for cooperative federal/state implementation
- Strong enforcement mechanisms

The Provisions of the Resource Conservation and Recovery Act (1976, 1984)

- Definitions

  Solid waste potentially any waste regardless of its physical form

  Hazardous waste a solid waste or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or incapacitating illness or pose a potential hazard to human health or the environment when improperly managed

- EPA publishes regulations identifying hazardous wastes by

  Lists of specific chemicals specific sources (e g petroleum refining wastes), commercial chemical products (e g acetone), nonspecific sources

  Characteristic hazardous wastes ignitability, corrosivity, reactivity and toxicity

  - Certain designated solid wastes (e g utility waste from coal combustion, household waste) are exempt from classification as hazardous wastes

  - Mixtures of solid and hazardous wastes are considered hazardous

  - A waste that is derived from the treatment, storage or disposal of a hazardous is considered hazardous

  - Companies can file a "delisting petition"

- "Cradle-to-grave" controls for hazardous wastes on generators, transporters, owners and operators of treatment, storage and disposal facilities generators and transporters have labeling, handling and manifest requirements

- Treatment, storage and disposal facilities must comply with minimum technology requirements, groundwater monitoring and a prohibition on the land disposal of hazardous wastes

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Provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (1980, 1986)

("Superfund")

- Applicable to situations involving the past disposal of hazardous substances

- Provides EPA with the authority to clean-up inactive hazardous waste sites and to distribute the clean-up costs among the parties who generated and handled hazardous substances at these sites

- Details the procedures and standards which must be followed to achieve site remediation

- Hazardous Substance "Superfund"

  - Funds from
    - Special taxes on petroleum and chemical industries
    - General environmental taxes on industries
    - General tax revenue

  - Funds expended to pay
    - EPA's cleanup and enforcement costs
    - Private party claims for clean-up costs not recovered from facility owner or operator

  - Costs of clean-up to be paid by "responsible party(s)"

- Superfund Amendments and Reauthorization Act (SARA, 1986)

  Title III Emergency Planning and Community Right-to-Know Act

  - Emergency planning
  - Emergency release notification
  - Community right-to-know reporting facility owner or operator must prepare or have available material safety data sheets (MSDS) for hazardous chemicals
  - Toxic release inventory annual reporting on emissions of toxic materials to air, water and land (SARA Form R)

The Provisions of the Clean Air Act (1990)

Title I	Strengthens measures for attaining air quality • National Ambient Air Quality Standards to limit air pollutants SO_2, NO_2, CO, O_3, lead and particulate matter
Title II	Expands provisions relating to mobile sources
Title III	Restructures the regulation of hazardous air pollutants
Title IV	Requires substantial reductions in power plant emissions for control of acid rain • Emission allowance and trading program for SO_2
Title V	Establishes operating permits for all major new and existing sources of air pollution (Administered by the States) • "major sources" defined as those emitting as little as 10 tons/yr
Title VI	Establishes provisions for stratospheric ozone protection • Requires complete phase-out of chlorofluorocarbons (CFC's) and halons
Title VII	Expands enforcement powers and penalties • Penalties of up to $25,000/day for violations

MATERIAL SAFETY DATA SHEET
SOLVENT KLEENE, INC
131½ LYNNFIELD STREET
PEABODY, MA 01960

D-GREEZE 500 RECYCLABLE

SECTION 1 - PRODUCT IDENTIFICATION & EMERGENCY INFORMATION

PRODUCT NAME.	D-GREEZE #500
DESCRIPTION	INDUSTRIAL DEGREASING SOLVENT CLEAR COLOR LOW VISCOSITY LIQUID, MILD ODOR
EMERGENCY TEL	(508) 531-2279 (508) 531-1686

SECTION II - HAZARDOUS COMPONENTS

INGREDIENT	HYDROCARBON COMPOUND
DOT	NON-FLAMMABLE, COMBUSTIBLE LIQUID NO SARA LISTED CHEMICALS PRESENT NON-CARCINOGENIC, VERY LOW ORDER OF TOXICITY
OSHA.	COMBUSTIBLE LIQUID, NON FLAMMABLE DEFINED BY 29CFR, 1910 1200 SECTION (i) TRADE SECRET FORMULATION

FOR ADDITIONAL INFORMATION SEE SECTION V

SECTION III - PHYSICAL DATA

BOILING POINT	351°F - 392°F	RELATIVE EVAPORATION	0 08
FLASH POINT	142°F	STATE.	LOW VISCOSITY LIQUID
SOLUBILITY IN WATER	NONE	VAPOR DENSITY	5 4
SPECIFIC GRAVITY	0 76	PERCENT VOLATILE.	100%
PH	6.5-7	VAPOR PRESSURE.	0 7

SECTION IV - FIRE AND EXPLOSION INFORMATION

UNUSUAL HAZARDS	N/K
HAZARDOUS DECOMPOSITION	ON COMBUSTION, CARBON MONOXIDE, CARBON DIOXIDE
FLAMMABLE LIMIT	LOWER 1 0% UPPER 6%
EXTINGUISHING MEDIA	REGULAR FOAM, OR CARBON DIOXIDE OR DRY CHEMICAL

CAUTION CAN BE IGNITED BY FLAME, SPARKS, PILOT LIGHT AND OTHER IGNITION SOURCES NEVER USE WELDING OR CUTTING TORCH ON DRUMS WITH PRODUCT OR LEFT-OVERS RESIDUE CAN BE IGNITED, FINE ATOMIZATION INCREASES COMBUSTIBILITY KEEP AWAY FROM IGNITION SOURCES

NFPA CODE. HEALTH 0, FLAMMABILITY 2, REACTIVITY 0

SECTION V - HEALTH HAZARD DATA

EFFECTS OF ACUTE OVEREXPOSURE

EYES	EXPOSURE TO LIQUID MAY CAUSE EYE IRRITATION, SYMPTOMS MAY INCLUDE BURNING, TEARING, REDNESS AND SWELLING

SKIN	EXPOSURE MAY CAUSE MILD SKIN IRRITATIONS PROLONGED AND REPEATED EXPOSURE MAY DRY THE SKIN SYMPTOMS MAY INCLUDE REDNESS, BURNING DRYING AND CRACKING LOW ORDER OF TOXICITY
BREATHING-	EXCESSIVE INHALATION OF VAPORS CAN CAUSE NASAL AND RESPIRATORY IRRITATION, FATIGUE, NAUSEA, HEADACHE, DIZZINESS, WEAKNESS LOW ORDER OF TOXICITY
SWALLOWING-	CAN CAUSE GASTROINTESTINAL IRRITATION, VOMITING, NAUSEA AND DIARRHEA. PUTTING THE LIQUID INTO LUNGS CAN CAUSE PNEUMONITIS

FIRST AID-

ON SKIN	FLUSH WITH COLD WATER, WASH WITH MINERAL OIL.
EYES	FLUSH FOR AT LEAST 15 MINUTES HOLDING EYELIDS APART
IF SWALLOWED	DO NOT INDUCE VOMITING, KEEP WARM AND CALM GET MEDICAL ATTENTION

SECTION VI - REACTIVITY DATA

HAZARDOUS POLYMERIZATION	CANNOT OCCUR
STABILITY	STABLE
INCOMPATIBILITY	AVOID CONTACT WITH STRONG OXIDIZING AGENTS

SECTION VII - SPILL OR LEAK PROCEDURE

SMALL SPILL.	ABSORB LIQUID OR VERMICULITE, FLOOR ABSORBENT OR OTHER ABSORBENT MATERIAL.
LARGE SPILL.	ELIMINATE IGNITION SOURCES (FLARES, FLAMES, PILOT LIGHTS, ELECTRICAL SPARKS) STOP SPILL AT SOURCE. PREVENT ENTERING DRAINS, STREAMS AND OTHER WATER BODIES PREVENT FROM SPREADING PUMP OR VACUUM TRANSFER SPILLED PRODUCT TO CLEAN CONTAINERS FOR RECOVERY ABSORB UNRECOVERABLE MATERIAL. TRANSFER CONTAMINATED SOIL AND OTHER MATERIALS TO CONTAINERS FOR DISPOSAL.
DISPOSAL.	IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS

SECTION VIII - PROTECTIVE EQUIPMENT

VENTILATION	PROVIDE SUFFICIENT MECHANICAL, LOCAL EXHAUST AND ADEQUATE VENTILATION
PROTECTIVE GLOVES	WEAR RESISTANT GLOVES (CONSULT SAFETY EQUIPMENT SUPPLIER)
EYE PROTECTION	CHEMICAL SPLASH GOGGLES OR OTHER SAFETY GLASSES

INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE, WHETHER ORIGINATING WITH THE COMPANY OR NOT

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Impact of Environmental Laws on Industry

1 Actions Industry Must Take

- Identify waste streams which are subject to regulation

- Maintain records of regulated substances
  - Stored on-site
  - Shipped off-site
  - Releases to the environment

- Handle on-site waste as specified by law
  - Allowable mixing
  - Labeling
  - Storage time limits
  - Use of approved shippers

- Periodically report
  - Off-site shipments of wastes
  - Other intended releases to the environment
  - Accidental releases

- Establish programs for source waste reduction (pollution prevention)

2 Penalties for Violations

- Fines

- Plant shutdown

- Criminal prosecution of responsible individuals (possible imprisonment if convicted)

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Sunday, January 12, 1997

Module II

Role of case studies in environmental management curricula

Ocean spray cranberries, inc.

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depths and studied to determine such things as direction in which groundwater flows and the types and amounts of contaminants present

National Priorities List (NPL) A list of the top priority hazardous waste sites in the country that are eligible for investigation and cleanup under the Superfund program

Parts per Billion (ppb) Units commonly used to express low concentrations of contaminants For example, one ounce of trichloroethylene (TCE) in one billion ounces of water is one ppb

Perchloroethylene (PCE) A nonflammable solvent used commonly in dry cleaning and to remove grease from equipment It is a suspected carcinogen

Potentially Responsible Party (PRP) Any individual(s) or company(ies) (such as owners, operators, transporters, or generators) potentially responsible for, or contributing to, the contamination problems at a Superfund site Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated

Remedial Investigation and Feasibility Study (RI/FS) A two part study of a hazardous waste site that must be completed before the site remedy is implemented The first part, or Remedial Investigation, examines the nature and extent of site contamination The second part, or Feasibility Study, identifies and evaluates alternatives for addressing site contamination

Risk Assessment An evaluation performed as part of the remedial investigation to assess conditions at a Superfund site and determine the risk posed to public health and/or the environment

Superfund The common name used for the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act (SARA), also referred to as the Trust Fund

Trichloroethylene (TCE) A nonflammable liquid used commonly as a solvent in dry cleaning and to remove grease from metal It is a suspected carcinogen

Source United States Environmental Protection Agency EPA and DWP Begin Investigating Groundwater in the San Fernando Valley Fact Sheet #1 March 1988 p 8

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Ocean Spray Cranberries, Inc

This case was written by Bert White and Thomas W Peters under the editorial guidance of James E Post Professor of Management Policy Boston University School of Management

"Actions have consequences, and criminal actions have criminal consequences," said U S District Attorney Frank McNamara, referring to Ocean Spray Cranberries, Inc at a Boston press conference [1] Ocean Spray, in a released statement, said, Our response is that at no time did Ocean Spray endanger the public s health or the environment We believe that Ocean Spray will be found innocent of the charges' [2] A company spokesperson, Thomas Linehan, said the government was charging Ocean Spray with releasing small amounts of cranberry juice and cranberry skins into the river According to Linehan, "The government might conceive that one cranberry falling from a truck into a river could constitute a violation of this regulation "[3]

On January 28, 1988, Ocean Spray Cranberries, Inc was indicted by a federal grand jury on 78 counts of violating the nation's Clean Water Act The charges were filed in the U S District Court The suit included 6 felony and 72 misdemeanor counts The felony charges were the first filed against a corporation since Congress toughened the Clean Water Act in 1987

The indictment stated that between February 1983 and October 1988 Ocean Spray illegally and knowingly discharged untreated wastewater and other pollutants from its plant in Middleboro Massachusetts into the Nemasket River According to Assistant U S Attorney Richard Welch, who was named to prosecute the case the 6 felony counts related to Ocean Spray's intentional dumping of its untreated wastewater from its plant into the town s sewage system The remaining 72 counts related to Ocean Spray's discharges into the Nemasket River and its adjacent wetlands If found negligent, the felony counts carry a maximum penalty of $50,000 each, while the misdemeanor counts carry a maximum penalty of $25 000 each Felonies may also carry a maximum three year prison sentence per violation for persons who knowingly violate pollution laws [4]

Under the amended Clean Water Act of 1987, felony charges can be filed if employees know or should have known that the firm was breaking the law According to McNamara This is the first case in the country which has utilized the provision [5] He continued, "This should send a signal to all companies—no matter how large, no matter how powerful—that they cannot pollute the nation's water and hope to pay small fines as a cost of doing business [6]

The Company

Ocean Spray was founded in 1930 by independent and competing cranberry farmers from Plymouth and Wareham, Massachusetts, and New Egypt New Jersey By pooling their marketing resources, the cranberry growers accumulated financial and managerial resources to enter and expand into the national food production and distribution industry Ocean Spray Cranberries, Inc s purpose is to insulate cranberry farmers from cyclical demand and oversupply patterns by providing ongoing annual income stability to its farmer owners This is done by increasing the popularity of cranberry products, balancing supply and demand of cranberries and increasing growers' total profitability

Ocean Spray markets fresh and processed cranberries The corporation neither owns bogs nor grows cranberries, grower members own their bogs and raise their own crops which are processed and marketed through the Ocean Spray cooperative Through this ownership structure, cranberry sales grew from $1 million in 1930 to $736 million in 1987 Ocean Spray's goal is to reach $1 billion in sales by the early 1990s Moreover, the number of member-growers increased from less than 100 in 1930 to 915 Cranberry member growers range geographically from New England to New Jersey, Wisconsin, Oregon, Washington, and Vancouver, Canada Citrus fruit growers have also joined the cooperative

The Ocean Spray" brand name—inspired by salt spray drifting over Cape Cod cranberry bogs—has been in use since 1912 for canned cranberry products [7] Recent product development activities at Ocean Spray have led the company into a year-round array of cranberry and citrus products

Ocean Spray controls 85 percent of the nation s cranberry sales, making it a Fortune 500 company [8] In April 1988 Ocean Spray registered 385 on the Fortune 500 list, an improvement over 410 in 1987 "We re very pleased,' said John Lawlor, Ocean Spray's manager of public relations, of the company s move up the list 'We think it's indicative of the strong

relationship that exists between Ocean Spray management and the cranberry growers through southeastern Massachusetts that have made this progress possible [9]

Recent years at Ocean Spray have been characterized by the development of processing innovations and the marketing of new products The retrofitting of concentrators, paper box container systems, and bottling operations required large investments These improvements strained additional capital expenditures

Ocean Spray has been a major support to the town of Middleboro Between 1983 and 1986 the company purchased over $12 million in goods and services from local vendors [10] In 1987 Ocean Spray paid a property tax of $238,000, a sewer bill totaling $152,000, and water bills of $160,000 [11]

The Town of Middleboro

Settled in 1660, and located near the Nemasket River, Middleboro now has a population of 17,300 Its industrial base includes cranberries, fire apparatus, shoes, brass goods, lumber, bricks, grain elevators, and novelty items Developers have recently discovered Middleboro, and cows graze near signs announcing the arrival of national and multinational companies Yet this small, rural town's principal feature is its location near Boston and several population centers in southeastern Massachusetts, including New Bedford and Taunton, as well as Providence, Rhode Island

Townspeople are torn between the benefits of economic development and preservation of the town's rural character Town qualities include a pattern of neighborhood development fostered by several small, neighborhood based elementary schools, scattered village centers, farms, natural resources such as the Nemasket River, significant wetland and water systems, and historic native American sites Municipal leaders increasingly discuss the community s dilemma of an escalating rate of land usage which conflicts with resource protection

Middleboro is extremely proud of being home to Ocean Spray Nearly everyone is related to or knows of someone directly involved with the company The title page of the town s 1988 Annual Report carries the heading Cranberry Capital of the World—319 Years of Progress' Its cover displays the new world headquarters of Ocean Spray on cranberry colored paper The town has a long history of manufacturing diverse products, but the cranberry has become king Ocean Spray s new world headquarters, completed in 1988 straddles the Middleboro Lakeville town line In addition, the world's largest cranberry processing plant,

operating 24 hours a day and owned by Ocean Spray, is located in Middleboro Full time employees number approximately 280, swelling to almost 1 000 during the autumn harvest season

Middleboro Town Manager John Healey, who initiated the federal indictment process against Ocean Spray, said, ' We have a very good relationship with Ocean Spray While this situation might strain it a bit, I don t think it changes it ' [12]

Recurrent Pollution Problems

The handling and processing of fruit at Ocean Spray is highly mechanized The process involves receiving and testing, dumping, temporary holding, destoning, dechaffing, drying, separation, bulking, washing, concentrating, juicing, and bagging the berries The process objective is to gather bulk berries and prepare them either for storage or for processing into frozen fresh berries, sauce, and juice These successive operations require extensive water baths, rinsing, and cleaning processes Middleboro s municipal water and sewer facilities are heavily utilized by Ocean Spray and are critical to the company's operations Ocean Spray is the town's largest industrial user, discharging approximately 200,000 gallons of wastewater a day into the town's sewage system

In 1967, when Ocean Spray was expanding its processing plants, Middleboro offered to provide the company with a wastewater pump station located four miles from the town's main wastewater treatment plant Ocean Spray accepted By 1971 the state required Middleboro to upgrade its gravity feed trickling filter plant Wastewater, including the town's domestic sewage and Ocean Spray's processed waste, was high in acid Moreover, wastewater was occasionally flowing directly into the Nemasket River damaging fish and wildlife The contamination of the Nemasket posed far reaching environmental problems The Nemasket connects with the Taunton River, which eventually flows into the Atlantic Ocean

According to Joe Ciagio, Middleboro's wastewater superintendent, "There was a lengthy history in Middleboro of pH fluctuations below the critical level of five, indicating high acidity This is an inherent aspect of cranberry waste" The high level of acidity appeared to be killing the bacteria necessary to process the wastewater As a result, viscose bulking, or slime, occasionally flowed into the Nemasket River from 1967 to 1980

Under the Industrial Coast Recovery (ICR) legislation, the federal government mandated corporate users of public facilities to pay for the capacity which municipalities reserved for their use Ocean Spray contracted with Middleboro in 1973 to take a major position in the town's

wastewater treatment facility Pollution levels were stipulated and agreed upon by both parties However, heavy industrial lobbying resulted in Congress voiding the ICR payment requirements in October 1977 In its place, the Clean Water Act was passed Federal law now required companies to treat their wastewater to limit or remove harmful chemicals, corrosive materials, and excessive acid The 1973 Middleboro–Ocean Spray contract had become outdated

The high acidity problem grew between 1980 and 1985 Sludge was not settling and the Middleboro wastewater plant was not meeting its National Pollutant Discharge Elimination System permit level Consequently, in 1985 Ciagio requested technical assistance from the state's Department of Environmental Quality and Engineering (DEQE) DEQE identified the culprit as a low pH acidity problem and highly variable Biochemical Oxygen Demand (BOD) levels

Water pollutants are dispersed in two forms Total Suspended Particles, which are visible, and Biochemical Oxygen Demand (BOD) units, which are invisible BODs indicate the oxygen required to decompose organic material Experts agree the accepted rule for ' really decent, healthy sludge quality is 100 BODs to five nitrogen to one phosphorus Expected presence of urine in wastewater contains sufficient nitrogen to provide the 100–5–1 balance for the bacteria to process normal domestic waste Ciagio describes the process to eliminate pollutants as ' keeping the bugs happy and well fed on a properly balanced 100–5–1 diet " Without this balance, bacteria function improperly and slime occurs

Seventy five percent of Middleboro's wastewater volume comes from the town and other non–Ocean Spray sources However, a significant pH factor and 80 percent of BOD loading comes from Ocean Spray's 25 percent of wastewater volume Public experts, backed by data, persuaded Ocean Spray into an informal agreement whereby it agreed to add sodium hydroxide to its cranberry wastewater This would reduce the acidity by increasing the pH level From Ocean Spray s perspective, however, the pH and slime problem belonged to Middleboro's taxpayers The company questioned its culpability and pointed to various possibilities for the pH imbalance deferred and poor maintenance of the treatment facility, mechanical breakdown, improper plant design, or lack of knowledge by the town's employees

Concurrent with its informal agreement to add sodium hydroxide to its wastewater Ocean Spray was developing a cranberry–citrus juice product line Juice production requires frequent process changes which utilize large amounts of water to flush out leftover skins and juices The procedure increases wastewater input to the Middleboro facilities

In early 1987 the DEQE announced the Nemasket River and its downstream wetlands were at risk DEQE tests indicated high acidity in the water Also the Middleboro waste plant s sludge would not settle, and viscose bulking was consistently exceeding the town s National Pollutant Discharge Elimination System permit level Consequently, the EPA had to be notified The town was in violation of the Clean Water Act and risked being fined

The DEQE immediately convened an on site technical experts meeting at the Middleboro wastewater treatment facility Town, EPA, Ocean Spray, and DEQE specialists were invited "I will never forget how [furious] the DEQE representative was,' remembers Ciagio, "when Ocean Spray showed up with both its technical staff *and* its lawyers'

In April 1987 the DEQE ordered Ocean Spray to construct a pretreatment plant to process its wastewater prior to releasing it to the town's system In August Ocean Spray appealed the agency's order in court According to attorney Neil Bryson, Ocean Spray pursued an appeal as a means to be heard, otherwise discharge standards would be set only by the state and town [13] The DEQE was responsible for scheduling an appeals hearing

On October 8, 1987, thousands of gallons of juice concentrate and cleaning solvents were released into storm drains at the Ocean Spray site The spill was caused by a faulty pipe at the processing plant Plant manager Raymond Nolan initially denied that the spill ever occurred Finally, Ocean Spray's public relations manager, John Lawlor, admitted that the spill happened but claimed it was contained before it reached the river Middleboro Town Manager Healey and Jeff Gould, chief of DEQE's Water Pollution Control Division, claimed the spill reached the river

Between 1983 and 1987 the town fined Ocean Spray $14,400 for pretreatment violations Each violation carried a $200 fine The untreated Ocean Spray wastewater was also costing the town added expenses at its municipal sewage facility Additional electricity, for example, was required to treat the wastewater several times before it could be released From 1985 to 1988 electric consumption at the municipal plant increased by 45 percent [14]

The biggest problem for the town s treatment facility was the solid loadings that the Ocean Spray processing plant produces These loadings include cranberry skins, orange and grapefruit rinds, and other high acid, bulky material Without adequate pretreatment, the loadings overwhelm the town's sewer system Healey said the Ocean Spray indictment was the culmination of more than two years of conflict between the town and the company According to Middleboro selectman Moushah C Krikorian, 'The town has been after them for a long time to build some kind of pretreatment plant [15] After extensive and unsuccessful efforts beginning in 1986 to get Ocean Spray to expand its pretreatment activities, Healey forwarded the case to the Environmental Protection Agency s Criminal Investigation Division

THE SETTLEMENT

At its February 24, 1988, arraignment, Ocean Spray pleaded innocent to all 78 charges Outside the court, U S Attorney Welch said that 65 of the counts referred to 65 separate dates when pollutants with a pH level lower than five were discharged into the town's sewer system

During the time Ocean Spray was facing arraignment, company officials authorized $25,000 to hire an expert to solve the waste treatment problems at the town's treatment facility The offer was made to the town of Middleboro Healey applauded the offer and said that while Ocean Spray will 'pay the bills, we ll direct the study '[16] According to Healey, 'We need to be able to establish standards for the pretreatment of wastes produced by industry So we'll direct the study under the watchful eye of the Department of Environmental Quality and Engineering '[17] Ocean Spray also offered to pay its share of the sewage plant's electric bill on a monthly basis, rather than the agreed upon quarterly basis, to avert cash flow problems for the town

Dr Paul Klopping, an environmental expert from Oregon, was hired to study the wastewater problems at the Middleboro municipal treatment plant In May 1988 Klopping reported nutrient imbalance in the combined industrial and residential wastewater treated at the town's plant He suggested that adding nitrogen to Ocean Spray's wastewater at its processing facility would eliminate the problem Ocean Spray implemented Klopping s recommendation

Ocean Spray also donated $12,500 to allow the town to begin a DEQE ordered study to identify and set pretreatment standards for industrial sewage users Both the town and company were under state orders to modify wastewater treatment to meet pollution standards According to town selectman Stephen D Morris, Ocean Spray's gift allowed the town to initiate the study without asking voters to a special meeting to appropriate funds [18]

Under the direction of the DEQE and the EPA Ocean Spray modified its drainage system and plant operation to help eliminate future discharges into the river and wetlands Linehan, Ocean Spray's spokesperson, said the company spent more than $1 million at the Middleboro

plant to improve wastewater quality He added, Though we are dismayed by the severity of the government s charges, as well as the heavy handed manner in which they were leveled, we are entirely prepared to continue to work with government agencies to meet their concerns [19]

On December 22, 1988 Ocean Spray Cranberries Inc reversed its innocent plea The company pled guilty to 21 misdemeanor counts of releasing improperly treated wastes from its plant into the town s sewer system and ultimately into the Nemasket River and adjoining wetlands over a five year period The company, which had faced as much as $2 1 million in fines, was fined $400,000 for its violations of the federal Clean Water Act The company also agreed to buy the town a piece of equipment valued between $100,000 and $125,000 that will be used to improve sludge handling at the municipal plant As part of the plea agreement, 51 other misdemeanor counts and the 6 felony charges were dropped

U S Attorney Welch said the company's willingness to make restitution to the town of Middleboro was a key factor in the avoidance of a lengthy trial We wanted to be sure that the town received restitution," Welch said He noted that the guilty plea marks "one of the first environmental convictions in which a town received restitution" An EPA spokesperson endorsed the view that Middleboro had been a "victim' and that it was more important to get the town the equipment than it was to press the felony charges

In a press release issued after the change of plea, the cranberry cooperative s president, John Llewellyn, Jr, called the settlement "tough and costly and fair"

Discussion Questions

1 What factors account for Ocean Spray s indictment? Is this a case of unintentional or intentional harm?

2 To what extent does Middleboro bear responsibility for the pollution of these water resources?

3 Why resort to lawsuits? Is this the best way to get business and local government to work together in developing solutions to environmental problems?

4 What management changes should Ocean Spray make to ensure that no future problems arise?

Notes

1 'Ocean Spray Faces Fines for Pollution, *Middleboro Standard Times* (Massachusetts), January 29, 1988, pp 4 12

2 Ibid

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5 'Ocean Spray Faces Fines for Pollution," pp 4, 12

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7 'The Ocean Spray Story, Ocean Spray Cranberries, Inc Plymouth, MA, n d

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13 Meagan Secatore, 'Ocean Spray to Finance Study of Sewage Treatment," *Middleboro Standard Times* (Massachusetts) March 4, 1988, p 5

14 Jane Lopes, Budget Shortfall Related to Ocean Spray ' *Middleboro Standard Times* (Massachusetts), February 4, 1988, p 1

15 "Ocean Spray Faces Fines for Pollution, pp 4, 12

16 Ocean Spray Offers to Hire Consultant, *Middleboro Standard Times* (Massachusetts), February 25, 1988, p 1

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18 Meagan Secatore, Ocean Spray Gives Middleboro $12 500, *Middleboro Standard Times* (Massachusetts), April 12, 1988, p 25

19 Ocean Spray Faces Fine for Pollution pp 4 12

Sunday, January 12, 1997

Module III

The Double-Death Dilemma

The Double-Death Dilemma

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Prepared for use in the Management 581 - Issues in Environmental Management course - Fall 1994 (Global Environmental Issues and International Business class section)

The Double-Death Dilemma

Plan Initial Outside Group Meeting (15 minutes)

1 Four Groups will be Formed
2 Read Your Position Papers
3 Meet with your group to discuss your position in the first meeting
4 Appoint a Representative for the first meeting
5 Appoint a Recorder for your group - KEEP A RECORD!

First Meeting With All Representatives (No Longer than 20 minutes)

1 The EPA will start the meeting and set out the agenda
2 Stay in Character
3 ONLY the group representatives may speak at the meeting, but behind the scenes advice is permitted
4 Get some results!

Second Outside Group Meeting (15 minutes)

1 Evaluate the meeting
2 Establish Goals for the next meeting
3 Plan for contingencies

Second Meeting With All Representatives (No Longer than 20 minutes)

1 Stay in Character
2 Look for Concrete Accomplishments
3 What's Next

Third Outside Group Meeting (15 minutes)

1 Take stock of what happened during the process
2 What additional information would you have liked?
3 How could you have improved your performance?

THE DOUBLE DEATH DILEMMA

In the waning hours prior to the final signatures being put to the Basel Convention, negotiators for several developed countries gave up on a provision to include Double-Death in the list of hazardous wastes whose transnational movement would be controlled Double-Death and its less potent cousin Single-Death are imbedded in a sludge by-product as a result of the production of fertilizer These fertilizers are very popular and bulky, so their production has tended to become regionalized much like the cement industry

The sludge created has been traditionally sealed in barrels and transported by railroad to container ships bound for one of a number of countries that provide disposal sites The reason for this cumbersome and expensive procedure is simple Due to the highly toxic nature of this sludge, disposal requirements in the U S are so stringent as to make it virtually impossible for these companies to find U S based disposal opportunities

Periodic efforts have been made at reducing the toxicity of the sludge with only moderate success Burning was quickly ruled out as heating the sludge caused a highly toxic and explosive gas to be released. Sealing the sludge in concrete just seemed to make it bulkier, but could be done to reduce the risk of a spill An interesting breakthrough may have been found with a very expensive bio-engineered micro-organism The organism appears to interact with the sludge and while not completely eliminating the risk, certainly reduced it to the point that domestic disposal appeared possible The commercial status of this potential solution appears to be in doubt due to a lack of funding as well as the necessity for a long period of trials

On January 27, 1995, the U S Department of Agriculture along with the Environmental Protection Agency decided jointly that the disposal of Double-Death needed to be controlled, whether an international agreement was involved or not The decision had been made that overseas shipping of Double-Death was to end. All of the major fertilizer producing companies were notified that a series of meetings was to be held in Washington, D C beginning on September 19, 1995 The established purpose of this meeting was to negotiate the elimination of Double-Death[11]

Monday, January 13, 1997

Module I

Identification and prioritization of energy efficiency improvements

Energy conservation measure checklist

Major US government-sponsored energy technology and environmental management programs

Power plant energy and environmental issues

Identification and Prioritization of Energy Efficiency Improvements

1 Types of Measures

- Procedural changes (e g shut down idling equipment)
- Retrofit with high efficiency components (e g drive motors)
- New high efficiency systems (e g chilled water system)
- Improved controls (e g building energy management systems)

2 Sources for identifying measures

- Government-sponsored resource databases
- Technical and professional literature (e g Energy Users News)
- Vendor literature
- General checklists
- Outreach service organizations (e g The University of Tennessee Center for Industrial Services)

3 Bases for Selecting Measures

- High level of projected energy and cost savings
- Capital is available
- Rapid recovery (payback) of investment
- Simple procedures for implementation

Energy Conservation Measure Checklist

Process Energy

1 Shut off equipment during periods of non-production

2 Improve operating efficiency of combustion equipment
   a) Purchase and utilize new energy-efficient equipment
   b) Replace burner(s) with high combustion efficiency burners
   c) Adjust gas/oil burners for efficient combustion
   d) Adjust air/fuel ratio
   e) Repair fuel leaks
   f) Add insulation to heated surfaces
   g) Recover heat from stack gases
   h) Lower control temperature for heated medium

3 Improve transfer efficiency of mechanical drives
   a) Lubricate/improve maintenance to reduce frictional losses
   b) Replace standard V-belts with cogged V-belts

4 Reduce heat losses from system components (e g , fluid-holding tanks, heated extruder barrels)
   a) Add insulation to hot/cold surfaces

5 Improve efficiency of electric motor drives
   a) Replace standard motors with high efficiency units
   b) Replace oversized motors with downsized units
   c) Install variable speed drive controls

Plant Utilities

1 Electricity
   a) Install cogeneration system
   b) Install demand control computer
   c) Install a demand peak-shaving generator
   d) Correct power factor
   e) Increase distribution system supply voltage

2 Steam systems
   a) Boilers
      i) Shut down boiler(s) during periods of non-use of steam or hot water
      ii) Valve off unused boilers
      iii) Reduce steam pressure set point
      iv) Replace inefficient burner

v) Adjust burner for efficient combustion
vi) Adjust air/fuel ratio
vii) Clean boiler tubes
viii) Install stack gas heat recovery (economizer) unit
ix) Install blowdown heat recovery system
x) Install turbulators in boiler fire-tubes
xi) Install combustion air preheater
xii) Install make-up water preheater

b) Steam and condensate distribution systems
i) Insulate steam lines and valve bodies
ii) Repair steam leaks
iii) Return condensate to boiler
iv) Repair leaking steam traps

3 Compressed air system
a) Compressors
i) Install high energy efficiency unit(s)
ii) Clean intake air filter(s)
iii) Duct cool outside air to compressor(s) intakes
iv) Reduce output pressure set point
v) Stage loading of multiple compressors
vi) Replace hydrocarbon with synthetic lubricant
vii) Duct compressor waste heat to building interior to supplement space heating

b) Compressed air distribution and use
i) Increase distribution pipe diameter or add parallel lines and reduce line pressure
ii) Repair leaks
iii) Install solenoid valve shut off of air supply to equipment when unneeded
iv) Replace air blow off with fan air or mechanical action

4 Chiller systems
a) Shut down idling units
b) Stage operation of multiple units
c) Insulate chilled water lines
d) Increase circulating chilled water temperature
e) Clean cooling tower water and heat transfer surfaces
f) Install chiller variable speed control
g) Turn off cooling tower fans during light load conditions
h) Duty cycle chilled water pumps

Lighting Systems

1 Delamp or turn off lights in unused areas
2 Install more energy efficient lighting fixtures or sources (e g , high-efficiency fluorescent tubes, high intensity discharge lighting systems)
3 Install mirror reflectors and delamp fluorescent fixtures
4 Lower fixtures and delamp
5 Clean fixtures and delamp
6 Install in-roof skylights and delamp

Space Heating and Cooling

1 Heating and cooling systems
   a) Discontinue space conditioning of unused plant areas
   b) Setback thermostats during unoccupied periods
   c) Install more efficient central heating and cooling systems
   d) Reduce make-up air flow rates
   e) Utilize outside air (economizer cycle) for interior conditioning
   f) Install destratification fans

2 Building envelope
   a) Add insulation roof and/or walls
   b) Weatherstrip doors and window
   c) Install storm windows or double-glazed glass
   d) Apply reflective film or paint to roof surface
   e) Install water-spray roof cooling system
   f) Install a vestibule at building entranceway

Miscellaneous Systems

1 Timer off vending machines during building unoccupied periods

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Major U S Government-Sponsored Energy Technology and Environmental Management Programs

1 Current U S Department of Energy Initiatives

- Seven Vision Industries/Industrial Technologies Programs
- Climate Wise (goal of reducing greenhouse gas emissions via energy conservation)
  - Industry contracts to identify and implement energy efficiency and pollution prevention actions Results are reported periodically
  - DOE provides access to technical and financial resources
- Motor Challenge Program (goal of reducing energy use in electric motor systems)
  - Industry contracts to incorporate energy efficiency as a necessary consideration in the design, purchase, and operation of electric motor systems Also, industry agrees to employee education
  - DOE agrees to
    - Operate an information clearinghouse for access to motor system information
    - Coordinate demonstrations of successful applications
    - Provide recognition to Partners
    - Sponsor training programs
    - Seek to remove market barriers to the use of efficient motor systems
  - Emphasis on
    - High efficiency motors
    - Variable speed drives

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- National Industrial Competitiveness Through Energy, Environment and Economics (NICE^3)

  - A cost-sharing grant program for the simultaneous reduction of industrial energy use, reduction of waste that is generated by industrial processes, and improvement of process economics

- Energy-Related Inventions Program

  - Competitive grant program for funding the development of energy conserving or producing technologies

2 Current U S Environmental Protection Agency Initiatives

- Green Lights (goal of reducing power plant emissions via energy conservation resulting from lighting system upgrades)

  - Organizations including private industry, government and commercial businesses volunteer to become program partners and to install economically-attractive energy-efficient lighting systems

- Energy Star (goal of reducing power plant emissions by encouraging the production and use of energy-efficient equipment)

  - Energy Star Office Equipment
  - Energy Star Computers
  - Energy Star Buildings
  - Energy Star Homes

- Design for the Environment (Office of Pollution Prevention and Toxics), Industry voluntary program to change business practices to provide incentives for pollution prevention, EPA and industries work with business and trade associations to evaluate risks, performance and costs of alternate chemicals, processes, and technologies, Specific programs

  - Dry Cleaning Project
  - Printing Industry Project
  - Lifecycle Analysis of a Computer Workstation

Relationship of Industrial Technologies Programs* to the Seven Vision Industries

	Aluminum	Chemicals	Forest Products	Glass	Metal-casting	Petroleum Refining	Steel
Alternative Feedstocks		■	■				
Bioprocessing		■	■			■	
Ceramic Composites	■	■	■	■	■	■	■
Catalysis	■	■	■			■	
Cogeneration/Advanced Turbine Systems		■	■			■	
Combustion	■	■	■	■	■	■	■
Materials	■	■	■	■	■	■	■
Sensors	■	■	■	■	■	■	■
Separations	■	■	■			■	

* The Municipal Solid Waste and Solar Industrial Programs have general ties to the Vision Industries but are not specifically focused on these industries

BEST AVAILABLE COPY

Power Plant Energy and Environmental Issues

1 Generating Capacity

- Demand Growth in Developed and Developing Economies
- Selection of New Plant Energy Source(s), interplay of availability, cost and environmental impacts
- Siting of Plants (principally a nuclear plant concern)

2 Generating Plant Conversion Efficiency

- User Demand-Side Management Programs

3 Power Plant Environmental Issues

- Fossil Fuel Plants

  Concerns
  - Global warming (CO_2 emissions)
  - Acid rain

  Recent Regulatory Action
  - EPA Clean Air Power Initiative to control SO_2, NO_x and mercury (July 1996)

  New Processes for Efficiency Improvement and Reduced Emissions (Coal plants)
  - Co-burning of waste tires (Ohio Edison, OH)
  - Atmospheric fluidized bed combustion
  - Pressurized fluidized bed combustion
  - Slagging Combustors
  - Combustion modifications (air/fuel ratio spacial variations)
  - Flue gas desulfurization
  - Regenerable flue gas desulfurization
  - Selective catalytic reduction
  - Selective noncatalytic reduction
  - Combined NO_x/SO_2 reduction

- Nuclear Plants

  Concerns
  - High cost of plant construction and operation
  - Criticality control
  - Radiation safety
  - Disposal of nuclear waste

- Photovoltaic Systems

  New Development
  - Use of low cost copper indium diselenide cells (Tucson Electric Power, AZ), plan to manufacture 1 5 MW

Monday, January 13, 1997

Module II

Approaches to the financial analysis of proposed energy efficiency projects

Energy efficiency project financing

Approaches to the Financial Analysis of Proposed Energy Efficiency Projects

1 Objective
To select among alternative actions the one which will yield the maximum financial benefit (value or worth) over a designated period of time

2 Factors Which Must Be Considered

- The economic life of the alternative
- All relevant costs and the time when these expenditures will occur
- All benefits or revenues attributable to the expenditures and the time when they will occur
- The prevailing interest rate at the time at which costs and revenues accrue and which accommodates the risk of the uncertain future

3 Determining the Economic Life (The number of years that the project will make a positive economic contribution to the firm)

- Estimated by considering when the following conditions will be met
  - Unsatisfactory functional characteristics (e g wear)
  - Unsatisfactory economic characteristics
  - Termination of need
  - Obsolescence due to changes in policy regulations of technology
- Estimates based on historical service records of equivalent assets (if available)

4 Development of Cash Flow Profiles (For all cash flowing into or from a project), Components

- First cost (Including the sum of costs for engineering, construction, purchasing, installation to bring the asset into service
- Salvage value (Net sum realized at end of useful economic life)
- Income and expenses
  - Periodic cash flow categories (e g scheduled maintenance)

- Uniform series revenues or expenses (e g sales, taxes, interest on debt)

- Continuous flows of revenues or expenses (e g savings accruing from use of a new process)

5 Selecting An Interest Rate

- Since money has a "time value," must compare alternatives at a common specific time, can use compound interest factors to shift cash flows to a common time

6 Comparing Alternative Projects

- Present Worth

  - Compares all of a project's expenditures to all of its estimated revenues and other benefits at a reference (present) time For a particular interest rate, if the present value of the revenues and other benefits exceeds the present value of the expenses, the project is considered acceptable

- Annual Worth

  - Converts all cash flows to an equivalent uniform series of equal annual payments If the annual worth of the revenues is greater than the annual worth of the costs for the specified interest rate, then the project is acceptable

- Future Worth

  - Comparable to present worth method, except that the comparison between the project's estimated expenditures and benefits occurs at a reference time called the "future " A project is acceptable at a particular interest rate if the future value of the revenues and other benefits exceeds the future value of the expenses

- Rate of Return

  - Finds the interest rate that equates the cash flows of receipts and disbursements the interest rate at which the present worth of the cash flows is zero

- Payback Period

  - Determines the length of time required to recover the initial investment at a zero rate of interest

Energy Efficiency Project Financing

1 Sources of Capital

- Institutional (e g company) funds (e g annual profits)
  - Budgeted (large projects) and unbudgeted
- Grants (e g international organizations)
- Vendor financing (usually via third party financial organization)
- Direct borrowing from primary lenders (e g banks)

2 U S Models

<u>Residential Properties</u>

- Federal Energy Efficiency Financing Programs
  - Federal Housing Administration (FHA)
  - Energy-efficient mortgages
  - Home rehabilitation loans
  - Veterans Affairs
  - Energy-efficient mortgages
- Non-Federal Energy Efficiency Financing Programs
  - Fannie Mae and Freddie Mac Secondary Financing Markets
  - Primary Lender Programs
  - Utility-Sponsored Energy Efficient Mortgage Programs for New Construction
  - Utility-Sponsored Energy Efficiency Home Improvement Loans

Industrial Projects

- Department of Energy (e g demonstration projects)
- National Industrial Competitiveness Through Energy, Environment and Economics (NICE^3)

3 Project Financing in Emerging Economies

- Required Elements of an Attractive Financing Package
  - Availability of many sources of soft loans, credits, grants, tied loans, and untied loans
  - Understanding of the objectives, tendencies and requirements of various financiers
  - Awareness of the possibilities of combining borrowing and guarantee instruments
  - Knowledge of effective ways of approaching financiers
- Overview of Project and Corporate Financing Methods
  - Corporate Financing (Recourse Financing)
    Borrowing by the public utility organization rather than by an entity created specifically to hold ownership of the new project (e g power plant)
  - Formation of a Project Company (Non-Recourse Financing)
    Owners provide investment capital and secure additional capital from a variety of sources (e g loans), the projects assets and cash flow secure debt, creditors do not have recourse to the sponsors' other resources
  - Limited Resource Financing
    The case for most projects, sponsors commit to providing contingent financial support, the extra security usually focuses on construction and startup periods

- Sources of Funds

  - Equity
    Provided by owners (typically varies between 20% and 40% of total project costs, sources

    - Sponsors' own capital
    - Multilateral institutions
    - International equity markets
    - Local capital markets
    - Certain investment funds
    - Governments and related lending and aid agencies

  - Debt
    Funds lent by financiers, repayment does not depend on the profit of the company, sources

    - Institutional investors (e g insurance companies, pension funds, mutual funds)
    - International commercial banks
    - The International Finance Corporation and regional development banks
    - International bond markets
    - Local banks and bond markets
    - Suppliers' credit
    - Specialized energy funds
    - Government-guaranteed loans from secondary agencies

- Major Sources of Funding for Specific Project Types

  - Methods of Financing Power Projects

    - Traditional source of financing has been the government budget or government-sponsored borrowing

    - The inability or unwillingness of governments to continue their financing has allowed and facilitated the use of private sector investment and encouraged public utilities to borrow from commercial sources

    - Private investment in the power sector is concentrated in generation but the trend is for participation in transmission and distribution as well

- Methods of Financing Gas Projects

    - Upstream (e g drilling) is financed mostly by private companies or public/private joint entities

    - Gas transmission and distribution projects are generally financed by government entities as for power projects, if these systems are privatized, new investments will likely be funded by private sources

- Methods of Financing Energy Projects

    - Owing to the large size of most energy projects, sponsors, whether government or private entities must consider all sources of financing (listed above)

- The Preparation of Successful Project Proposals

    - Analyzing the Business Environment
      Consider project costs, benefits and risks

        - Political circumstances (e g stability, government interventions)

        - Economic conditions (e g growth potential, country's debt, interest and exchange rates, inflationary pressures)

        - Establishing Economic and Financial Viability

        - Energy sector characteristics resources, supply, significance to the economy, prices and demand

        - Condition of subsectors petroleum, gas and power industries

        - Other factors taxes, experience of others

    - Structuring the Financing Package (Ownership structure, financing structure, security package)

        - Ownership structure

    - Complete state ownership
    - Complete private ownership
    - Joint ventures between state and private parties

- Stepwise procedure for securing financing

    - Assume a flexible ownership structure
    - Examine government interests
    - Assess the receptivity of the multilaterals
    - Approach the Bilaterals
    - Ask equipment suppliers to mobilize finance
    - Use the International Finance Corporation or regional development banks to mobilize commercial funds
    - Review the availability of specialized energy funds
    - Survey domestic investors and lenders

- Security package

    - Identify sources of applicable guarantees
    - Evaluate options for mitigating political risks
    - Investigate options for mitigating commercial risks

- <u>Environmental Concerns</u>

    - Legal issues, usual requirement to assess environmental impacts of energy projects to ensure that standards are met during construction and operation of a plant

    - Possible financial damages, investment and related returns can be ruined if environmental standards are not adhered to

    - Social responsibilities broad concerns raised by certain government and development agencies, environmental groups and possibly affected neighboring communities

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Monday, January 13, 1997

Module III

Opportunities for practice-oriented student training
Networking for jobs

Overview of UT industrial assessment center program

NETWORKING FOR JOBS

INDIVIDUAL NETWORKING STRATEGIES

Who has hired graduates in your field for jobs in the past? (List)

What are the different ways students and graduates now get jobs?
Think of any unusual ways to possibly make a job contact
Expand on the ideas suggested Get creative
How might you use these ideas successfuly

Add other suggestions for ways to find jobs
May include the following Where do employers list jobs? In general? Specific local employers Alternative titles for jobs? Job Descriptions? How can you get one? How can you use it?

Volunteer Get name recognition, like advertising Phone prospect Business section of the newspaper

NETWORKING

Who has gotten a job in the past through someone you knew?

Utilize your resources Know what you have to offer and "what you need", specifically, at this time Ask a few individuals what they have to offer "What you need" is NOT a job, in this situation -- it's contacts in your field of interest

List your network of contacts Use a Personal Network form
Put at least three names under each category Ask each contact for 2 referrals in the industry The list is no good unless you use it, so plan what you will say when you call Write out your script for phone calls

How to prepare a script
As you know (tell what's happening with you)
I am (share some self-management skills)
I can (share some job specific skills)
Do you know anyone who (ask for contacts in your field, not a job)

Part 2: My friend, _____, suggested I call you
I would like to talk with you about _____ industry
I'd like about ____ minutes of your time
When can we get together?

Always get another referral Make a job contact daily

REMEMBER - An object in motion tends to remain in motion
An object at rest tends to remain at rest

Industrial Assessment Center
(formerly the Energy Analysis and Diagnostic Center) Program

- Concept

  The federal government supports universities to provide consulting services to regional industry in the areas of energy efficiency, waste minimization and productivity enhancement

- Program Structure

  - The U S DOE provides program funding (≈$8 million/yr) There is no direct cost to participating industrial plants

  - 30 participating U S universities are overseen by two field management agencies

  - Each University Center serves 30 small-to-medium-sized clients within a 150 mile radius of campus per year

  - Project activities include a one-day in-plant assessment and the preparation of an assessment report for submission to each participating client

  - Center employs both undergraduate and graduate full-time engineering students as technical assistants

- Program Benefits

  - Industrial clients receive a quality study with recommendations for specific actions to reduce energy use and waste generation and to improve productivity

  - Participating students

    - Receive practical training in industrial technologies and energy auditing techniques

    - Receive salary funds to assist in personal costs of educational program of study

  - Engineering faculty and staff engineers are exposed to actual industrial work settings which

    - Improves the industrial relevance of classroom instruction

        - Serves to aid in the identification of relevant industrial research needs

    - The sponsoring government agency achieves conservation of national resources and improvement of industrial productivity

- History

    - Program has operated continuously since 1976

    - Over 5,000 industrial assessments have been performed by all centers since program inception

    - Over 1,000 students have been employed in the program over a twenty-year period

- Project Staffing

    - Engineering faculty members or professional staff engineers participate as assessment team leaders

    - Several students work in team format during in-plant data gathering and in the drafting of technical reports

- Program Activities

    - Student Staffing

        - Exceptional students are invited to accept a project position

        - Notices of position openings are posted and interested students are interviewed before ranking and hiring

        - The University of Tennessee IAC employees from 3 to 8 students at any time

    - Student Training for Project Work

        - Completion of specific engineering coursework is not required but students must be enrolled in an engineering program of academic study

        - Students learn project procedures by working in teams during assessments as apprentices to more experienced students

- Facilities for Project Work

    - A university office equipped with desks, desktop computers and hardcopy files, telephones

- Overall Procedure for Completion of Assessments

    - Prospective industrial clients are identified from published listings of regional manufacturers

    - Plants are contacted by telephone by student assistants to solicit program participation

    - Qualifying plants accepting the offer of an assessment are scheduled for a plant visit

    - The team drives in an automobile to the plant to be assessed (up to 4 hour drive one-way)

- In-plant activities

    - Interview with plant staff members

    - Completion of data questionnaires

    - Inspection of actual plant processes

- Selected measurement are made on energy-using systems

    - Boiler stack gas analysis

    - Process equipment surface and air temperatures

    - Lighting levels

    - Electrical equipment power use (in cases where plant electrician can access cabling)

    - Air flowrates

- Return to university

- Student teams prepare a draft report for iterative internal review and finalization before mailing to client (within two months of the plant visit date)

- Post-Assessment Evaluation

    - Within one year after submission of the assessment report the client is contacted by telephone to collect data on the implementation of recommendations made in the client's report Typical measure implementation rate is 50%

- Maintenance of Program Quality

    - Field manager must approve individuals serving as professional team leaders

    - Copies of all assessment reports are provided to the program field managers Selected reports are critiqued

    - Requirement to collect and report recommendation implementation data to field manager

    - Field management organization staff periodically accompany assessment teams in the field

    - DOE and field managers join all Center Directors in a annual "Director's Meeting" to share program results and to discuss administrative matters

    - Field managers submit annual reports of program results to DOE

Tuesday, January 14, 1997

Module I

Total quality environmental management (TQEM)

The Bread Box Experiment

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Bead Box Experiment

Sample Number	Number Of Units Inspected (n)	Number Nonconforming	Fraction Nonconforming(p)
1			
2			
3			
4			
5			
6			
7			
8			
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10			
11			
12			
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25			
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27			
28			
29			
30			

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Control Chart for p
(constant sample size)

Center Line $\bar{p} = \dfrac{\text{Total number of nonconforming units}}{\text{Total number of units inspected}}$

Upper Control Limit $UCL_p = \bar{p} + 3\sqrt{\dfrac{\bar{p}(1-\bar{p})}{n}}$

Lower Control Limit $LCL_p = \bar{p} - 3\sqrt{\dfrac{\bar{p}(1-\bar{p})}{n}}$

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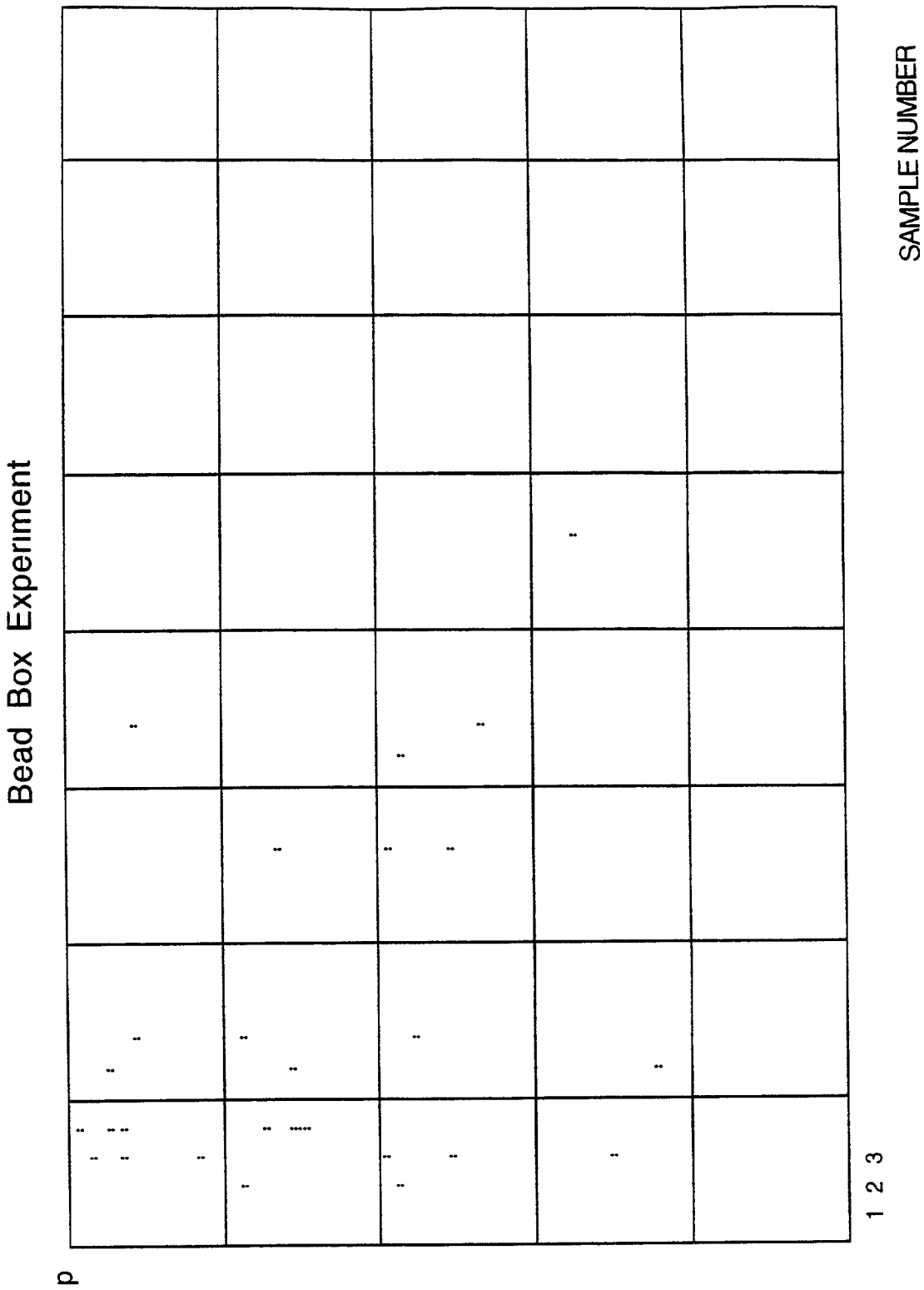

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PLEASE!

DO NOT TURN
THIS PAGE UNTIL
AFTER
COMPLETING THE
CONTROL CHART

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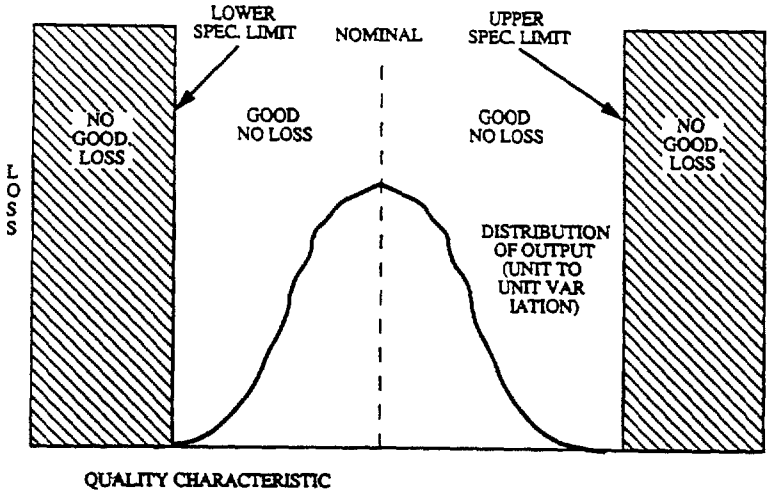
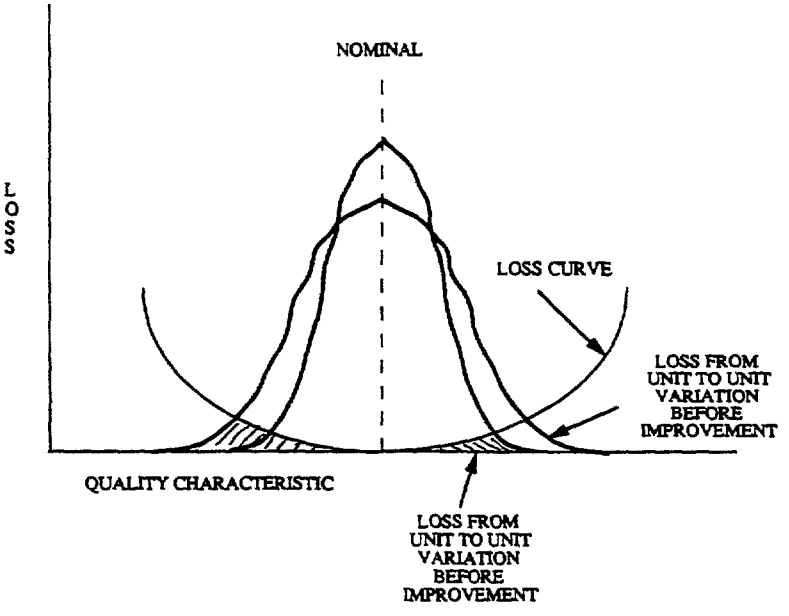
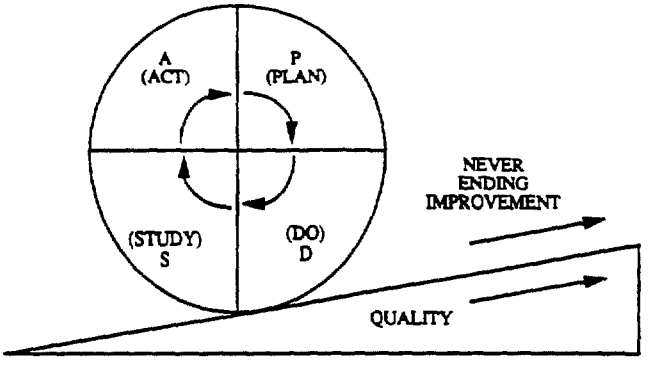
THE TRADITIONAL VIEW OF LOSSES ARISING FROM DEVIATION FROM SPECS



A MORE REALISTIC VIEW OF LOSSES ARISING FROM DEVIATION FROM SPECS



THE DEMING (PDSA) CYCLE



COMMON AND SPECIAL CAUSES

	DEFINITION	EXAMPLES	RESPONSIBILITY
SPECIAL CAUSES	INTERVENTIONS OUTSIDE OF NORMAL WORKING SYSTEM	NEW SUPPLIER. BROKEN DIE. NEW OPERATOR	VARIES
COMMON CAUSES	INHERENT VARIATION BY EXTENDED SYSTEM COMPONENTS	POOR LIGHTING VARIATION BY NORMAL SUPPLIER LACK OF TRAINING POOR DESIGN	MANAGEMENT

INSPECTION EXERCISE

COUNT ALL THE "F" IN THE FOLLOWING PHRASE

"FINISHED FILES ARE THE RESULT OF YEARS OF SCIENTIFIC STUDY COMBINED WITH THE EXPERIENCE OF MANY YEARS "

THE PHILOSOPHICAL BASIS OF TQM

1) EXTENDED SYSTEMS/EVERYONE HAS SUPPLIERS AND CUSTOMERS

2) THE BEST WAY TO INCREASE PRODUCTIVITY IS THROUGH QUALITY

3) STOP DEPENDENCE ON INSPECTION BY BUILDING QUALITY IN THE FIRST PLACE

4) CONTINUOUS IMPROVEMENT

5) TWO SOURCES OF SYSTEM VARIATION
   a) 80/20 "PARETO" PRINCIPLE
   b) GET CONTROL, ADJ TO SPECS, REDUCE VARIATION

6) MANAGEMENT (AND ONLY MANAGEMENT) IS RESPONSIBLE FOR THE SYSTEM

7) ALL EMPLOYEES NEED TRAINING IN PHILOSOPHY AND IN BASIC STATISTICAL TOOLS

8) DISPLACE FEAR AND COMPETITION WITH TRUST AND COLLABORATION

9) ELIMINATE VARIOUS FORMS OF GOAL SETTING

10) INCULCATE PRIDE OF WORKMANSHIP AND ABOLISH ANNUAL MERIT RATINGS

TQEM -- CONTRAST BETWEEN QMS AND EMS

QUALITY	ENVIRONMENT
Focal stakeholder -- customer	Multiple stakeholders
Limited functional involvement	Broader functional participation
Measurement relatively easy	Measurement is very difficult
No legal constraints	Many legal constraints
Activity chain coordination	Even broader life cycle impl
Zero defects knowable	Zero impact unknowable
System assumed controlable	Greater consideration of emerg
Statistical training critical	Broader training dimensions
QC dimensions fairly clear	Env effects evaluation and special emphasis on methdology
Audit process rel. clear	Audit process more ambigious

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Tuesday, January 14, 1997

Module II

ISO 14000 and environmental management systems

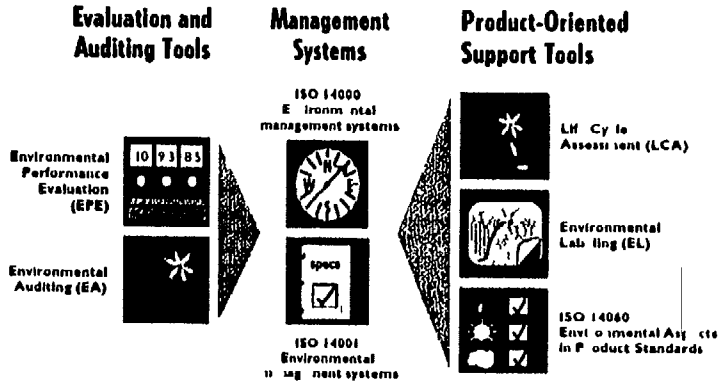
What is ISO?

- International Organization for Standardization
  - Worldwide federation founded in 1946 to promote the development of international manufacturing, trade, and communication standards
  - Greek = equal
- American National Standards Institute (ANSI) is U S representative

What is ISO 14000?

- A developing series of management standards for helping organizations manage environmental aspects of their operations
- Two Types
  - Specification (ISO 14001 EMS standard only)
  - Guidance
- Two Foci
  - Organization evaluation
    - environmental management systems environmental auditing environmental performance evaluation
  - Product evaluation
    - life cycle assessment environmental labeling, environmental aspects in product standards

Internal Organization for Standardization--TC207



Drivers of the ISO movement

- Corporate desire for worldwide standardization of environmental performance expectations
- Need for more proactive, integrated system for dealing with environmental issues
- Increasing international attention to environmental performance
- Success of ISO 9000
- Multiple standards being adopted in other countries/regions
  - BS (British Standard) 7750 EMAS (Eco management and audit scheme)

ISO Series Standards--by the numbers

- Environmental Management Systems
  - 14001, EMS specifications with guidance for use
  - 14004, EMS general guidelines on principles, systems and supporting techniques
- Environmental Auditing
  - 14010, General principles on environmental auditing
  - 14011, Audit procedures Auditing of EMS
  - 14012, Qualification criteria for environmental auditing
- Environmental Labeling (14021, 22, 23, 24, 25)
- Environmental Performance Evaluation (14031)
- Life Cycle Assessment (14040, 41, 42, 43)
- Terms and Definitions (14050)
- Environmental Aspects of Product Standards (14060)

Environmental Management System

Dimensions of the overall management function of an organization that develop, implement achieve, review and maintain the environmental policy, including organizational structure, responsibilities, practices, procedures, processes and resources

ISO EMS standards

- EMS standards will not replace the environmental requirements set by nations and do not set technical environmental requirements
- EMS's are intended to assist companies go beyond obligations set by law
- EMS's allow organizations to determine priorities

ISO 14001 EMS status and applicability

- TC 207 formed in January 1993
- ISO 14001 IS published in Sept , 1996
- Designed to be applicable to
  - Any type of product/service
  - Any country
  - Any size organization
  - Can be adopted at corporate and/or facility level
- ISO 14010-2 Audit guidlines ratified in Oct

ISO 14000 applicable to organizations that want to

- Implement, maintain and/or improve its EMS
- Assure itself of conformance
- Demonstrate conformance to others
- Seek certification from a third party
- Self-declare conformance

Why should companies adopt ISO 14000?

- Improve environmental performance
- Create integrated, proactive environmental mgmt function
- Reduce costs
- Obtain differentiation advantages
- Buyer pressure
- International competitive necessity
- Create Competitive Advantage!!!???

ISO 14001 Registration

- Countries create national accreditation bodies
- National bodies accredit registration companies
- Certified auditors at registration companies audit companies to certify conformance to the standard

ISO EMS Definitions

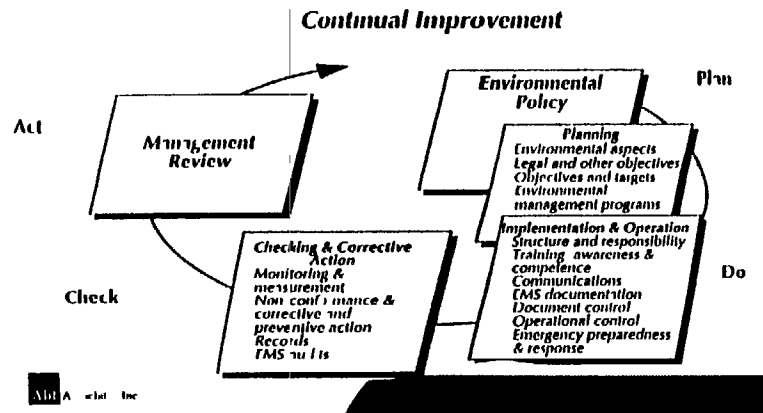
- Environment, Surroundings in which an organization operates, including air, water land, natural resources, flora, fauna, humans, and their interrelation The environment in this context extends from within an organization to the global system
- Environmental Aspect, Elements of an organization s activities whether adverse or beneficial, wholly or partially resulting from an organisation s activities products and services
- Environmental Impact Any change in the environment whether adverse or beneficial wholly or partially resulting from an organization s activities products, and services
- EMS Audit, Systematic and documented verification process to objectively obtain and evaluate evidence to determine whether an organization s environmental management system conforms to the EMS audit criteria

ISO EMS Definitions (cont)

- Environmental Performance Measurable outputs of the environmental management system, relating the organization s control of the impact of its activities products, and services on the environment, based on its environmental policy, objectives, and targets
- Environmental Objectives Overall environmental goals, arising from the environmental policy and significant impacts that an organization sets itself to achieve, and which are quantified wherever practicable
- Environmental Target, Detailed performance requirement, quantified wherever practicable, applicable to the organization or parts thereof, that arise from the environmental objectives and that need to be set and met in order to achieve those objectives
- Environmental Policy, Statement by the Organization of its intention and principles in relation to its overall environmental performance which provides a framework for action and for the setting of its environmental objectives and targets

ISO 14000 EMS Principles

EMS Model



ISO 14001, Commitment and Environmental Policy

- Principle 1, An organization should first focus on what needs to be done-it should ensure commitment to environmental management and define its policy
- Top management shall define the organization's environmental policy and ensure that it,
  - Is appropriate to the nature, scale and environmental impacts of its activities, products and services
  - Includes a commitment to continual improvement and prevention of pollution
  - Include a commitment to comply with relevant environmental legislation and regulations
  - Provides a framework for setting objectives and targets
  - Is documented, implemented and maintained and communicated to all employees
  - Is available to the public

ISO 14001; Planning

- Principle 2, An organization should formulate a plan to fulfill its environmental policy
- Environmental Aspects
- Legal and other requirements
- Objectives and targets
- Environmental Management Program

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ISO 14001, Implementation

- Principle 3, For effective implementation an organization should develop the capabilities and support mechanisms necessary to achieve its policy, objectives, and targets
- Structure and responsibility
- Training, awareness and competence
- Communication
- Documentation and document control
- Operational control
- Emergency preparedness and response

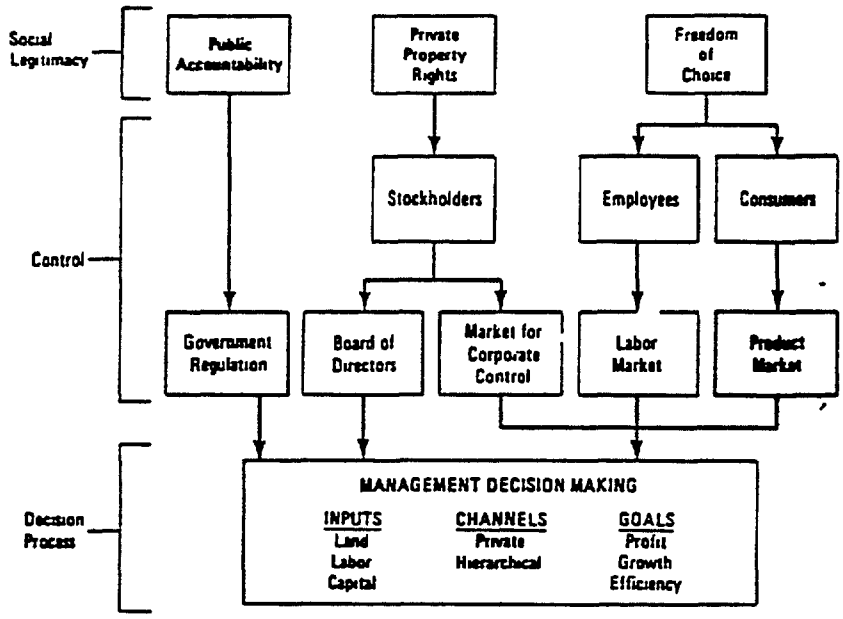
ISO 14001, Measurement and Evaluation

- Principle 4, An organization should measure, monitor and evaluate its environmental performance
- Monitoring and measurement
- Non-conformance and corrective and preventive action
- Records
- EMS System Audit

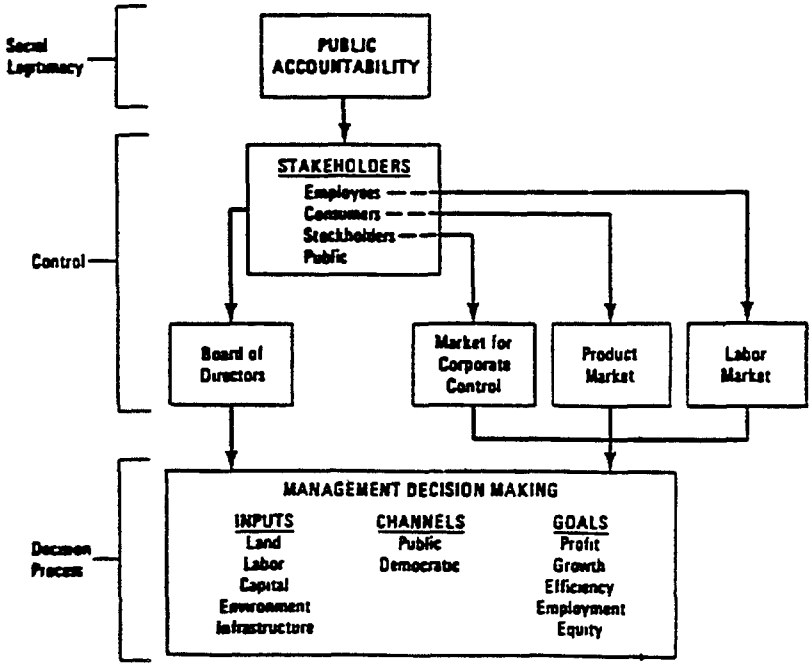
ISO 14001, Management Review

- Principle 5, An organization should review and continually improve its environmental management system, leading to an improvement in overall environmental performance

MARKET CONTROL



STAKEHOLDER INFLUENCE



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Tuesday, January 14, 1997

Module III

The "Fun Factory" Simulation

PARTICPANT'S MANUAL

The Fun Factory

Training in Waste Reduction Using a Mock Industrial Process

BACKROUND

Your division, part of a giant defense contracting corporation, lost its only significant contract 14 months ago in a surprise policy reversal by the Government Since then the division has been downsizing while it desperately seeks a new contract Specifically, your division, and every other firm in your former industry, is competing in the proof of concept/proof of capability phase of what promises to be a major new Government contract As part of its new sole sourcing strategy, the Government plans to award the entire contract to the supplier who wins the competition Success will be based upon the speed of production ramp up, delivery times for new products, quality of products, rejection rates, ability to quickly respond to rush orders, scrap, environmental compliance, and levels of hazardous waste materials generated.

DIVISION'S POSITIONS AND JOB DESCRIPTIONS

VP of Marketing - In charge of finding new contracts Career suffered a direct hit when the VP was surprised by the Governmental reversal of policy and the cutting of former contract Figures (and rightly so) that promotion to the corporate level rides on getting this new contract Firm believer in TQM.

Plant Engineer - In charge of handling the drums, preparing the Play-Doh material for use in the machine, worker complaints, and the company Christmas party

Storage Shed Manager - Inventory control over wastes - proper labeling, proper storage, and reports quantity of wastes to Plant Engineer (reports are generally 3-4 months behind production)

Line Operator - Extrudes the products as ordered, cleans up the machinery Minimum wage (plus $ 10 per hour premium due to seniority) Glad to have the Job

Regulatory Compliance Coordinator - Monitors the entire operation for environmental safety, and solid waste compliance B S Chemistry, M S Environmental Engineering, C S P (Certified Safety Professional), C H.W T (Certified Hazardous Waste Trainer)

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GOVERNMENT POSITIONS

Governmental EH&S Compliance Inspector - Monitors manufacturers for violation of environmental, safety, and health violations Has complete access to all production facilities Has the right to reclassify any improperly produced goods from non-hazardous to hazardous classification Faces serious consequences if press discovers noncompliant behavior before the inspector does

Governmental Vendor Relations Officer - Former purchasing agent who received a promotion to VRO without a raise Would like to run things by the book Very particular about product dimensions, smooth aerodynamic surfaces on all products, and supplier's ability to deliver all products fast - ESPECIALLY rush orders

COMPANY POLICIES

1 QUALITY is everyone's responsibility Objections by anyone to the appearance, performance, or condition of any product makes the part a "REJECT"

2 SAFETY is vital to the economic feasibility of staying in business Unsafe acts will result in corrective counseling Repeated unsafe acts may result in discharge

RULES

1 This is a military specifications job, while the material is in the hands of the Plant Engineer, it may be kneaded, rolled, and worked Once it is placed in the machine, it becomes either product or waste - THERE IS NO RECYCLING OR REUSE OF MATERIAL!

2 Yellow Play-Doh is non-hazardous Blue Play-Doh is VERY hazardous and the third color of dough is mildly hazardous Any mixing of colors, no matter how trivial, results in hazardous waste (Government Inspectors and VRO's are real sticklers on this)

3 JIT production requires that all work must be scheduled according to the sequence of customer orders

INSTRUCTIONS TO PARTICIPANTS

1 Set up materials to each facility, have employees decide on which position each will assume (allocate dual roles if you run short of players)

2 Once the Customer orders are received and understood, begin production

3 Waste will be accumulated in the Storage Shed Separate waste by color and type of waste Waste will be either Quality Control Waste, Process Waste, or Clean-Up Waste Quality Control Waste is defined as any product rejected by an employee from either your division or the Government Process Waste is waste generated in the start-up or end-of-run material Each time production is completed, any material left in the machine will be pushed through and declared Process Waste Clean-up Waste is any material removed from the machine during the preparation for a color change

4 Remember, you are in competition with the other companies for selection as the sole source supplier under the new contract (Please review selection criteria listed in background) Winning this contract would save your division

5 Once you have completed production of all parts, form a Quality Circle to discuss your wastes and the improvements you made, or could make during future production runs

Quality Control is

Everyone's Responsibility

- **Make 3 Yellow Stars**

  (Non hazardous width of lid)

- **Make 3 I-Beams - Third Color**

  (Somewhat hazardous,

  width = diameter of Play-Doh lid)

- **Make 6 Blue Ropes**

  (Make 3 at a time)

  (Very Hazardous, Length of

  Play-Doh can without lid)

Separate Wastes by Color and Type:

---

1. Quality Control Waste

2. Process Waste

3. Clean Up Waste

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	Q C Waste	Process Waste	Clean-up Waste
Yellow			
Third Color			
Blue			

Wednesday, January 15, 1997

Module I

Networking and information exchange

Networking for energy efficiency

Energy efficiency resources

Environmental management resources

Job hunting on-line

Networking for Energy Efficiency

1 Objective

To facilitate the interchange of technical and policy information among practicing professionals to facilitate success in achieving energy efficiency and environmental enhancement

2 Networking Methods

- Personal Interactions
  - Conferences Technical (e g ASHRAE)
    Professional (e g DOE/EPA)
    Industrial trade shows
  - Faculty visiting/exchange programs
- Electronic Communications
  - Electronic mail
  - Internet sites
- Professional Group Newsletters

3 Specific Information for Network Dissemination

- Governmental policies considered or established
- New technologies for incorporation into curricula
- Energy/environment research opportunities

Energy Efficiency Resources

1 U S Department of Energy

- Energy Efficiency and Renewable Energy Clearinghouse
  P O Box 3048
  Merrifield, VA 22116
  (800) 273-2957

  - Fact sheets, publications
  - Technical responses to queries
  - Personal business assistance for entrepreneurs
  - Referrals to trade and professional associations, laboratories, state energy offices, and special interest groups

- Energy Efficiency and Renewable Energy Network (EREN)

  - online library of resources offers news and archives about conservation techniques and developments of world energy technology
    (Internet URL <www eren doe gov/>)

- Special Programs

  - Climate Wise (Reduction of greenhouse gases and resultant global warming)

    U S DOE
    Energy Efficiency and Renewable Energy
    1000 Independence Avenue, SW
    Washington, DC 20585
    Phone (202) 586-1878
    Fax (202) 586-711

  - Motor Challenge (Improvement in motor drive system efficiency)
    Phone (800)862-2086
    Fax (360)586-8303

  - NICE3 Program (Improvement of industrial competitiveness through energy efficiency, waste minimization and productivity improvement)

    U S Department of Energy
    Golden Colorado Field Office
    Phone (303) 275-4755

- Energy-Related Inventions Program (Competitive grant program for funding the development of energy conserving or producing technologies)

  Office of Technology Innovation
  National Institute of Standards and Technology
  Gaithersburg, MD 20899-0001
  Phone (301) 975-5500
  Fax (301) 975-3839
  E-mail innovate@enh nist gov

- DOE-Sponsored Conferences

  Example

  Second Industrial Energy Efficiency Symposium and Exposition, sponsored by the DOE Office of Industrial Technologies, to be held at the Hyatt Regency Crystal City Hotel, Arlington, Virginia, February 24-26, 1997

2 Other Internet Resources

- International Energy Agency (IEA)

  - Fosters cooperation between participating countries to increase energy security through energy conservation, development of alternative energy sources, new energy technology and research and development
    (Internet URL <www zdsubs/zdim/>)

- Center for the Analysis and Dissemination of Demonstrated Energy Technologies-Energy Efficiency Center (CADDET) (Sittard, the Netherlands)

  - Objective is to broaden and improve the collection and exchange of information on energy-efficient technologies that have been demonstrated in the applications in industry, buildings, transport, utilities an,d agriculture
    (Internet URL <www caddet-ee org/>)

- International Institute for Energy Conservation (IIEC)

  - Accelerates the global adoption of energy-efficiency policies, technologies and practices in order to enable economically an ecologically sustainable development
    (Internet URL <www crest org/clients/iiec/>)

- World Energy Efficiency Association (WEEA)

  - Missions
    1 To assist developing countries in accessing information on energy efficiency
    2 To serve as a clearinghouse for information on energy efficiency programs, technologies and measures
    3 To disseminate this information worldwide
    4 To publicize international cooperation efforts in energy efficiency (Internet URL <www weea org/>)

- Solstice

  - A site for energy efficiency, renewable energy, and sustainable technology information
    (Internet URL <www solstice crest org/>)

3 Professional Societies

- Association of Energy Engineers (8000 members in 52 countries)
  4025 Pleasantdale Road, Suite 420
  Atlanta, GA 30340-4264

  - Annual Meeting in Atlanta, fall each year
  - Sponsors several regional conferences with energy and environmental themes
  - Energy efficiency seminar series (throughout the U S)
  - Publications Energy Engineering, Strategic Planning for Energy and the Environment
  - Energy manager certification program (by examination)

4 Not-For-Profit Organizations

- American Council for an Energy-Efficient Economy
  1001 Connecticut Avenue, NW, Suite 801
  Washington, DC 20036

  - Numerous recently-published books and research reports offered in the subject areas of energy and the environment, industrial and residential energy use efficiency, energy policy, utility issues, transportation systems and international topics

- The Energy Efficiency Center
  Slezska
  120 56 Prague 2
  Phone (42-2) 2425 2115, 2424 7552
  Fax (42-2) 2424 7597
  E-mail seven@ecn cz

- Sponsors an annual international conference and exhibition dealing with a wide variety of Czech and international energy efficiency topics of current concern

5 Book Publishers

Example

- PennWell Publishing Company
  P O Box 21288
  Tulsa, OK 74121

  - Numerous recently-published books offered in the field of electric power generation

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Environmental Management Resources

1 U S Environmental Protection Agency

- Pollution Prevention Information Clearinghouse
  Environmental Protection Agency, PM 211-A
  401 M Street, SW
  Washington, DC 20460
  (202) 260-2602

  - Fact sheets, publications
  - Technical responses to inquiries

- Environment

  - Provides a single repository for pollution prevention, compliance assurance, and enforcement information and databases, includes pollution prevention case studies, technologies, points of contact, environmental statutes, regulations and compliance and enforcement policies and guidelines
    (Internet URL <es inel gov/>)

- EnviroFacts Database

  - Integrates environmental data extracted from five EPA program systems (Internet URL <www epa gov/docs/enviro/html/ef_home html/>)

- Special Programs

  - Green Lights (Lighting energy conservation) and
  - Energy Star Programs (Energy efficient devices)
    U S EPA Atmospheric Pollution Prevention Division
    401 M Street SW, (6202J)
    Washington, DC 20460
    Phone (202) 233-9190
    fax (202) 233-9569
    (Internet URL Green Lights <www epa gov/greenlights html>, Energy Star <www epa gov/energystar html>)

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2 U S Department of Energy

- Pollution Prevention Information Clearinghouse

  - Developed to enhance the exchange of pollution prevention information between Federal, state and local government agencies, as well as with industries, academic institutions and the general public
    (Internet URL <146 138 5 107/EPIC EXE?EPIC>)

JOB HUNTING ON-LINE

The following are job search/lists on the internet that you may find of interest:

Americas Job Bank	www.ajb.dni.us
Career City	www.careercity.com
Career Magazine	www.careermag.com
CareerMosaic	www.careermosaic.com/cm
CareerPath	www.careerpath.com
Catapult on Jobweb	www.jobweb.org/catapult/catapult.htm
E-Span	www.espan.com
Fed World Careers	www.fedworld.gov
Good Works Careers	www.essential.org/goodworks
Help Wanted USA	iccweb.com
Indiana U Employment Web	www.indiana.edu/~reeiweb/indemp.html
Job Listings in Academia	volvo.gslis.utexas.edu:80/~acadres/jla.h
JOBNET	www.westga.edu/~coop/index.html
Jobtrak	www.jobtrak.com
MonsterBoard	www3.monster.com:80
NationJob Network	www.nationjob.com
Online Career Center	www.occ.com/occ
TAMU Jobline	ageninfo.tamu.edu/jobs.html
Virtual Job Fair	www.careerexpo.com

Wednesday, January 15, 1997

Module II

Guidance in course design

Energy course and outreach program design & marketing

Energy Course and Outreach Program Design and Marketing

1 Options for the 'Packaging' of New Energy Courses

Full-Term Courses

- Modify existing courses (e g design of internal combustion engines) to include new content (e g operation on alternate fuels, designs for minimizing tailpipe emissions)
- Develop new courses (e g design of geothermal building heating systems)

Condensed-Term Courses

- Two-week "mini-term" course packaging (same total number of lecture hours)

2 Timing of Course Offerings

- Evening School" (attract area professionals)
- During normal term breaks (e g two-week mini-term course)

3 Location of Course Offerings

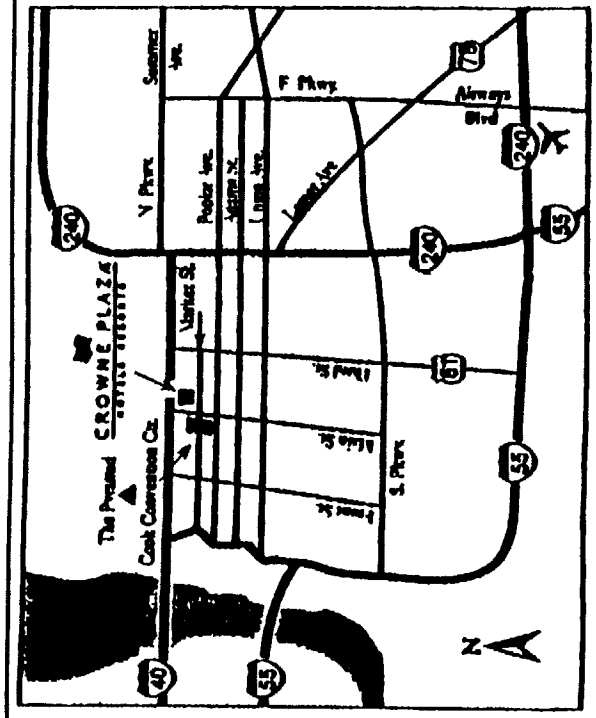
- Normal on-campus sites
- Regional satellite sites (e g University of Tennessee Knoxville/Oak Ridge locations)
- Remote sites (via television transmission, network with other universities)

4 No-Credit Outreach Programs

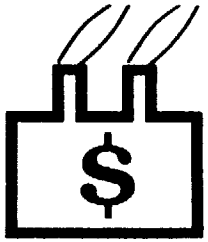
- On-campus short courses' (Certificate of participation)
- Off-campus "short courses" (Certificate of participation)

Travel Directions

CROWNE PLAZA MEMPHIS
250 N Main
Phone 901-527-7300



INDUSTRIAL ENERGY COST REDUCTION WORKSHOP



WHEN

Tuesday, June 18, 1996

WHERE:

Crowne Plaza Memphis
Memphis, Tennessee

Sponsored by

U S DEPARTMENT OF ENERGY
Office of Industrial Technologies

TENNESSEE DEPARTMENT OF ECONOMIC
& COMMUNITY DEVELOPMENT
Energy Division

MEMPHIS LIGHT, GAS & WATER

THE UNIVERSITY OF TENNESSEE
INDUSTRIAL ASSESSMENT CENTER
Department of Mechanical and Aerospace
Engineering and Engineering Science

Overview

This one day seminar, which will include presentations by industrial specialists, utility representatives and university faculty, will provide an overview of the most important energy management concerns for regional industrial facilities It will be valuable for plant managers engineers and and maintenance supervisors who want to reduce annual O&M costs and organize effective energy management stratagies The seminar is also appropriate for facility managers and corporate financial officers interested in

- Gaining a better understanding of regional electric utilities rate schedules
- Reducing electricity demand charges
- Reducing lighting costs
- Reducing energy use in motor-driven systems
- Improving compressed air system efficiency
- Enhancing chiller system efficiency
- Strategies for controlling waste management costs
- Establishing and implementing effective in-plant energy conservation & waste minimization programs

Program

8 00 - 8 30	**Registration - Refreshments provided**
8 30 - 8 45	**Introduction of sponsors and program overview**
8 45 - 9 30	**Understanding utility electric rate schedules**
9 30 - 10 00	**Strategies for reducing electricity demand charges**
10 00 - 10·15	**Break - Refreshments provided**
10 15 - 10 45	**Controlling facility lighting energy costs**
10 45 - 11 15	**Techniques for reducing energy use in motor-driven systems**
11 15 - 12 00	**Compressed air system efficiency improvements**
12 00 - 1 00	**Group Lunch, Crowne Plaza**
1 00 - 1 45	**Improvement of chiller system efficiency, refrigerant phase-out issues**
1 45 - 2 30	**Strategies for controlling waste management costs**
2 30 - 2 50	**Financing efficiency improvement measures**
2 50 - 3 30	**"Putting it all together" How to set-up effective programs in your facility**
3 30 - 3 45	**Discussion and wrap-up**

Registration

Seating is limited so advance registration is requested (Walk ins will be admitted on a space-available basis) Preregistration deadline is **Wednesday, June 12, 1996**

The seminar is offered to area manufacturing facility personnel for $65 per participant and includes all workshop materials, lunch at the Crowne Plaza and all break refreshments

To register, send a check payable to "The University of Tennessee' to

University of Tennessee
Industrial Assessment Center
ATTN Jonathan G Overly,
Project Coordinator
310 Perkins Hall
Knoxville, TN 37996 2030

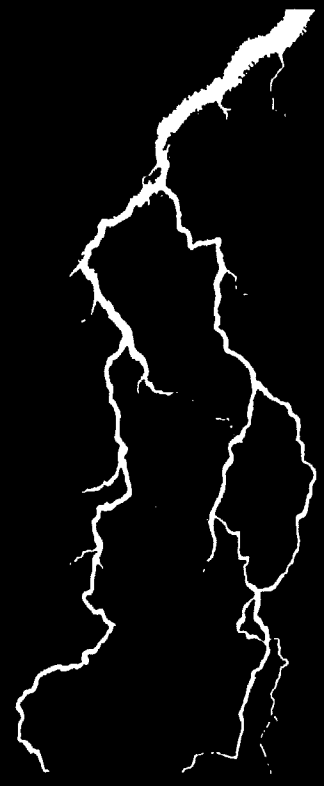
Include with your correspondence the following information

- Company name
- Personnel name(s) attending
- Business address (including street city and zip code)
- Business phone number

For workshop information or to register by phone please call Jonathan G Overly at The University of Tennessee Industrial Assessment Center (423) 974 5355

Plant Engineering Series

North Carolina State University
Maintenance and Energy



FEBRUARY
Results Oriented Maintenance

MARCH
Preventive/Predictive Maintenance

Electricity for Non-Electricians

A Guide to The National Electric Code

Chilled Water and Air Distribution

Quality for Plant Engineers

APRIL
Basics of HVAC

Improving Maintenance Inventory Control

Air Conditioning and Refrigeration for Maintenance Personnel

The Maintenance Productivity Game

Sponsored by
INDUSTRIAL EXTENSION SERVICE
N.C. Manufacturing Extension Partnership
College of Engineering

Coordinated by
Continuing and Professional Education
Division of Continuing Studies
NORTH CAROLINA STATE UNIVERSITY

aipe

Approved for recertification credits for the "Certified Plant Engineers" program by the American Institute of Plant Engineers

Professional Engineers
NCSU is an approved sponsor of Professional Development Hours

Energy Management Diploma Series

Program Objectives

The Energy Management Program opens its seventeenth year with new impetus from the Energy Policy Act of 1992 New and more stringent government reduction criteria are being placed on the Energy user Ever increasing national and international competition accentuates the need for Energy Cost reductions Education provides the most productive avenue for implementing an Energy cost reducing program Our program is staffed by the most experienced of hands on" Energy managers available and has trained some of the most successful Energy Managers in the World

EM-1 Managing Energy for Greater Profitability (2½ days)
February 3–5, 1997 Raleigh, NC

USA Energy Future
World Resources — Political and Economic Forces
Energy Accounting and Economics
How to Develop an Organizational Structure for Managing Energy
Procurement of Fuels
Workshop — Developing a Plan to Manage Energy
Strategic Planning — How to Develop a One Sheet Plan
Codes and Standards — Existing and Proposed

Course Fee for EM-1 and EM-2 $995

EM-2 How to Conduct and Maximize the Results of Your Energy Surveys (2½ days)
February 5–7, 1997 Raleigh, NC

How to Understand Electrical Costs and Rate Structures
Measuring Instruments for Energy Surveys
Demand Side Management Definition and Opportunities
Computer Programs for Energy Survey Assistance
Survey Planning and Implementation
Case Study
Simulated Walk through Audit
Low Cost No Cost Projects

Course Fee for EM 1 and EM 2 $995

EM-3 Improving Equipment Efficiencies (4½ days)
June 2–6, 1997 Raleigh, NC

Small HVAC Systems
Thermal Energy Storage
Electric Motors
Heat Recovery
Chillers and Cooling Towers
Cogeneration
Lighting
HVAC Controls
Boilers / Steam Systems
Energy Management Control Systems
Air Compressors

Course Fee $995

EM-4 Industrial Energy Process and Building Analysis (4½ days)
October 13–17, 1997 Raleigh, NC

Building Envelope Analysis
Environmental Implications of EM
Large HVAC Systems
New Energy Technologies
Industrial Process Energy Analysis
Industrial / Commercial Plant Survey by Class
Energy Performance Analysis
Survey Presentations

Course Fee $845

The College of Engineering
University of Wisconsin–Madison
Department of Engineering Professional Development
432 North Lake Street Madison Wisconsin 53706

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A limited enrollment offering
Cogeneration Technology
March 3–7, 1997
In Las Vegas, Nevada

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University of Wisconsin–Madison

Cogeneration Technology

March 3–7, 1997
in Las Vegas, Nevada

College of Engineering
Department of Engineering Professional Development

Cogeneration Technology

March 3–7, 1997, in Las Vegas, Nevada

- Examine the utilization of current cogeneration technologies matching end use electric and thermal loads with design concepts and equipment selection
- Focus on the specific operating characteristics and economics of representative installations using gas turbines internal combustion engines and steam turbines
- Increase your overall understanding of the application of cogeneration technologies
- Know how to conduct a feasibility analysis

The Trend Toward Cogeneration

Since the implementation of PURPA in 1978 more than 29 300 MW of electric generation capacity from more than 2 500 facilities has come on line in the form of cogeneration small power production and independent power production Installed capacity in this market segment is growing at the rate of 15 percent per year representing more than $3 billion in annual business Half (45 000 MW) of all the new capacity needs during the 1990s are expected to be provided by the private sector Cogeneration site installations range from 30-KW packaged systems to multi-system installations of more than 1 000 MW

Industrial plants universities hospitals and commercial facilities with year round steam hot water or cooling load or a combination of these are excellent candidates for the use of cogeneration technologies Facilities with a 12 month electrical demand and large seasonal load variations, such as food processing plants or institutions with large air conditioning loads can also benefit from this technology

In this course system cost guidelines along with a discounted cashflow economic computer model will help you to evaluate internal rate of return on investment and payback periods which could be less than a year

Computer Program

You will receive software that analyzes cogeneration options and heat recovery We will provide hands on training

Calculators and Laptop Computers

Be sure to bring your calculator which will be essential to effective and rapid calculations If you have a laptop PC computer we suggest you bring it to the course This is not required but may allow you to do more evening work related to this course

Who Will Benefit

This course will help facility and consulting engineers to plan select and evaluate the best cogeneration systems for their plants or clients Utilities engineers will gain an understanding of various cogeneration applications to support customer cogeneration interests

Course participants will learn to evaluate cogeneration against other energy system alternatives and conservation opportunities

Certified Plant Engineer (CPE) Recertification Credit

To maintain status as a Certified Plant Engineer a CPE must earn credits within each five-year period of certification By attending this course the CPE can earn one of the required eight credits Simply submit a copy of the CEU certificate when applying for recertification For more information on recertification or the CPE program in general contact the American Institute of Plant Engineers at 513-489-2473

Course Staff

Robert C Erickson President, Erickson Energy Applications Consulting, Guffey, Colorado

William A Liegois Process and Instrument Engineer Stanley Consultants, Muscatine, Iowa

Charles E Dorgan Program Director, Department of Engineering Professional Development, University of Wisconsin–Madison

Walter P Smith Retired Former Manager, Energy Technology and Conservation BASF Corporation Enka North Carolina Currently President, Energy Technology Services International, Candler North Carolina

Course Outline

Monday, March 3

8 00 Registration–Coffee/Pastries
Tropicana Hotel
3801 Las Vegas Blvd South
Las Vegas Nevada

8 15 Course Introduction
Charles E. Dorgan

8.30 Cogeneration Overview
- Definitions/cycles
- Cogeneration efficiency
- PURPA
- Justification for cogeneration
- How cogeneration fits into the energy use pattern
- Load reduction and load shifting using absorbers thermal storage etc
- Selecting and feasibility

Rules of Thumb for Phase I Concept Analysis
Walter P Smith

10 30 Basic Thermodynamic Cycles
William A Liegois

11·00 Single Line Utility Diagrams
- How to develop
- Power
- Steam
- Examples of diagrams
- Using to select cogeneration opportunities

Walter P Smith

12·00 Lunch

1·00 Data Gathering and Load Profiles
- Plant energy use
- Collecting data
- Load duration curves
- Matching steam to electric loads
- Feasibility analysis
- Topping cycle
- Replace PRV
- Performance

Robert C. Erickson

2 45 Cogeneration Steam Turbine Technology
- Steam turbine equipment
- Steam process diagrams
- Input and output

***Course Outline** continues inside*

Course Outline continued

- Process efficiency and cost
- Topping cycle
- Replace PRV with back pressure turbine
- Performance

Walter P Smith

3 30 Introduction to Class Workshops

Group Problem

Staff

4 15 Workshop—One-Line Diagrams and Load Duration Curves

Staff

5·00 Social Hour (Cash Bar)

6·00 Adjournment

Tuesday, March 4

8 00 Coffee/Pastries

Workshop Review

Staff

9 00 Selecting Steam Turbines

- Back pressure
- Extraction
- Condensing
- Examples

William A. Liegois

10 30 Internal Combustion Engine—Generator

- Engine characteristics
- Fuels
- Operations and maintenance
- Heat recovery
- Heat exchangers
- Applications
- Package equipment
  - –advantages
  - –IC engines
  - –gas turbines
  - –absorption chillers
  - –cost
  - –system development

Robert C Erickson

12 00 Lunch

1 00 Gas Turbine—Generators

- Gas turbine cycle
- Electric and heat balance
- Equipment characteristics
- Economics and installed costs
- Available equipment

William A Liegois

3 00 Combined Cycle Gas Turbine

- Operating advantages
- Site needs
- Performance
- Selection

Walter P Smith

4 00 Workshop—Cogeneration Options and Technology Selection

Staff

5 30 Adjournment

Wednesday, March 5

8 00 Coffee/Pastries

Workshop Review

Staff

9 00 Waste Heat Recovery

- Heat exchangers
- Steam turbine
- Diesel engines
- Gas turbine
- Waste heat boiler
- Supplemental duct burners

Robert C Erickson

10 15 Emissions from Engines and Gas Turbines

William A Liegois

11 00 Absorption Chillers and Ice Storage

Walter P Smith/
William A Liegois

12 00 Lunch

1 00 Water Treatment Review

Walter P Smith

1 45 Electrical Interconnection

- Utility concerns
  - –distribution
  - –reliability
  - –safety
  - –system protection
- Multi-electrical connections
- Draft guidelines
- Owner concerns
  - –equipment protection
  - –cost
  - –safety and reliability
- Wheeling
- Case study

William A Liegois/
Robert C Erickson

3 00 Implementing Cogeneration, Avoiding Pitfalls

- Project management and strategy
- Selecting a consultant, technology and hardware
- Operation and maintenance options
- Economics

Walter P Smith

3 45 Workshop—Equipment Sizing and Data Collection for Model

Staff

5 30 Adjournment

Thursday, March 6

8 00 Coffee/Pastries

Workshop Review

Staff

9 00 Developing Budgetary Project Cost

- Major equipment
- Support equipment
- Environmental equipment
- Building work
- Fuel supply
- Electrical interconnections
- Utilities

William A. Liegois

10 15 Energy Audits and Process Optimization

Walter P Smith

11 00 Computer Sizing of Gas Turbines and Heat Recovery

Robert C Erickson/
William A Liegois

12 00 Lunch

1 00 Feasibility/Economic Methodology

- Economic modeling
- Sensitivity
- Spreadsheet models
- Data requirements
  - –utility rate
  - –load profile
  - –equipment/process use
  - –matching technologies
  - –equipment costs

Robert C Erickson

2 30 Computer Modeling Examples

Robert C Erickson

3 00 Evaluation of Cogeneration Designs

- Life cycle costs
  - –first cost
  - –power generation
  - –heat recovered
  - –maintenance
  - –operating labor
- Specifications

William A Liegois

3 30 Workshop Problem Development with Computers

- Gas turbine
- IC engine
- Thermal storage/absorption
- Economics

Staff

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4 00 Run Computer Models
Staff

5 30 Adjournment

Friday, March 7

8 00 Coffee/Pastries
Workshop Review
Staff

9 00 Operational Reliability
Robert C Erickson

10 00 Case Studies
• Commercial hospital, industrial
William A Liegois Robert C Erickson and Invited Guests

12 00 Lunch

1 00 Optional General Discussion
Share your ideas problems and solutions during this opportunity to visit with your instructors and fellow participants

2 00 Final Adjournment

Schedule Note
Each day will begin at 8 00 with early coffee and pastries There will be coffee/soft drink breaks at approximately 10 00 a m each morning and 2 30 p m each afternoon except Friday Lunch will be served at noon each day

Related Courses

To receive brochures on the following courses please call 800 462 0876

Process Piping #7069
April 14–18 1997

HVAC for Industrial Facilities #7070
June 2–6 1997

Psychrometric Processes and Load Calculations #7081
September 22–26 1997

Energy Analysis for Industrial Refrigeration #7204
November 17–21 1997

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Need to Know More?

Call toll free **800 462 0876** and ask for
Program Director Charles E Dorgan
Program Assistant Mary Danielson

General Information

Fee Covers Notebook program materials break refreshments lunches and certificate

Cancellation We prefer enrollment in advance If you cannot attend please notify us immediately We will refund your fee or you can have someone take your place

Location and Accommodations The course will be held at the Tropicana Hotel 3801 Las Vegas Blvd South Las Vegas Nevada We have reserved a block of sleeping rooms for course participants until February 2 at the rate of $70/person single or double To reserve a room please call 702 739 2222 or toll free 800 634 4000 and indicate that you will be attending the University of Wisconsin–Madison course *Cogeneration Technology* Please advise us at time of enrollment if you are a person with a disability and desire special accommodations Requests will be kept confidential

Save on Air Travel Your enrollment confirmation will include details on discounted airfares

UW Madison provides equal opportunities in employment and programming Including Title IX requirements This course is supported in part by funds administered through UW–Extension

Enrollment Form

UW#

Important–please enter the 3-digit UW# Code from the mailing label

UW# ☐ ☐ ☐

Limited Enrollment

COURSE

☐ Please enroll me in **Course #7278**
Cogeneration Technology
March 3–7 1997 in Las Vegas Nevada Fee $1495 (5 0 CEU)

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Please type or use ink print information as you d like it on your record

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Title _____

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DEMOGRAPHICS

Voluntary information collected to enhance UW programming

☐ Female ☐ Male

Birthdate Month Day Year

Heritage
☐ African American 1
☐ Asian/Pacific Islander 2
☐ American Indian/Alaskan Native 3
☐ Hispanic/Latino 4
☐ White/Other 5

Occupational Area
☐ Engineering Architecture & Surveying
☐ Other

Are you enrolled in this program primarily for career purposes?
☐ Yes ☐ No

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Wednesday, January 15, 1997

Module III

Leadership/Management

Concluding discussions

Next phase scheduling
    Table 2: Proposed Framework for US Visit

Program evaluation

TABLE 2
Proposed Framework for U.S. Visitation by Czech Delegation/March 1997

	Monday	Tuesday	Wednesday	Thursday	Friday
WEEK 1	• Introduction • Program overview • Goals • Schedule • Review of Jan training experiences	• Curriculum development I • Survey of energy efficiency training in US & UTK[a] curriculum	• Faculty/student interactions • Energy audit of a manufacturing plant • Audits as a training tool with emphasis on pedagogy	• Development of energy effic measures for audited plant • Group work sessions • Overview of energy effic measures for industry	• Curriculum development III • Establishment of frameworks suitable for Czech settings • Discussion of Czech curricula

	Monday	Tuesday	Wednesday	Thursday	Friday
WEEK 2	• Energy audit of a UTK building • Group development of energy efficiency measures • Overview of energy efficiency measures for office facilities	• Group visit to TVA[b] coal-fired power plant • Energy efficiency for electricity generation and distribution • Identify sources of technical literature and teaching aids	• Curriculum development II • Further gorup development of specific courses and curricula for Czech Universities	• Overview of state-of-the-art energy effic technologies • TVA, ORNL[c] UTK equipment suppliers	• Curricula development IV • Evaluation of curriculum designs • Administrative issues • Planning and implementation • Support visits in May 1997

a University of Tennessee--Knoxville
b Tennessee Valley Authority
c Oak Ridge National Labs

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PROGRAM EVALUATION
General Questions

1) I am from

Liberec ☐ Ostrava ☐ Prague ☐

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
2) Overall, this program provided information that will be useful to the energy curriculum at my university	☐	☐	☐	☐	☐
3) The content of this program was appropriate and clear	☐	☐	☐	☐	☐
4) This program was well organized	☐	☐	☐	☐	☐

Preferences for Phase II?

If you could travel to the US for a program in energy management, when would be the most preferable time period? Rank order the following choices from 1-4 (1= most favorable, 4 = least favorable)

March 1-15 ☐

March 8-22 ☐

April 5-19 ☐

April 12-26 ☐

PROGRAM EVALUATION

Content Modules

Please indicate how effective you believe the following sessions were in terms of their relevance in terms of content and pedagogy

	This was mostly irrelevant	I will probably use something	I will use some content	I will use much content	I will use almost all of this content	This module had no effect on how I will teach in the future	I liked this session and how it was taught	I liked this session and will try this approach
Saturday Module II-- Jendrucko Linkages to environmental management, Teaching in an open society	☐	☐	☐	☐	☐	☐	☐	☐
Saturday Module III-- Fryxell Common simulation	☐	☐	☐	☐	☐	☐	☐	☐
Sunday Module I -- Jendrucko Historical evolution of U S legal framework, Impact on engineering	☐	☐	☐	☐	☐	☐	☐	☐
Sunday Module II -- Bamford Role of the case study in env management	☐	☐	☐	☐	☐	☐	☐	☐
Sunday Module III -- Bamford "Double Death"--a negotiation exercise	☐	☐	☐	☐	☐	☐	☐	☐
Monday Module I -- Jendrucko Identificaiton of energy efficiency improvements	☐	☐	☐	☐	☐	☐	☐	☐
Monday Module II -- Jendrucko Financial analysis	☐	☐	☐	☐	☐	☐	☐	☐
Monday Module III -- Stanelle Opportunities for practice-oriented study training	☐	☐	☐	☐	☐	☐	☐	☐
Monday Module III -- Jendrucko Overview of UT Industrial Assessment Center	☐	☐	☐	☐	☐	☐	☐	☐
Tuesday Module I -- Fryxell TQEM	☐	☐	☐	☐	☐	☐	☐	☐
Tuesday Module II-- Fryxell ISO 14000	☐	☐	☐	☐	☐	☐	☐	☐
Tuesday Module III -- Bamford Play-doh exercise	☐	☐	☐	☐	☐	☐	☐	☐
Wed. Module I -- Jendrucko Networking and information exchange	☐	☐	☐	☐	☐	☐	☐	☐
Wed. Module II -- Stanelle Guidance in course design	☐	☐	☐	☐	☐	☐	☐	☐

ADDENDUM

Political system definitions

Toward a sustainable world

The tragedy of the commons

Statistical measures for management oversight to achieve continuous improvement at Monsanto Chemical Company

What leaders really do

Management 581: Issues in Environmental Management, Fall 1996

POLITICAL SYSTEM DEFINITIONS

COMMUNISM

You have two cows The government takes both of them and gives you part of the milk

SOCIALISM

You have two cows The government takes one and gives it to your neighbor

FASCISM

You have two cows The government takes both cows and sells you the milk

NAZISM

You have two cows The government takes both your cows, then shoots you

BUREAUCRACY

You have two cows The government takes both of them, shoots one, milks the other, then pours the milk down the drain

CAPITALISM

You have two cows You sell one of them and buy a bull

DEMOCRACY

Everyone has two cows, then a vote is taken, and whatever the majority decides to do, you do That's no bull!

Toward a Sustainable World

What policies can lead to the changes in behavior—of individuals, industries and governments—that will allow development and growth to take place within the limits set by ecological imperatives?

Mod II SAT

by William D Ruckelshaus

The difficulty of converting scientific findings into political action is a function of the uncertainty of the science and the pain generated by the action. Given the current uncertainties surrounding just one aspect of the global environmental crisis—the predicted rise in greenhouse gases—and the enormous technological and social effort that will be required to control that rise it is fair to say that responding successfully to the multifaceted crisis will be a difficult political enterprise. It means trying to get a substantial proportion of the world's people to change their behavior in order to (possibly) avert threats that will otherwise (probably) affect a world most of them will not be alive to see.

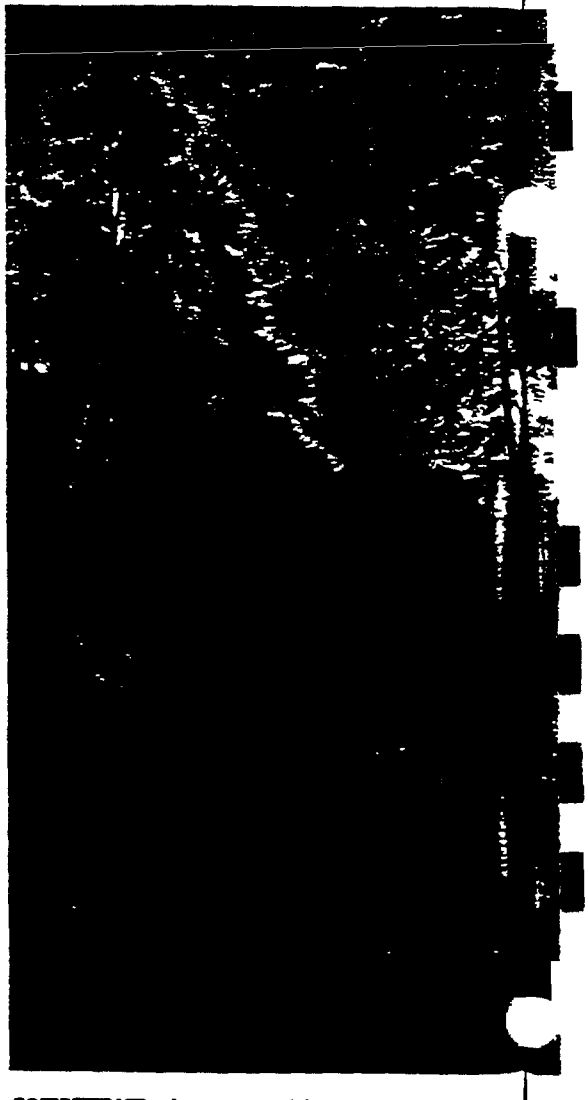
The models that predict climatic change for example, are subject to varying interpretations as to the timing distribution and severity of the changes in store. Also whereas models may convince scientists, who understand their assumptions and limitations as a rule projections make poor politics. It is hard for people—hard even for the groups of people who constitute governments—to change in response to dangers that may not arise for a long time or that just might not happen at all.

How then, can we make change happen? The previous articles in this single-topic issue have documented the reality of the global ecological crisis and have pointed to some specific ameliorative measures. This article is about how to shape the policies launch the programs and harness the resources that will lead to the adoption of such measures—and that will actually convince ordinary people throughout the world to start doing things differently

Insurance is the way people ordinarily deal with potentially serious contingencies and it is appropriate here as well. People consider it prudent to pay insurance premiums so that if catastrophe strikes they or their survivors will be better off than if there had been no insurance. The analogy is clear Current resources foregone or spent to prevent the buildup of greenhouse gases are a kind of premium. Moreover as long as we are going to pay premiums we might as well pay them in ways that will yield dividends in the form of greater efficiency, improved human health or more widely distributed prosperity If we turn out to be wrong on greenhouse warming or ozone depletion, we still retain the dividend benefits In any case, no one complains to the insurance company when disaster does not strike.

That is the argument for some immediate, modest actions. We can hope that if shortages or problems arise, there will turn out to be a technological fix or set of fixes or that technology and the normal workings of the market will combine to solve the problem by product substitution. Already for example, new refrigerants that do not have the atmospheric effects of the chlorofluorocarbons are being introduced perhaps a cheap and nonpolluting source of energy will be discovered.

It is comforting to imagine that we might arrive at a more secure tomorrow with little strain, to suppose with Dickens's Mr Micawber that something will turn up Imagining is harmless but counting on such a rescue is not. We need to face up to the fact that something enormous may be happening to our world. Our species may be pushing up against some immovable



COEXISTENCE of nature and human activity is celebrated in *Progress*, painted by Asher B. Durand in 1853 It is an im

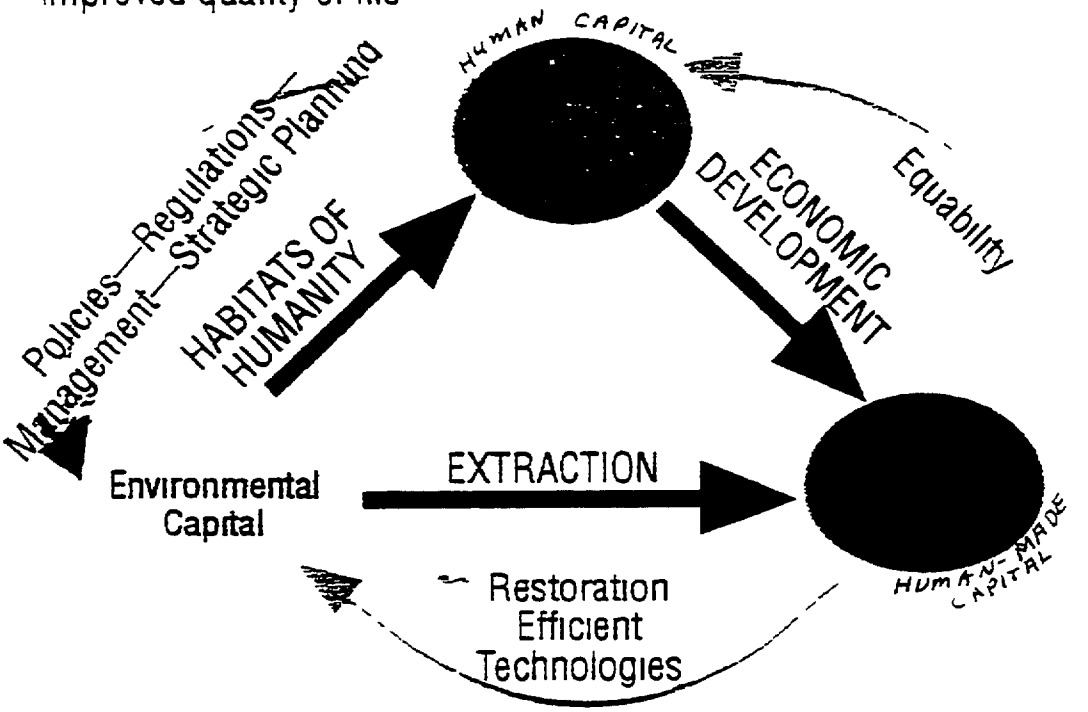
WILLIAM D RUCKELSHAUS is chief executive officer of Browning Ferris Industries Inc. He was administrator of the Environmental Protection Agency from 1970 to 1973 and again from 1983 to 1984 and was a member of the World Commission on Environment and Development. A graduate of Princeton University and Harvard Law School, he has served as deputy attorney general of Indiana and of the U S. and as acting director of the Federal Bureau of Investigation. Ruckelshaus acknowledges the major contribution of Michael A Gruber a senior policy analyst at the E P.A in the preparation of this article.

PURPOSE

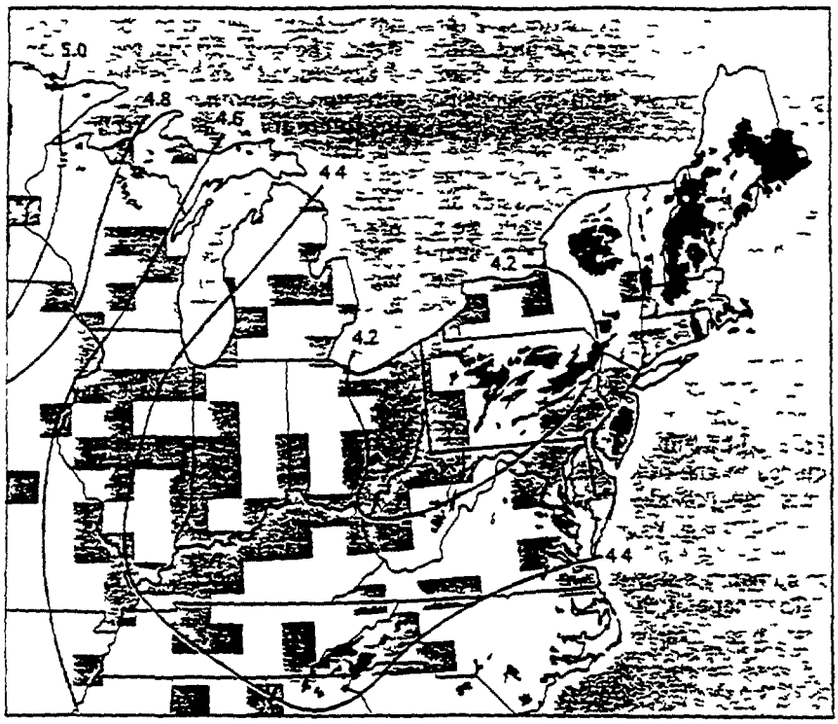
Our purpose is to provide intensive training courses, workshops and conferences in the United States and abroad for those involved in the planning, design, management, implementation and evaluation of programs and projects of sustainable economic development

SUSTAINABLE DEVELOPMENT

Sustainable development is equitable across socioeconomic groups, gender and generations Sustainable development does not diminish natural resource capital, human capital or human made capital available to future generations Equitability and sustainability are prerequisites to democratization and improved quality of life



DYNAMIC MODEL OF SUSTAINABLE DEVELOPMENT
Inner circle of arrows represents traditional relationships among various form of capital involved in economic development The outer circle of arrows illustrates reciprocal relationships necessary to achieve



ACID RAIN is a political problem because industrial emissions responsible for acid ic precipitation cross political borders. Regions where the density of sulfur dioxide emissions was more than 1.5 tons per square kilometer in 1980 are shown in gray states with the largest emissions are in the Midwest and along the Ohio River The contours show the *pH* of precipitation, low *pH* means high acidity Within the low *pH* regions, lakes and streams are at highest risk of acidification where the water's alkalinity is lowest (*orange*)—largely in the Adirondacks and New England. Sulfur diox ide data are from the National Acid Precipitation Assessment Program, alkalinity data from James M. Omernick of the Environmental Protection Agency and his colleagues.

do something else. We have to under stand that we are all in the same canoe and that steering toward sustainabili ty is necessary

Sustainability was the original economy of our species Prein dustrial peoples lived sustain ably because they had to if they did not, if they expanded their popula tions beyond the available resource base, then sooner or later they starved or had to migrate. The sustainability of their way of life was maintained by a particular consciousness regarding nature the people were spiritually connected to the animals and plants on which they subsisted they were part of the landscape, or of nature not set apart as masters

The era of this "original sustainabil ity" eventually came to an end. The development of cities and the maintenance of urban populations called for intensive agriculture yielding a sur plus. As a population grows it requires an expansion of production, either by conquest or colonization or improved technique. A different consciousness also embodied in a structure of myth, sustains this mode of life. The earth and its creatures are considered the property of humankind, a gift from the supernatural. Man stands outside of nature, which is a passive playing field that he dominates, controls and manipulates. Eventually with indus trialization, even the past is colon ized the forests of the Carboniferous are mined to support ever-expand ing populations Advanced technology gives impetus to the basic assumption that there is essentially no limit to humanity's power over nature.

This consciousness this condition of "transitional unsustainability" is dominant today It has two forms. In the underdeveloped, industrializing world, it is represented by the drive to develop at any environmental cost. It includes the wholesale destruction of forests the replacement of sustain able agriculture by cash crops the attendant exploitation of vulnerable lands by people such cash cropping forces off good land and the creation of industrial centers that are also cen ters of environmental pollution.

In the industrialized world, unsus tainable development has generated wealth and relative comfort for about one fifth of humankind, and among the populations of the industrialized nations the consciousness supporting the unsustainable economy is nearly universal. With a few important excep tions the environmental protection movement in those nations despite its major achievements in passing leg islation and mandating pollution-con trol measures has not had a substan tial effect on the lives of most people Environmentalism has been ameliora tive and corrective—not a restructur ing force. It is encompassed within the consciousness of unsustainability

Although we cannot return to the sustainable economy of our distant ancestors, in principle there is no reason why we cannot create a sustainability consciousness suitable to the modern era. Such a consciousness would include the fol lowing beliefs

1 *The human species is part of na ture. Its existence depends on its ability to draw sustenance from a finite nat ural world its continuance depends on its ability to abstain from destroy ing the natural systems that regener ate this world.* This seems to be the major lesson of the current environ mental situation as well as being a direct corollary of the second law of thermodynamics.

2. *Economic activity must account for the environmental costs of produc tion.* Environmental regulation has made a start here, albeit a small one. The market has not even begun to be mobilized to preserve the environ ment as a consequence an increasing amount of the "wealth" we create is in a sense stolen from our descendants.

3 *The maintenance of a livable global environment depends on the sus tainable development of the entire hu man family* If 80 percent of the mem bers of our species are poor we can not hope to live in a world at peace if the poor nations attempt to improve their lot by the methods we rich have pioneered, the result will eventually be world ecological damage.

This consciousness will not be at tained simply because the arguments for change are good or because the alternatives are unpleasant. Nor will exhortation suffice. The central lesson of realistic policy making is that most individuals and organizations change when it is in their interest to change, either because they derive some bene fit from changing or because they in cur sanctions when they do not—and the shorter the time between change (or failure to change) and benefit (or

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sanction) the better This is not mere cynicism. Although people will struggle and suffer for long periods to achieve a goal, it is not reasonable to expect people or organizations to work against their immediate interests for very long—particularly in a democratic system, where what they perceive to be their interests are so important in guiding the government.

To change interests three things are required. First a clear set of values consistent with the consciousness of sustainability must be articulated by leaders in both the public and the private sector Next motivations need to be established that will support the values Finally institutions must be developed that will effectively apply the motivations The first is relatively easy the second much harder and the third perhaps hardest of all.

Values similar to those I described above have indeed been articulated by political leaders throughout the world. In the past year the president and the secretary of state of the U S the leader of the Soviet Union, the prime minister of Great Britain and the presidents of France and Brazil have all made major environmental statements In July the leaders of the Group of Seven major industrialized nations called for "the early adoption, worldwide, of policies based on sustainable development." Most industrialized nations have a structure of national environmental law that to at least some extent reflects such values and there is even a small set of international conventions that begin to do the same thing.

Mere acceptance of a changed value structure, although it is a prerequisite, does not generate the required change in consciousness nor does it change the environment. Although diplomats and lawyers may argue passionately over the form of words, talk is not action. In the U S. which has a set of environmental statutes second to none in their stringency, and where for the past 15 years poll after poll has recorded the American people s desire for increased environmental protection, the majority of the population participates in the industrialized world s most wasteful and most polluting style of life. The values are there the appropriate motivations and institutions are patently inadequate or nonexistent.

The difficulties of moving from stated values to actual motivations and institutions stem from basic characteristics of the major industrialized nations—the nations that must, because of their economic strength, preeminence as polluters and dominant share of the world s resources take the lead in any changing of the present order These nations are market system democracies The difficulties ironically are inherent in the free-market economic system on the one hand and in democracy on the other

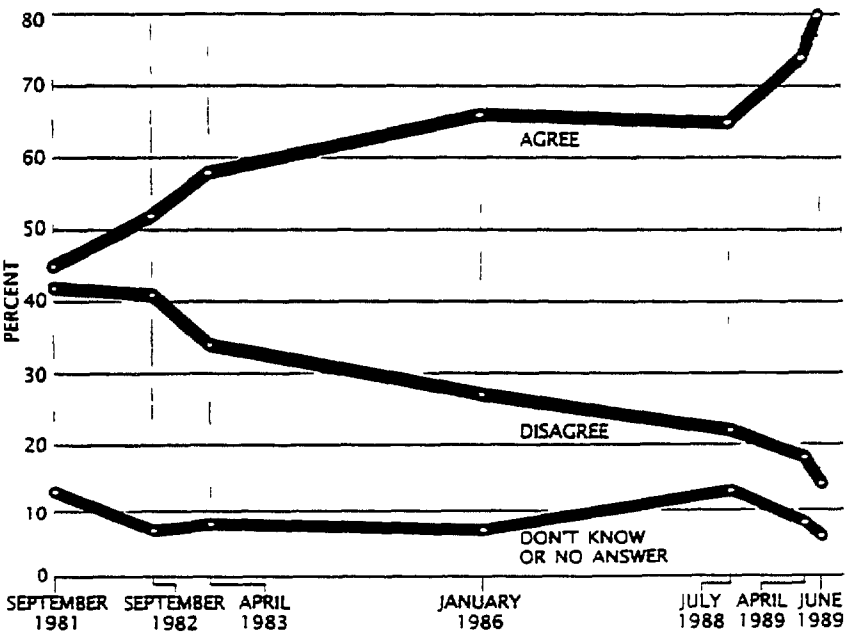
The economic problem is the familiar one of externalities the environmental cost of producing a good or service is not accounted for in the price paid for it. As the economist Kenneth E Boulding has put it "All of nature's systems are closed loops while economic activities are linear and assume inexhaustible resources and sinks in which to throw away our refuse." In willful ignorance, and in violation of the core principle of capitalism, we often refuse to treat environmental resources as capital. We spend them as income and are as befuddled as any profligate heir when our checks start to bounce.

Such "commons" as the atmosphere, the seas, fisheries and goods in public ownership are particularly vulnerable to being overspent in this way treated as either inexhaustible resources or bottomless sinks The reason is that the incremental benefit to each user accrues exclusively to that user and in the short term it is a gain. The environmental degradation is spread out among all users and is apparent only in the long term, when the resource shows signs of severe stress or collapse. Some years ago the biologist Garrett Hardin called this the tragedy of the commons

The way to avoid the tragedy of the commons—to make people pay the full cost of a resource use—is to close the loops in economic systems The general failure to do this in the industrialized world is related to the second problem, the problem of action in a democracy Modifying the market to reflect environmental costs is necessarily a function of government. Those adversely affected by such modifications although they may be a tiny minority of the population, often have disproportionate influence on public policy In general the much injured minority proves to be a more formidable lobbyist than the slightly benefited majority

The Clean Air Act of 1970 in the U S. arguably the most expensive and far reaching environmental legislation in the world, is a case in point. Parts of the act were designed not so much to cleanse the air as to protect the jobs of coal miners in high sulfur coal regions. Utilities and other high-volume consumers were not allowed to substitute low-sulfur coal to meet regulatory requirements but instead had to install scrubbing devices

Although the act expired seven



ENVIRONMENTAL VALUES have drawn increasing support in the U S. In *New York Times*/CBS News polls taken since 1981 respondents were asked to react to this statement "Protecting the environment is so important that requirements and standards cannot be too high, and continuing environmental improvements must be made regardless of cost." The two latest polls were taken after the *Exxon Valdez* spill.

years ago Congress found it extraordinarily difficult to develop a revision, largely because of another set of contrary interests involving acid rain. The generalized national interest in reducing the environmental damage attributable to this long-range pollution had to overcome the resistance of both high-sulfur coal mining interests and the Midwestern utilities that would incur major expenses if they were forced to control sulfur emissions. The problem of conflicting interests is exacerbated by the distance between major sources of acid rain and the regions that suffer the most damage. It is accentuated when the pollution crosses state and national boundaries: elected representatives are less likely to countenance short term adverse effects on their constituents when the immediate beneficiaries are nonconstituents.

The question, then, is whether the industrial democracies will be able to overcome political constraints on bending the market system toward long term sustainability. History provides some cause for optimism: a number of contingencies have led nations to accept short-term burdens in order to meet a long-term goal.

War is the obvious example. Things considered politically or economically impossible can be accomplished in a remarkably short time, given the belief that national survival is at stake. World War II mobilized the U.S. population, changed work patterns, manipulated and controlled the price and supply of goods and reorganized the nation's industrial plant.

Another example is the Marshall Plan for reconstructing Europe after World War II. In 1947 the U.S. spent nearly 3 percent of its gross domestic product on this huge set of projects. Although the impetus for the plan came from fear that Soviet influence would expand into Western Europe, the plan did establish a precedent for massive investment in increasing the prosperity of foreign nations.

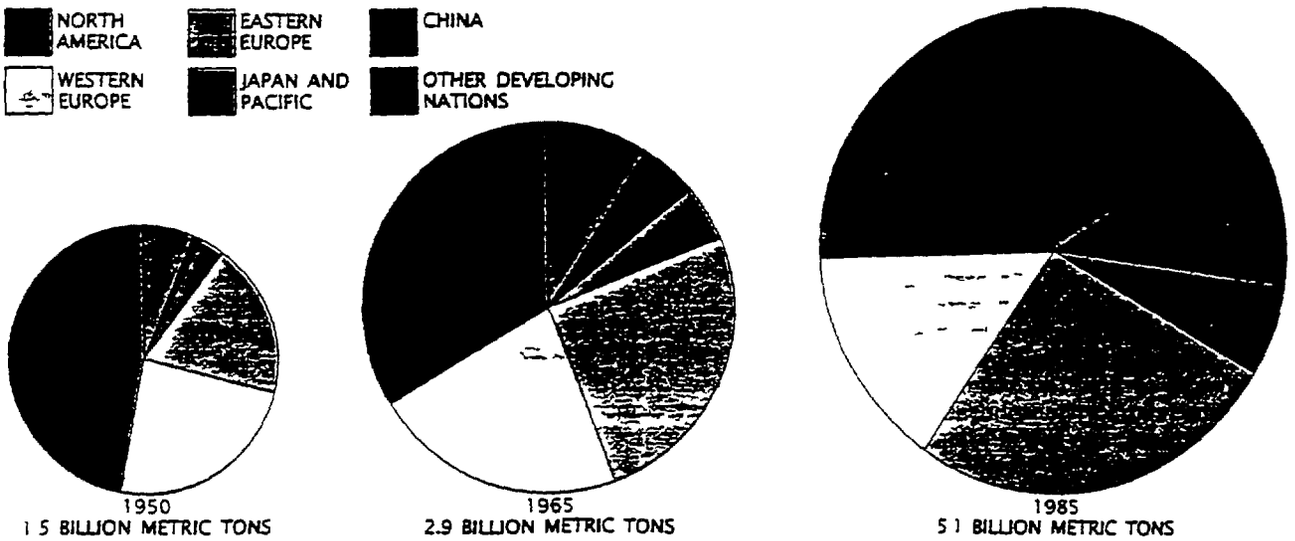
There are other examples. Feudalism was abandoned in Japan, as was slavery in the U.S., in the 19th century; this century has seen the retreat of imperialism and the creation of the European Economic Community. In each case important interests gave way to new national goals.

If it is possible to change, how do we begin to motivate change? Clearly, government policy must lead the way since market prices of commodities typically do not reflect the environmental costs of extracting and replacing them, nor do the prices of energy from fossil fuels reflect the risks of climatic change. Pricing policy is the most direct means of ensuring that the full environmental cost of goods and services is accounted for. When government owns a resource, or supplies it directly, the price charged can be made to reflect the true cost of the product. The market will adjust to this as it does to true scarcity by product substitution and conservation.

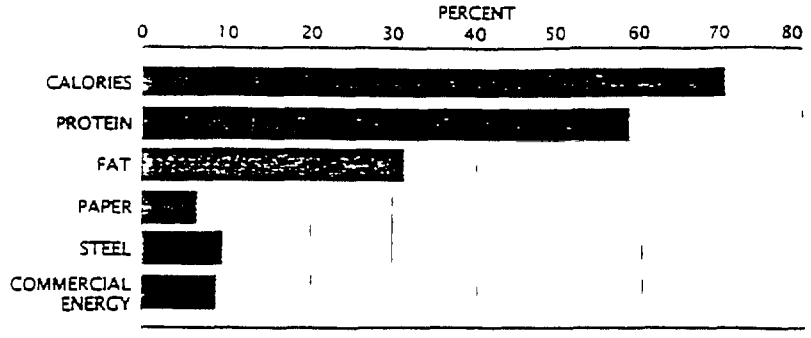
Environmental regulation should be refocused to mobilize rather than suppress the ingenuity and creativity of industry. For example, additional gains in pollution control should be sought not simply by increasing the stringency or technical specificity of command-and-control regulation but also by implementing incentive-based systems. Such systems magnify public sector decisions by tens of thousands of individual and corporate decisions. To be sure, incentive systems are not a panacea. For some environmental problems such as the use of unacceptably dangerous chemicals, definitive regulatory measures will always be required. Effective policies will include a mixture of incentive-based and regulatory approaches.

Yet market-based approaches will be a necessary part of any attempt to reduce the greenhouse effect. Here the most attractive options involve the encouragement of energy efficiency. Improving efficiency meets the double-benefit standard of insurance: it is good in itself and it combats global warming by reducing carbon dioxide emissions. If the world were to improve energy efficiency by 2 percent a year, the global average temperature could be kept within one degree Celsius of present levels. Many industrialized nations have maintained a rate of improvement close to that over the past 15 years.

Promoting energy efficiency is also relatively painless. The U.S. reduced the energy intensity of its domestic product by 23 percent between 1973 and 1985 without much notice. Substantial improvement in efficiency is available even with existing technol-



DEVELOPED NATIONS are responsible for far more industrial emission of carbon dioxide, a major greenhouse gas, than are the developing nations. Total emissions have increased sharply since 1950. Data are from the World Resources Institute.



DEVELOPED NATIONS consume far more of the world s goods than do the developing nations—which have some 75 percent of the world's population. Per capita consumption in the developing nations is shown as a percent of that in the developed nations. Data are estimates by the World Commission on Environment and Development.

ogy Something as simple as bringing all U S buildings up to the best world standards could save enormous amounts of energy Right now more energy passes through the windows of buildings in the U S than flows through the Alaska pipeline.

Efficiency gains may nevertheless have to be promoted by special market incentives because energy prices tend to lag behind increases in income. A "climate protection" tax of $1 per million Btu s on coal and 60 cents per million Btu's on oil is an example of such an incentive. It would raise gasoline prices by 11 cents a gallon and the cost of electricity an average of 10 percent, and it would yield $53 billion annually

Direct regulation by the setting of standards is cumbersome, but it may be necessary when implicit market signals are not effective. Examples are the mileage standards set in the U S for automobiles and the efficiency standards for appliances that were adopted in 1986 The appliance standards will save $28 billion in energy costs by the year 2000 and keep 342 million tons of carbon out of the atmosphere.

Over the long term it is likely that some form of emissions trading program will be necessary—and on a much larger scale than has been the case heretofore. (Indeed, the President's new Clean Air Act proposal includes a strengthened system of tradeable permits) In such a program all major emitters of pollutants would be issued permits specifying an allowable emission level. Firms that decide to reduce emissions below the specified level—for example, by investing in efficiency—could sell their excess "pollution rights" to other firms Those that find it prohibitively costly to retrofit old plants or build new ones could buy such rights or could close down their least efficient plants and sell the unneeded rights

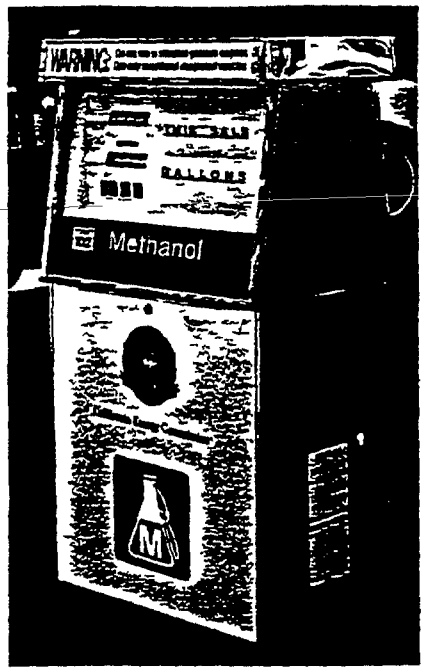
Another kind of emissions trading might reduce the impact of carbon dioxide emissions. Companies responsible for new greenhouse-gas emissions could be required to offset them by improving overall efficiency or closing down plants or by planting or preserving forests that would help absorb the emissions Once the system is established, progress toward further reduction of emissions would be achieved by progressively cranking down the total allowable levels of various pollutants on both a national and a permit by permit basis.

The kinds of programs I have just described will need to be supported by research providing a scientific basis for new environmental-protection strategies Research into safe, nonpolluting energy sources and more energy-efficient technologies would seem to be particularly good bets. An example in the mid 1970's the U S. Department of Energy developed a number of improved-efficiency technologies at a cost of $16 million among them were a design for compact fluorescent lamps that could replace incandescent bulbs and window coatings that save energy during both heating and cooling seasons. At current rates of implementation, the new technologies should generate $63 billion in energy savings by the year 2010

The motivation of change toward sustainability will have to go far beyond the reduction of pollution and waste in the developed countries and it cannot be left entirely to the environmental agencies in those countries. The agencies whose goals are economic development, exploitation of resources and international trade—and indeed foreign policy in general—must also adopt sustainable development as a central goal. This is a formidable challenge, for it touches the heart of numerous special interests. Considerable political skill will be required to achieve for environmental protection the policy preeminence that only economic issues and national security (in the military sense) have commanded.

But it is in relations with the devel

ENVIRONMENTAL ISSUES look different to people and governments in the rich and in the poor nations. The cartoon was drawn by Scott Willis of the *San Jose Mercury News*.



SUBSTITUTION is one route to the reduction of pollution. Substitution of methanol (already available at some gas stations in Los Angeles) for gasoline would cut down emissions of nitrogen oxides.

oping world that the industrialized nations will face their greatest challenges. Aid is both an answer and a perpetual problem. Total official development assistance from the developed to the developing world stands at around $35 billion a year. This is not much money. The annual foreign aid expenditure of the U.S. alone would be $127 billion if it spent the same proportion of its gross national product on foreign aid as it did during the peak years of the Marshall Plan.

There is no point, of course, in even thinking about the adequacy of aid to the undeveloped nations until the debt issue is resolved. The World Bank has reported that in 1988 the 17 most indebted countries paid the industrialized nations and multilateral agencies $31.1 billion more than they received in aid. This obviously cannot go on. Debt-for-nature swapping has taken place between such major lenders as Citicorp and a number of countries in South America: the bank forgives loans in exchange for the placing of land in conservation areas or parks. This is admirable, but it will not in itself solve the problem. Basic international trading relations will have to be redesigned in order to eliminate, among other things, the ill effects on the undeveloped world of agricultural subsidies and tariff barriers in the industrialized world.

A prosperous rural society based on sustainable agriculture must be the prelude to future development in much of the developing world, and governments there will have to focus on what motivates people to live in an environmentally responsible manner. Farmers will not grow crops when governments subsidize urban populations by keeping prices to farmers low. People will not stop having too many children if the labor of children is the only economic asset they have. Farmers will not improve the land if they do not own it. It is clear that land tenure reform will have to be instituted.

Negative sanctions against abusing the environment are also missing throughout much of the undeveloped world. To help remedy this situation, substantial amounts of foreign aid could be focused directly on improving the status of the environmental ministries in developing nations. These ministries are typically impoverished and ineffective, particularly in comparison with their countries' economic-development and military ministries. To cite one small example: the game wardens of Tanzania receive an annual salary equivalent to the price paid to poachers for two elephant tusks—one reason the nation has lost two thirds of its elephant population to the ivory trade in the past decade.

To articulate the values and devise the motivations favoring a sustainable world economy, existing institutions will need to change and new ones will have to be established. These will be difficult tasks, because institutions are powerful to the extent that they support powerful interests—which usually implies support of the status quo.

The important international institutions in today's world are those concerned with money, with trade and with national defense. Those who despair of environmental concerns ever reaching a comparable level of importance should remember that current institutions (for example, NATO, the World Bank, multinational corporations) have fairly short histories. They were formed out of pressing concerns about acquiring and expanding wealth and maintaining national sovereignty. If concern for the environment becomes comparably pressing, comparable institutions will be developed.

To further this goal, three things are wanted. The first is money. The annual budget of the United Nations Environment Program (UNEP) is $30 million, a derisory amount considering its responsibilities. If nations are serious about sustainability they will provide this central environmental organization with serious money, preferably money derived from an independent source in order to reduce its political vulnerability. A tax on certain uses of common world resources has been suggested as a means to this end.

The second thing wanted is information. We require strong international institutions to collect, analyze and report on environmental trends and risks. The Earthwatch program run by the UNEP is a beginning, but there is need for an authoritative source of scientific information and advice that is independent of national governments. There are many nongovernmental or quasi-governmental organizations capable of filling this role; they need to be pulled together into a cooperative network. We need a global institution capable of answering questions of global importance.

The third thing wanted is integration of effort. The world cannot afford a multiplication of conflicting efforts to solve common problems. On the aid front in particular this can be tragically absurd. Africa alone is currently served by 82 international donors and more than 1,700 private organizations. In 1980, in the tiny African nation Burkina Faso (population about eight million) 340 independent aid projects were under way. We need to form and strengthen coordinating institutions that combine the separate strengths of nongovernmental organizations, international bodies and industrial groups and to focus their efforts on specific problems.

Finally, in creating the consciousness of advanced sustainability we shall have to redefine our concepts of political and economic feasibility. These concepts are, after all, simply human constructs; they were different in the past, and they will surely change in the future. But the earth is real, and we are obliged by the fact of our utter dependence on it to listen more closely than we have to its messages.

FURTHER READING

THE GLOBAL POSSIBLE: RESOURCES, DEVELOPMENT AND THE NEW CENTURY. Edited by Robert Repetto. Yale University Press, 1985.

ARE TODAY'S INSTITUTIONAL TOOLS UP TO THE TASK? Michael Gruber in *EPA Journal*. Vol. 14, No. 7, pages 2–6. November/December 1988.

STATE OF THE WORLD 1989. Lester R. Brown et al. W. W. Norton & Company. February 1989.

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SMOKING GUN A citizen of Nizhniy Tagil, an industrial center near Sverdlovsk in the U.S.S.R., stands on a soot laden snow bank and contemplates the emission stacks of the local iron and steel mill. In the spring of 1988 a particularly dense smog prompted public demonstrations that led to the closing down of one of the mill s two coke ovens. Smoking chimneys, icons of economic activity are also symbolic of the impact exert ed by the works of human beings on the global ecosystem.

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The Tragedy of the Commons

GARRETT HARDIN

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At the end of a thoughtful article on the future of nuclear war, J B Wiesner and H F York concluded that "Both sides in the arms race are confronted by the dilemma of steadily increasing military power and steadily decreasing national security *It is our considered professional judgment that this dilemma has no technical solution* If the great powers continue to look for solutions in the area of science and technology only, the result will be to worsen the situation "[1]

I would like to focus your attention not on the subject of the article (national security in a nuclear world) but on the kind of conclusion they reached namely, that there is no technical solution to the problem An implicit and almost universal assumption of discussions published in professional and semipopular scientific journals is that the problem under discussion has a technical solution A technical solution may be defined as one that requires a change only in the techniques of the natural sciences, demanding little or nothing in the way of change in human values or ideas of morality

In our day (though not in earlier times) technical solutions are always welcome Because of previous failures in prophecy, it takes courage to assert that a desired technical solution is not possible Wiesner and York exhibited this courage, publishing in a science journal, they insisted that the solution to the problem was not to be found in the natural sciences

The Tragedy of the Commons by Garret Hardin, from *Science* v 162 (1968) pp 1243–48 Copyright 1968 by the AAAS Reprinted by permission

[1] J B Wiesner and H F York *Scientific American* 211 (No 4) 27 (1964)

They cautiously qualified their statement with the phrase, "It is our considered professional judgment " Whether they were right or not is not the concern of the present article Rather, the concern here is with the important concept of a class of human problems which can be called "no technical solution problems,' and more specifically, with the identification and discussion of one of these

It is easy to show that the class is not a null class Recall the game of tick-tack-toe Consider the problem, ' How can I win the game of tick-tack-toe?" It is well known that I cannot, if I assume (in keeping with the conventions of game theory) that my opponent understands the game perfectly Put another way, there is no "technical solution" to the problem I can win only by giving a radical meaning to the word ' win " I can hit my opponent over the head, or I can falsify the records Every way in which I "win" involves, in some sense, an abandonment of the game, as we intuitively understand it (I can also, of course, openly abandon the game—refuse to play it This is what most adults do)

The class of "no technical solution problems" has members My thesis is that the ' population problem," as conventionally conceived, is a member of this class How it is conventionally conceived needs some comment It is fair to say that most people who anguish over the population problem are trying to find a way to avoid the evils of overpopulation without relinquishing any of the privileges they now enjoy They think that farming the seas or developing new strains of wheat will solve the problem—technologically I try to show here that the solution they seek cannot be found The population problem cannot be solved in a technical way any more than can the problem of winning the game of tick-tack-toe

WHAT SHALL WE MAXIMIZE?

Population, as Malthus said, naturally tends to grow ' geometrically or as we would now say, exponentially In a finite world this means that the per-capita share of the world's goods must decrease Is ours a finite world?

A fair defense can be put forward for the view that the world is infinite or that we do not know that it is not But, in terms of the practical problems that we must face in the next few generations with the foreseeable technology, it is clear that we will greatly increase human misery if we do not, during the immediate future, assume that the world available to the terrestrial human population is finite 'Space" is no escape [2]

A finite world can support only a finite population, therefore population growth must eventually equal zero (The case of perpetual wide fluctuations above and below zero is a trivial variant that need not be

[2] G Hardin *Journal of Heredity* 50 68 (1959) S von Hoernor *Science* 137 18 (1962)

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discussed) When this condition is met, what will be the situation of mankind? Specifically, can Bentham's goal of "the greatest good for the greatest number" be realized?

No—for two reasons, each sufficient by itself The first is a theoretical one It is not mathematically possible to maximize for two (or more) variables at the same time This was clearly stated by von Neumann and Morgenstern,[3] but the principle is implicit in the theory of partial differential equations, dating back at least to D'Alembert (1717–1783)

The second reason springs directly from biological facts To live, any organism must have a source of energy (for example, food) This energy is utilized for two purposes mere maintenance and work For man, maintenance of life requires about 1600 kilocalories a day ("maintenance calories") Anything that he does over and above merely staying alive will be defined as work and is supported by "work calories" which he takes in Work calories are used not only for what we call work in common speech, they are also required for all forms of enjoyment, from swimming and automobile racing to playing music and writing poetry If our goal is to maximize population it is obvious what we must do We must make the work calories per person approach as close to zero as possible No gourmet meals, no vacations, no sports, no music no literature, no art I think that everyone will grant, without argument or proof, that maximizing population does not maximize goods Bentham's goal is impossible

In reaching this conclusion I have made the usual assumption that it is the acquisition of energy that is the problem The appearance of atomic energy has led some to question this assumption However, given an infinite source of energy population growth still produces an inescapable problem The problem of the acquisition of energy is replaced by the problem of its dissipation, as J H Fremlin has so wittily shown [4] The arithmetic signs in the analysis are as it were reversed, but Bentham's goal is unobtainable

The optimum population is then less than the maximum The difficulty of defining the optimum is enormous so far as I know no one has seriously tackled this problem Reaching an acceptable and stable solution will surely require more than one generation of hard analytical work—and much persuasion

We want the maximum good per person but what is good? To one person it is wilderness to another it is ski lodges for thousands To one it is estuaries to nourish ducks for hunters to shoot to another it is factory land Comparing one good with another is we usually say, impossible because goods are incommensurable Incommensurables cannot be compared

[3] J von Neumann and O Morgenstern *Theory of Games and Economic Behavior* (Princeton University Press Princeton N J 1947) p 11

[4] J H Fremlin *New Scientist* No 415 (1964) p 285

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Theoretically this may be true, but in real life incommensurables *are* commensurable Only a criterion of judgment and a system of weighting are needed In nature the criterion is survival Is it better for a species to be small and hideable, or large and powerful? Natural selection commensurates the incommensurables The compromise achieved depends on a natural weighting of the values of the variables

Man must imitate this process There is no doubt that in fact he already does, but unconsciously It is when the hidden decisions are made explicit that the arguments begin The problem for the years ahead is to work out an acceptable theory of weighting Synergistic effects, nonlinear variation, and difficulties in discounting the future make the intellectual problem difficult, but not (in principle) insoluble

Has any cultural group solved this practical problem at the present time, even on an intuitive level? One simple fact proves that none has there is no prosperous population in the world today that has, and has had for some time, a growth rate of zero Any people that has intuitively identified its optimum point will soon reach it, after which its growth rate becomes and remains zero

Of course, a positive growth rate might be taken as evidence that a population is below its optimum However, by any reasonable standards, the most rapidly growing populations on earth today are (in general) the most miserable This association (which need not be invariable) casts doubt on the optimistic assumption that the positive growth rate of a population is evidence that it has yet to reach its optimum

We can make little progress in working toward optimum population size until we explicitly exorcise the spirit of Adam Smith in the field of practical demography. In economic affairs *The Wealth of Nations* (1776) popularized the "invisible hand,' the idea that an individual who "intends only his own gain,' is, as it were, "led by an invisible hand to promote the public interest [5] Adam Smith did not assert that this was invariably true and perhaps neither did any of his followers But he contributed to a dominant tendency of thought that has ever since interfered with positive action based on rational analysis namely, the tendency to assume that decisions reached individually will in fact, be the best decisions for an entire society If this assumption is correct it justifies the continuance of our present policy of *laissez faire* in reproduction If it is correct we can assume that men will control their individual fecundity so as to produce the optimum population If the assumption is not correct, we need to reexamine our individual freedoms to see which ones are defensible

[5] A Smith *The Wealth of Nations* (Modern Library New York 1937) p 423

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TRAGEDY OF FREEDOM IN A COMMONS

The rebuttal to the invisible hand in population control is to be found in a scenario first sketched in a little-known pamphlet in 1833 by a mathematical amateur named William Forster Lloyd (1794–1852) [6] We may well call it "the tragedy of the commons," using the word "tragedy" as the philosopher Whitehead used it "The essence of dramatic tragedy is not unhappiness It resides in the solemnity of the remorseless working of things " He then goes on to say, "This inevitableness of destiny can only be illustrated in terms of human life by incidents which in fact involve unhappiness For it is only by them that the futility of escape can be made evident in the drama " [7]

The tragedy of the commons develops in this way Picture a pasture open to all It is to be expected that each herdsman will try to keep as many cattle as possible on the commons Such an arrangement may work reasonably satisfactorily for centuries because tribal wars poaching and disease keep the numbers of both man and beast well below the carrying capacity of the land Finally however comes the day of reckoning that is the day when the long-desired goal of social stability becomes a reality At this point the inherent logic of the commons remorselessly generates tragedy

As a rational being, each herdsman seeks to maximize his gain Explicitly or implicitly, more or less consciously, he asks, "What is the utility *to me* of adding one more animal to my herd?" This utility has one negative and one positive component

1 The positive component is a function of the increment of one animal Since the herdsman receives all the proceeds from the sale of the additional animal the positive utility is nearly +1

2 The negative component is a function of the additional overgrazing created by one more animal Since, however the effects of overgrazing are shared by all the herdsmen the negative utility for any particular decision-making herdsman is only a fraction of −1

Adding together the component partial utilities the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd And another But this is the conclusion reached by each and every rational herdsman sharing a commons Therein is the tragedy Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited Ruin is the destination toward which all men rush each pursuing his own best interest in a society that believes in the freedom of the commons Freedom in a commons brings ruin to all

[6] W F Lloyd *Two Lectures on the Checks to Population* (Oxford University Press Oxford England 1833)

[7] A N Whitehead *Science and the Modern World* (Mentor New York 1948) p 17

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Some would sav that this is a platitude Would that it were! In a sense it was learned thousands of vears ago, but natural selection favors the forces of psychological denial [8] The individual benefits as an individual from his ability to deny the truth even though society as a whole, of which he is a part, suffers Education can counteract the natural tendency to do the wrong thing, but the inexorable succession of generations requires that the basis for this knowledge be constantly refreshed

A simple incident that occurred a few years ago in Leominster Massachusetts, shows how perishable the knowledge is During the Christmas shopping season the parking meters downtown were covered with plastic bags that bore tags reading ' Do not open until after Christmas Free parking courtesv of the mavor and city council ' In other words facing the prospect of an increased demand for already scarce space the city fathers reinstituted the system of the commons (Cynically, we suspect that thev gained more votes than thev lost by this retrogressive act)

In an approximate way the logic of the commons has been understood for a long time perhaps since the discoverv of agriculture or the invention of private propertv in real estate But it is understood mostly onlv in special cases which are not sufficiently generalized Even at this late date, cattlemen leasing national land on the Western ranges demonstrate no more than an ambivalent understanding, in constantly pressuring federal authorities to increase the head count to the point where overgrazing produces erosion and weed-dominance Likewise the oceans of the world continue to suffer from the survival of the philosophv of the commons Maritime nations still respond automatically to the shibboleth of the 'freedom of the seas Professing to believe in the inexhaustible resources of the oceans ' thev bring species after species of fish and whales closer to extinction [9]

The National Parks present another instance of the working out of the tragedv of the commons At present thev are open to all without limit The parks themselves are limited in extent—there is onlv one Yosemite Vallev—whereas population seems to grow without limit The values that visitors seek in the parks are steadily eroded Plainly we must soon cease to treat the parks as commons or they will be of no value to anvone

What shall we do? We have several options We might sell them off as private property We might keep them as public property but allocate the right to enter them The allocation might be on the basis of wealth bv the use of an auction svstem It might be on the basis of merit as defined by some agreed-upon standards It might be bv lottery Or it might be on a first-come first-served basis administered to long queues These I think are all objectionable But we must choose—or acquiesce in the destruction of the commons that we call our National Parks

[8] G Hardin Ed *Population Evolution and Birth Control* (Freeman San Francisco 1964) p 56

[9] S McVay *Scientific American* 216 (No 8) 13 (1966)

POLLUTION

In a reverse way, the tragedy of the commons reappears in problems of pollution Here it is not a question of taking something out of the commons, but of putting something in—sewage, or chemical, radioactive, and heat wastes into water, noxious and dangerous fumes into the air, and distracting and unpleasant advertising signs into the line of sight The calculations of utility are much the same as before The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them Since this is true for everyone, we are locked into a system of "fouling our own nest," so long as we behave only as independent, rational, free-enterprisers

The tragedy of the commons as a food basket is averted by private property, or something formally like it But the air and waters surrounding us cannot readily be fenced, and so the tragedy of the commons as a cesspool must be prevented by different means, by coercive laws or taxing devices that make it cheaper for the polluter to treat his pollutants than to discharge them untreated We have not progressed as far with the solution of this problem as we have with the first Indeed, our particular concept of private property, which deters us from exhausting the positive resources of the earth, favors pollution The owner of a factory on the bank of a stream—whose property extends to the middle of the stream—often has difficulty seeing why it is not his natural right to muddy the waters flowing past his door The law, always behind the times, requires elaborate stitching and fitting to adapt it to this newly perceived aspect of the commons

The pollution problem is a consequence of population It did not much matter how a lonely American frontiersman disposed of his waste "Flowing water purifies itself every ten miles," my grandfather used to say, and the myth was near enough to the truth when he was a boy, for there were not too many people But as population became denser, the natural chemical and biological recycling processes became overloaded calling for a redefinition of property rights

HOW TO LEGISLATE TEMPERANCE?

Analysis of the pollution problem as a function of population density uncovers a not generally recognized principle of morality, namely *the morality of an act is a function of the state of the system at the time it is performed* [10] Using the commons as a cesspool does not harm the general public under frontier conditions, because there is no public, the same

[10] J Fletcher *Situation Ethics* (Westminster Philadelphia 1966)

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behavior in a metropolis is unbearable A hundred and fifty years ago a plainsman could kill an American bison cut out only the tongue for his dinner, and discard the rest of the animal He was not in any important sense being wasteful Today, with only a few thousand bison left we would be appalled at such behavior

In passing, it is worth nothing that the morality of an act cannot be determined from a photograph One does not know whether a man killing an elephant or setting fire to the grassland is harming others until one knows the total system in which his act appears "One picture is worth a thousand words," said an ancient Chinese, but it may take ten thousand words to validate it It is as tempting to ecologists as it is to reformers in general to try to persuade others bv way of the photographic shortcut But the essence of an argument cannot be photographed it must be presented rationally—in words

That morality is system-sensitive escaped the attention of most codifiers of ethics in the past "Thou shalt not " is the form of traditional ethical directives which make no allowance for particular circumstances The laws of our society follow the pattern of ancient ethics, and therefore are poorly suited to governing a complex, crowded, changeable world Our epicyclic solution is to augment statutory law with administrative law Since it is practically impossible to spell out all the conditions under which it is safe to burn trash in the backyard or to run an automobile without smog control, by law we delegate the details to bureaus The result is administrative law, which is rightlv feared for an ancient reason—*Quis custodiet ipsos custodes?*—Who shall watch the watchers themselves? John Adams said that we must have a government of laws and not men Bureau administrators, trying to evaluate the morality of acts in the total system are singularly liable to corruption producing a government by men, not laws

Prohibition is easy to legislate (though not necessarily to enforce), but how do we legislate temperance? Experience indicates that it can be accomplished best through the mediation of administrative law We limit possibilities unnecessarilv if we suppose that the sentiment of *Quis custodiet* denies us the use of administrative law We should rather retain the phrase as a perpetual reminder of fearful dangers we cannot avoid The great challenge facing us now is to invent the corrective feedbacks that are needed to keep custodians honest We must find wavs to legitimate the needed authority of both the custodians and the corrective feedbacks

FREEDOM TO BREED IS INTOLERABLE

The tragedy of the commons is involved in population problems in another way In a world governed solely by the principle of "dog eat dog"—if indeed there ever was such a world—how many children a family had would not be a matter of public concern Parents who bred too exuberantly would leave fewer descendants not more, because they would be unable to care adequately for their children David Lack and others have found that such a negative feedback demonstrably controls the fecundity of birds [11] But men are not birds, and have not acted like them for millenniums, at least

If each human family were dependent only on its own resources *if* the children of improvident parents starved to death *if* thus, overbreeding brought its own "punishment" to the germ line—*then* there would be no public interest in controlling the breeding of families But our society is deeply committed to the welfare state [12] and hence is confronted with another aspect of the tragedy of the commons

In a welfare state, how shall we deal with the family, the religion, the race, or the class (or indeed any distinguishable and cohesive group) that adopts overbreeding as a policy to secure its own aggrandizement? [13] To couple the concept of freedom to breed with the belief that everyone born has an equal right to the commons is to lock the world into a tragic course of action

Unfortunately this is just the course of action that is being pursued by the United Nations In late 1967 some thirty nations agreed to the following "The Universal Declaration of Human Rights describes the family as the natural and fundamental unit of society It follows that any choice and decision with regard to the size of the family must irrevocably rest with the family itself, and cannot be made by anyone else [14]

It is painful to have to deny categorically the validity of this right, denying it one feels as uncomfortable as a resident of Salem Massachusetts who denied the reality of witches in the seventeenth century At the present time in liberal quarters something like a taboo acts to inhibit criticism of the United Nations There is a feeling that the United Nations is our last and best hope that we shouldn't find fault with it we shouldn't play into the hands of the archconservatives However, let us not forget what Robert Louis Stevenson said "The truth that is suppressed by friends is the readiest weapon of the enemy " If we love the truth we must openly deny the validity of the Universal Declaration of Human Rights,

[11] D Lack *The Natural Regulation of Animal Numbers* (Clarendon Press Oxford England 1954)

[12] H Girvetz *From Wealth to Welfare* (Stanford University Press Stanford Calif 1950)

[13] G Hardin *Perspectives in Biology and Medicine* 6 366 (1963)

[14] U Thant *International Planned Parenthood News* No 168 (February 1968) p 3

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even though it is promoted by the United Nations We should also join with Kingslev Davis[15] in attempting to get Planned Parenthood–World Population to see the error of its ways in embracing the same tragic ideal

CONSCIENCE IS SELF-ELIMINATING

It is a mistake to think that we can control the breeding of mankind in the long run by an appeal to conscience Charles Galton Darwin made this point when he spoke on the centennial of the publication of his grandfather s great book The argument is straightforward and Darwinian

People vary Confronted with appeals to limit breeding, some people will undoubtedly respond to the plea more than others Those who have more children will produce a larger fraction of the next generation than those with more susceptible consciences The differences will be accentuated generation by generation

In C G Darwin's words "It may well be that it would take hundreds of genrations for the progenitive instinct to develop in this way, but if it should do so, nature would have taken her revenge, and the variety *Homo contracipiens* would become extinct and would be replaced by the varietv *Homo progenitivus* [16]

The argument assumes that conscience or the desire for children (no matter which) is hereditary—but hereditary only in the most general formal sense The result will be the same whether the attitude is transmitted through germ cells, or exosomaticallv, to use A J Lotka s term (If one denies the latter possibility as well as the former, then what s the point of education?) The argument has here been stated in the context of the population problem but it applies equally well to any instance in which society appeals to an individual exploiting a commons to restrain himself for the general good—by means of his conscience To make such an appeal is to set up a selective svstem that works toward the elimination of conscience from the race

PATHOGENIC EFFECTS OF CONSCIENCE

The long-term disadvantage of an appeal to conscience should be enough to condemn it but it has serious short-term disadvantages as well If we ask a man who is exploiting a commons to desist "in the name of con-

[15]K Davis *Science* 158 730 (1967)

[16]S Tax Ed *Evolution After Darwin* (University of Chicago Press Chicago 1960) vol 2 p 469

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science," what are we saying to him? What does he hear?—not only at the moment but also in the wee small hours of the night when, half asleep, he remembers not merely the words we used but also the nonverbal communication cues we gave him unawares? Sooner or later, consciously or subconsciously, he senses that he has received two communications, and that they are contradictory 1 (intended communication) "If you don't do as we ask, we will openly condemn you for not acting like a responsible citizen", 2 (the unintended communication) "If you *do* behave as we ask, we will secretly condemn you for a simpleton who can be shamed into standing aside while the rest of us exploit the commons"

Everyman then is caught in what Bateson has called a "double bind" Bateson and his co-workers have made a plausible case for viewing the double bind as an important causative factor in the genesis of schizophrenia [17] The double bind may not always be so damaging, but it always endangers the mental health of anyone to whom it is applied 'A bad conscience," said Nietzsche, "is a kind of illness"

To conjure up a conscience in others is tempting to anyone who wishes to extend his control beyond the legal limits Leaders at the highest level succumb to this temptation Has any president during the past generation failed to call on labor unions to moderate voluntarily their demands for higher wages or to steel companies to honor voluntary guidelines on prices? I can recall none The rhetoric used on such occasions is designed to produce feelings of guilt in noncooperators

For centuries it was assumed without proof that guilt was a valuable perhaps even an indispensable ingredient of the civilized life Now, in this post-Freudian world we doubt it

Paul Goodman speaks from the modern point of view when he says "No good has ever come from feeling guilty, neither intelligence, policy nor compassion The guilty do not pay attention to the object but only to themselves and not even to their own interests which might make sense but to their anxieties" [18]

One does not have to be a professional psychiatrist to see the consequences of anxiety We in the Western world are just emerging from a dreadful two centuries-long Dark Ages of Eros that was sustained partly by prohibition laws but perhaps more effectively by the anxiety-generating mechanisms of education Alex Comfort has told the story well in *The Anxiety Makers* [19] it is not a pretty one

Since proof is difficult we may even concede that the results of anxiety may sometimes from certain points of view be desirable The larger question we should ask is whether as a matter of policy we should ever encourage the use of a technique the tendency (if not the intention) of

[17] G Bateson D D Jackson J Haley J Weakland *Behavioral Science* 1 251 (1956)
[18] P Goodman *New York Review of Books* 10 (8) 22 (23 May 1968)
[19] A Comfort *The Anxiety Makers* (Nelson London 1967)

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which is psychologically pathogenic We hear much talk these days of responsible parenthood, the coupled words are incorporated into the titles of some organizations devoted to birth control Some people have proposed massive propaganda campaigns to instill responsibility into the nation's (or the world's) breeders But what is the meaning of the word conscience? When we use the word responsibility in the absence of substantial sanctions are we not trying to browbeat a free man in a commons into acting against his own interest? Responsibility is a verbal counterfeit for a substantial quid pro quo It is an attempt to get something for nothing

If the word responsibility is to be used at all, I suggest that it be in the sense Charles Frankel uses it [20] "Responsibility," says this philosopher, "is the product of definite social arrangements " Notice that Frankel calls for social arrangements—not propaganda

MUTUAL COERCION MUTUALLY AGREED UPON

The social arrangements that produce responsibility are arrangements that create coercion, of some sort Consider bank robbing The man who takes money from a bank acts as if the bank were a commons How do we prevent such action? Certainly not by trying to control his behavior solely by a verbal appeal to his sense of responsibility Rather than rely on propaganda we follow Frankel s lead and insist that a bank is not a commons we seek the definite social arrangements that will keep it from becoming a commons That we thereby infringe on the freedom of would-be robbers we neither deny nor regret

The morality of bank robbing is particularly easy to understand because we accept complete prohibition of this activity We are willing to say Thou shalt not rob banks," without providing for exceptions But temperance also can be created by coercion Taxing is a good coercive device To keep downtown shoppers temperate in their use of parking space we introduce parking meters for short periods and traffic fines for longer ones We need not actually forbid a citizen to park as long as he wants to we need merely make it increasingly expensive for him to do so Not prohibition, but carefully biased options are what we offer him A Madison Avenue man might call this persuasion I prefer the greater candor of the word coercion

Coercion is a dirty word to most liberals now but it need not forever be so As with the four-letter words its dirtiness can be cleansed away by exposure to the light by saying it over and over without apology or

[20] C Frankel *The Case for Modern Man* (Harper & Row New York 1955) p 203

embarrassment To many the word coercion implies arbitrary decisions of distant and irresponsible bureaucrats, but this is not a necessary part of its meaning The only kind of coercion I recommend is mutual coercion, mutually agreed upon by the majority of the people affected

To say that we mutually agree to coercion is not to say that we are required to enjoy it, or even to pretend we enjoy it Who enjoys taxes? We all grumble about them But we accept compulsory taxes because we recognize that voluntary taxes would favor the conscienceless We institute and (grumblingly) support taxes and other coercive devices to escape the horror of the commons

An alternative to the commons need not be perfectly just to be preferable With real estate and other material goods, the alternative we have chosen is the institution of private property coupled with legal inheritance Is this system perfectly just? As a genetically trained biologist I deny that it is It seems to me that, if there are to be differences in individual inheritance legal possession should be perfectly correlated with biological inheritance—that those who are biologically more fit to be the custodians of property and power should legally inherit more But genetic recombination continually makes a mockery of the doctrine of "like father, like son' implicit in our laws of legal inheritance An idiot can inherit millions and a trust fund can keep his estate intact We must admit that our legal system of private property plus inheritance is unjust—but we put up with it because we are not convinced at the moment, that anyone has invented a better system The alternative of the commons is too horrifying to contemplate Injustice is preferable to total ruin

It is one of the peculiarities of the warfare between reform and the status quo that it is thoughtlessly governed by a double standard Whenever a reform measure is proposed it is often defeated when its opponents triumphantly discover a flaw in it As Kingsley Davis has pointed out,[21] worshipers of the status quo sometimes imply that no reform is possible without unanimous agreement an implication contrary to historical fact As nearly as I can make out automatic rejection of proposed reforms is based on one of two unconscious assumptions (1) that the status quo is perfect or (2) that the choice we face is between reform and no action if the proposed reform is imperfect we presumably should take no action at all while we wait for a perfect proposal

But we can never do nothing That which we have done for thousands of years is also action It also produces evils Once we are aware that the status quo is action, we can then compare its discoverable advantages and disadvantages with the predicted advantages and disadvantages of the proposed reform discounting as best we can for our lack of experience

[21]See J D Roslansky *Genetics and the Future of Man* (Appleton-Century-Crofts New York 1966) p 177

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On the basis of such a comparison, we can make a rational decision which will not involve the unworkable assumption that only perfect systems are tolerable

RECOGNITION OF NECESSITY

Perhaps the simplest summary of this analysis of man's population problems is this the commons, if justifiable at all, is justifiable only under conditions of low-population density As the human population has increased, the commons has had to be abandoned in one aspect after another

First we abandoned the commons in food gathering, enclosing farmland and restricting pastures and hunting and fishing areas These restrictions are still not complete throughout the world

Somewhat later we saw that the commons as a place for waste disposal would also have to be abandoned Restrictions on the disposal of domestic sewage are widely accepted in the Western world, we are still struggling to close the commons to pollution by automobiles, factories, insecticide sprayers, fertilizing operations, and atomic energy installations

In a still more embryonic state is our recognition of the evils of the commons in matters of pleasure There is almost no restriction on the propagation of sound waves in the public medium The shopping public is assaulted with mindless music, without its consent Our government has paid out billions of dollars to create a supersonic transport which would disturb 50,000 people for every one person whisked from coast to coast 3 hours faster Advertisers muddy the airwaves of radio and television and pollute the view of travelers We are a long way from outlawing the commons in matters of pleasure Is this because our Puritan inheritance makes us view pleasure as something of a sin, and pain (that is, the pollution of advertising) as the sign of virtue?

Every new enclosure of the commons involves the infringement of somebody's personal liberty Infringements made in the distant past are accepted because no contemporary complains of a loss It is the newly proposed infringements that we vigorously oppose, cries of "rights" and 'freedom' fill the air But what does "freedom" mean? When men mutually agreed to pass laws against robbing, mankind became more free, not less so Individuals locked into the logic of the commons are free only to bring on universal ruin, once they see the necessity of mutual coercion, they become free to pursue other goals I believe it was Hegel who said, "Freedom is the recognition of necessity"

The most important aspect of necessity that we must now recognize is the necessity of abandoning the commons in breeding No technical solution can rescue us from the misery of overpopulation Freedom to breed

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will bring ruin to all At the moment to avoid hard decisions many of us are tempted to propagandize for conscience and responsible parenthood The temptation must be resisted because an appeal to independently acting consciences selects for the disappearance of all conscience in the long run and an increase in anxiety in the short

The only way we can preserve and nurture other and more precious freedoms is by relinquishing the freedom to breed and that very soon Freedom is the recognition of necessity —and it is the role of education to reveal to all the necessity of abandoning the freedom to breed Only so can we put an end to this aspect of the tragedy of the commons

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Statistical Measures for Management Oversight to Achieve Continuous Improvement at Monsanto Chemical Company

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Monsanto Chemical Company has developed a Total Quality Improvement Process that has ensured the company of continuous improvement in its environmental and safety processes management This paper will focus on that process, which actually began in the increasing awareness of quality considerations worldwide

As a result of rising standards being created and met by global competition consumers have become more aware of quality and its importance Every time they receive the features and performance they look for in a product, consumers become less tolerant of poorly made items In fact, a 1988 survey conducted by the Gallup Group indicated that Americans are willing to pay a substantial premium to get high quality products rather than average quality ones

Consumers for example, indicated that they were willing to pay 20 percent more for high quality automobiles 67 percent more for premium televisions, and 72 percent more for high quality sofas Granted, Monsanto Chemical Company doesn t manufacture these products, but it does produce a number of different materials that go into them, such as *Lustran* plastics, *Santoprene* thermoplastic elastomers, and *Wear-Dated* fabric fibers Our entire product portfolio consists of high-performance materials that add quality and value to our customer's products — what the ultimate consumer is looking for

The foreign car market offers one example Japanese and German car manufacturers took a huge share of the American automotive market by providing what the consumer was looking for better gas mileage, quality, and styling

In response to this loss of market share, the American auto industry — firms like Ford, Goodyear, Armstrong, and others — initiated aggressive campaigns to improve the quality of their products They also approached their suppliers, including Monsanto Chemical Company, and asked them to join with them in their effort to improve the quality of their goods and services

Not surprisingly, Monsanto elected to work with them as did its competitors Dow, DuPont, General Electric, and Borg Warner These companies recognized that those who didn t play — and play well — would be replaced by someone else The journey toward total quality had begun

About the same time, quality consultants and individual companies recognized as leaders in quality management determined that internal inefficiencies in most American firms represent 20 to 30

percent of revenues That figure represented a potential benefit of several hundred million dollars for companies the size of Monsanto Chemical

Finally, the consultants and leaders showed us that by eliminating inefficiencies and the hassles that go with them employees would become motivated and their productivity and pride in their work would increase

Monsanto's Approach to Quality Improvement

Monsanto defines "quality" as consistency in meeting agreed-upon requirements with goods and services that add value, for example, product purity, just in-time delivery, invoice accuracy, or any other measure agreed upon with the customer To deliver quality we worked with SRI International to develop the Total Quality Improvement Process Total Quality involves a systematic process designed to change the culture of a company to make it more effective and efficient in meeting agreed-upon customer requirements Hallmarks of this process include a strong customer focus and a commitment to continuous improvement

Monsanto s process encourages employees (1) to meet with their customers (internal or external) to agree on the requirements or factors most important to the customer and (2) to use systematic procedures to create opportunities that will reduce waste and improve customer satisfaction Quality Improvement Teams, typically multifunctional and multilevel are used extensively to address opportunities to improve quality Monsanto is committed to continuous improvement, the target is perfection

Three guiding principles describe the Total Quality process at Monsanto

- Focusing on the customer;
- Constantly striving to improve everything we do with perfection as our goal, and
- Involving every person in the process

Monsanto focuses on the customer by

- Meeting agreed-upon requirements,
- Understanding how our products and services add value for customers,
- Collaborating with customers to develop new products, and
- Continuously seeking objective feedback on our performance

We continuously improve by

- Viewing all work as a process,
- Making all processes effective, efficient and adaptable,
- Controlling with in-process measures,
- Maintaining constructive dissatisfaction with the present level of performance,
- Eliminating activities that do not add value to the customer, and
- Holding gains and incorporating lessons learned

And finally, all employees

- View their job as part of a process that can be systematically improved,
- Recognize people as the major source of all process improvement,
- Understand our customer's needs and expectations,
- Realize that every level in the organization must be actively involved to assure long-term success, and
- Reward those who practice and apply these concepts in their pursuit of customer-focused continuous improvement

Total Quality was introduced company-wide in 1986 Since then, extensive training has been conducted Essentially, all 18,000 Monsanto Chemical Company employees completed the one-day orientation course that introduced quality improvement concepts

Key Tools

All employees also completed the two-day Principles of Continuous Improvement Course that focuses on Monsanto s 10-step process to identify problems, causes, and solutions Monsanto uses cost of quality analysis to identify opportunities for improvement, especially in staff support areas Extensive training in statistical methods was conducted at plants and offices to help improve the capabilities of our many manufacturing, business, and administrative processes Employees learn to "listen to the process," and identify opportunities

for step-change improvements. Extensive training is also conducted in our plants and offices on teamwork, leadership, and facilitation. We have found this training to be the most effective way of empowering employees and achieving a sense of ownership.

ISO 9000 is a series of International Quality Assurance Standards designed to improve the ability of services and manufacturing processes to consistently achieve desired outcomes. As a result of EC-1992 and the global environment in which we compete, more and more companies have asked their suppliers to have ISO 9000 Quality Assurance Systems in place as evidence of their ability to meet requirements. Monsanto has plants that are registered in these criteria and is aggressively pursuing registration in others.

Business Process Improvement is a technique designed to improve very complex administrative/business processes (see Fig. 1). Monsanto uses this process to help align its quality improvement effort with key businesses strategies.

Benefits of the Total Quality Improvement Process

Results achieved to date include rising enthusiasm and involvement among employees, significant and increasing financial benefits for Monsanto Chemical Company, and a growing number of customer awards recognizing our progress and contribution. The number of active quality improvement teams has increased from 200 in 1986 to over 1,500 last year. Each team represents roughly 10 people who actively participate in the quality improvement process, ranging from hourly employees eliminating waste and rework to senior managers streamlining administrative processes.

The economic benefits are even more impressive. The dollar impact of quality improvement projects has increased nearly four times when compared to the dollar impact in 1986. We now see a payback ratio of 4- or 5-to-1 for every dollar invested in quality improvement. These numbers represent an impressive return on Monsanto's investment in training and support and illustrate the reason why we say that "quality doesn't cost it pays."

Total Quality also pays big dividends, as indicated by our customers. Numerous examples exist of increased sales volume and market share resulting from the improvements in product and service quality achieved through the Total Quality process. Monsanto Chemical Company plants, business units, and divisions have received dozens of formal supplier recognition awards from customers such as Chrysler, Firestone, Ciba-Geigy, Dow, General Motors, Pillsbury, Texaco Chemicals, and others.

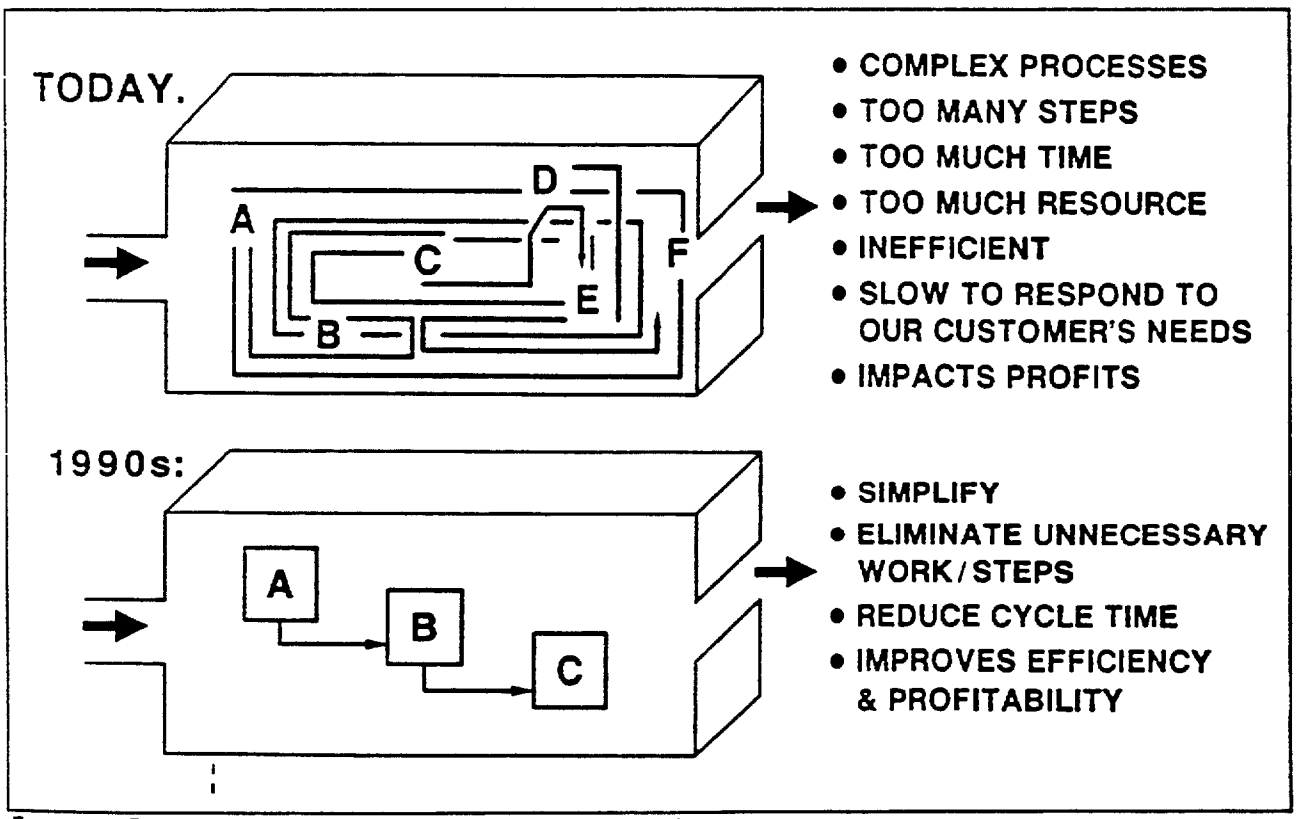

Figure 1 —Example of the Business Process Improvement technique

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Using Statistical Measures

The MERIT Project

Continuous improvement of all Monsanto processes is one of the three guiding principles of our Total Quality Improvement Process Our training course Principles of Continuous Improvement (PCI) emphasizes that all work is a process and all processes can be continuously improved Virtually every Monsanto employee has taken the Principles of Continuous Improvement This course provides a 10 step process for improving processes and the basic team tools, including process flow diagrams, cause and effect diagrams, and data analysis techniques The data analysis tools taught in the PCI course include histograms, scatter diagrams, run charts and control charts Also, thousands of employees had four days of additional training in using statistical process control techniques for improving processes

This training has had a dramatic impact on the organization s culture and performance The hundreds of quality improvement project teams described earlier successfully completed projects that attained breakthrough performance in environmental and safety areas as well as in product quality and customer service Each year we celebrate the accomplishments of these teams at a Conference of Champions" For Monsanto employees this event is roughly equivalent to Oscar" night for the motion picture industry This event features presentations of exemplary improvement projects including those that have achieved significant results in the environmental, health and safety areas

An example of projects submitted to this conference is one called "Improve MERIT Communications MERIT is the acronym for Monsanto Emergency Response Information Team — our system for communicating with and responding to a chemical emergency incident site outside plant boundaries This MERIT system often interacts with the Chemical Manufacturers Association's Chemtrec system This system had proven effective with no obvious problems, however, a team of Monsanto employees decided to apply the Total Quality Improvement Process to the MERIT system The team s objective was to reduce the time required for Monsanto s response to requests for assistance during outside emergency incidents

Figure 2 shows the results of the team s continuous improvement efforts The average MERIT response time was reduced by nearly 60 percent from the base year 1987 The techniques this team used are "text book examples of the continuous improvement process

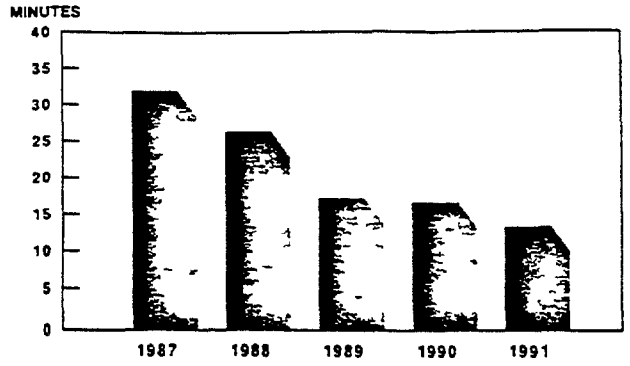

Figure 2 —Average merit response time

First this team validated their project's objectives by holding discussions with several metropolitan St Louis emergency response organizations (These are the customers in the quality context) The MERIT response communications system is complex To ensure that all improvement possibilities were reviewed, a flow diagram of the communications process was developed (Fig 3) After defining the process, a cause-and-effect diagram — an especially effective team tool — was developed

In the quality business, Figure 4 is known as a fishbone or Ishikawa diagram, which records and shows relationships between potential causes of an effect such as improved response time Usually it s produced by brainstorming, organizing, and diagramming potential causes into categories The diagram then serves as a focal point to discuss such topics as what the most probable causes are and what data should be collected to verify these cause-and-effect relationships

The MERIT Communications Team then designed a survey instrument to collect detailed categorized data on all incidents The causes of delays in communications were identified, and corrective action on the systemic causes of these delays was developed and implemented One solution was to improve the system for selection and training of MERIT personnel

The MERIT team's work is typical, many other teams are currently pursuing improvements in virtually every process we use to serve our stakeholders customers, employees, communities, and stockholders Thus, to take another example, employees and communities have benefited from the continual improvement in Monsanto's safety performance Figure 5 reflects the favorable trends This chart prepared for senior management, is reviewed monthly for trends The center line repre-

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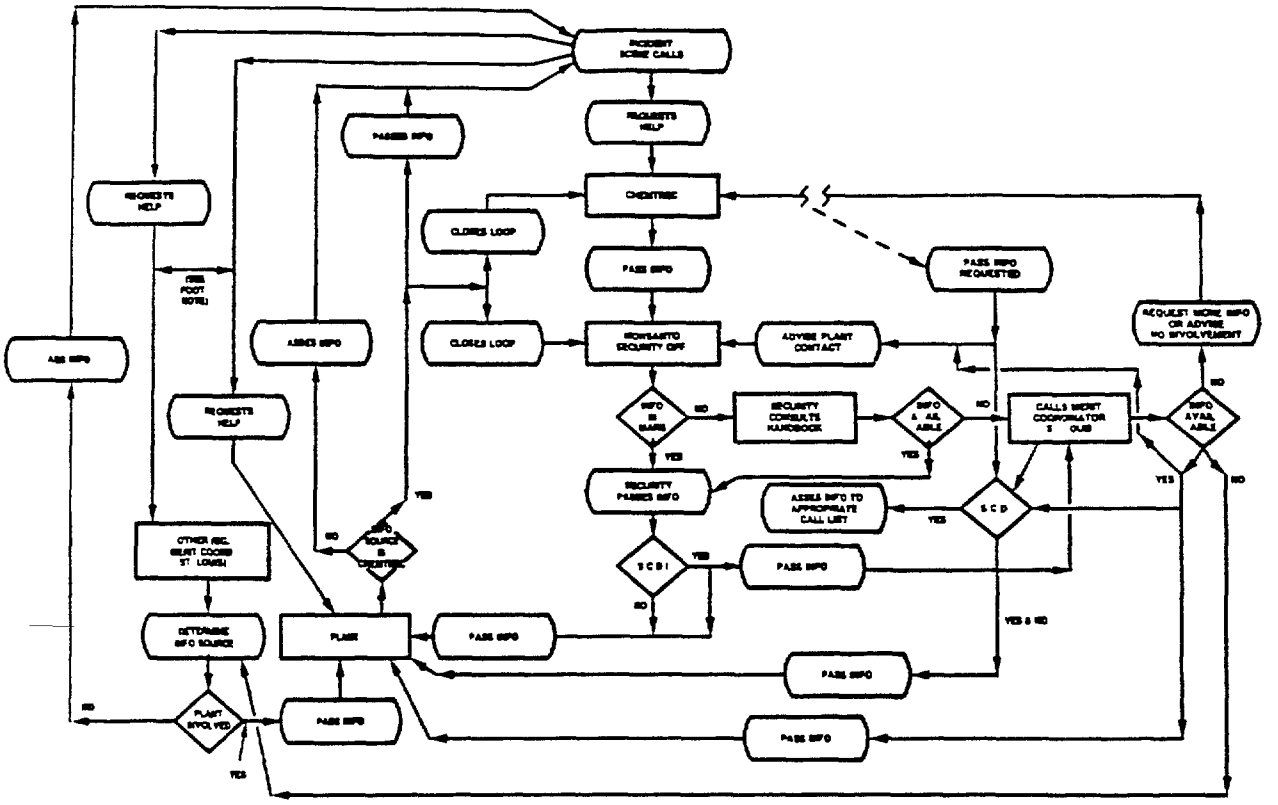

Figure 3 —MERIT communications flow diagram

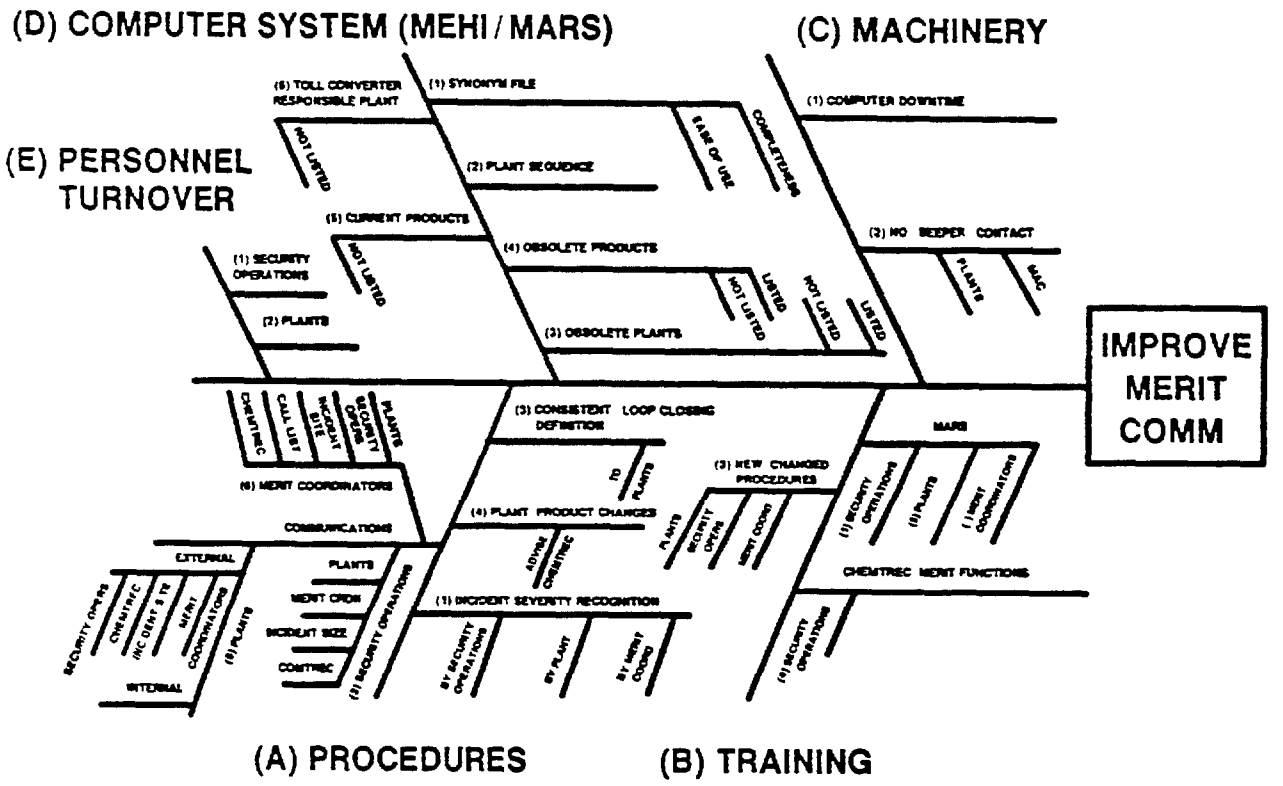

Figure 4 —A fishbone diagram showing MERIT communications perceived obstacles

sents an estimate of the process average i e the moving average of the monthly injury rates The control limits are three standard deviations above and below the center line These control limits provide a visual alarm This process has not been stable over the four year period Instead, a clear improvement trend has occurred the center line and control limits have been adjusted twice

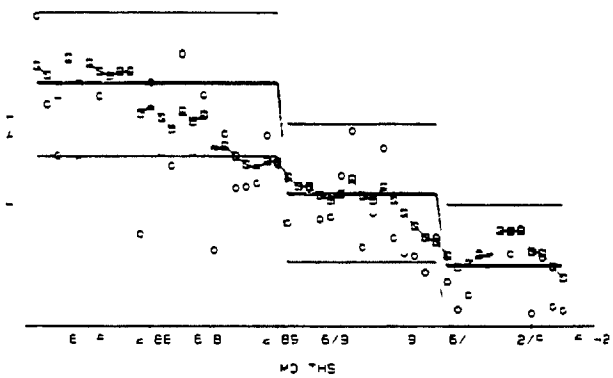

Figure 5 —Monsanto Chemical Company's OSHA injury rate and moving average by month

Note the trend in the past six months This series of six points above the center line may have resulted from a pause in work on improvement in safety processes caused by a major restructuring of Monsanto Chemical Company Trend analysis using charts like this one is a vital activity for management personnel with responsibility for improving the systems used to assure safe operations

Management oversight on the results of process improvement work is greatly facilitated by statistical control charts and an understanding of variation The statistical control chart provides essential information on the capability and stability of the systems being used Owners of systems or processes must have information on two vital questions

1 Is the process stable and in control?

2 Is the system or process capable of consistently meeting requirements?

An owner of a process or system is defined as the individual who controls the necessary resources and has the authority needed to change the system or process One of the lessons of continuous improvement is that the owner of the system must be involved in all activities directed at changing the system The owner should manage improvement using facts and data Control charting of process output data provides the owner with answers to the vital questions If the output of the process is unstable and unpredictable the owner has an opportunity to find and correct the causes of instability

If trends exist in the charted data or points that are outside the range of normal variation, a high probability exists that the cause is findable These special causes are usually easy to find and correct Eliminating them is the recommended first step in improving processes

When the process is stable and predictable, the next vital question can be addressed Is the process capable of consistently meeting requirements? This question is answered by comparing the normal variation inherent to a stable process with the requirements established for the process output If a reasonable probability exists that the normal variation in the output of a process will fall outside the requirements, then the capability of a process must be improved Such improvement will require a fundamental change in the process or system and leads to another important lesson in continuous improvement owners of processes must understand that exhortations, slogans, and goals are not effective in bringing about improvement in a incapable process

Improving a process or system's capability requires a systematic approach, such as the 10-step improvement process taught in the Principles of Continuous Improvement The MERIT Communications Improvement Team used this basic principle to develop an improved system for training involved personnel This fundamental change resulted in much of the improvement shown in the Average MERIT Response Time Chart The improvements shown in Figure 5 are a direct result of applying Monsanto s Total Quality process to its safety activities

Using statistical charting can greatly aid management s oversight of systems operations Traditional management reports often obscure vital information needed to assess the stability and capability of the system being reviewed Figure 6 is one example of a traditional report to management These old style' reports are tabular summaries of data-of-the-month and year-to-date results In this format, it s impossible to analyze the report for trends or to assess the basic stability and capability of systems

Contrast the old style report with a statistical control chart of the same data shown in Figure 7, which provides a clear picture of variation and trends in results This chart will help management make informed decisions about prioritizing improvement efforts, allocating resources to improvement activities interpreting rates of progress and the effects of changes to the system and others

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RELEASE INCIDENT SUMMARY
FOR MONTH, YEAR

COMPANY MCC DATE CREATED _____

TOTAL INCIDENTS FOR MONTH # TOTAL INCIDENTS YTD #

PRIMARY CAUSE OF INCIDENT

- EQUIPMENT FAILURE
- PIPING FAILURE
- INSTRUMENTATION FAILURE
- PROCESS UPSET
- PROCEDURAL
- OTHER

SIGNIFICANT EVENT OR ACCOMPLISHMENT FOR THE MONTH.

Figure 6 —Example of a traditional report.

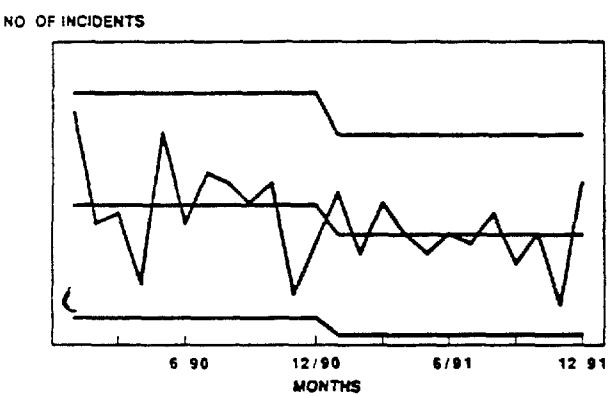

Figure 7 —A statistical control chart showing total release incidents.

Conclusion

Monsanto Chemical Company clearly benefits from using the Total Quality Process for continuous improvement While progress is apparent, and we have learned some things about improving processes, no one has declared victory Monsanto continues to search for ways to increase its rate of progress with the Total Quality Process

Based on our experiences with Total Quality and these basic statistical techniques, we can highly recommend them to any organization Monsanto has willingly shared, and will continue to share, experiences with its Total Quality Process These techniques will facilitate improvements in environmental safety, and health control systems and in communications related to this improvement work.

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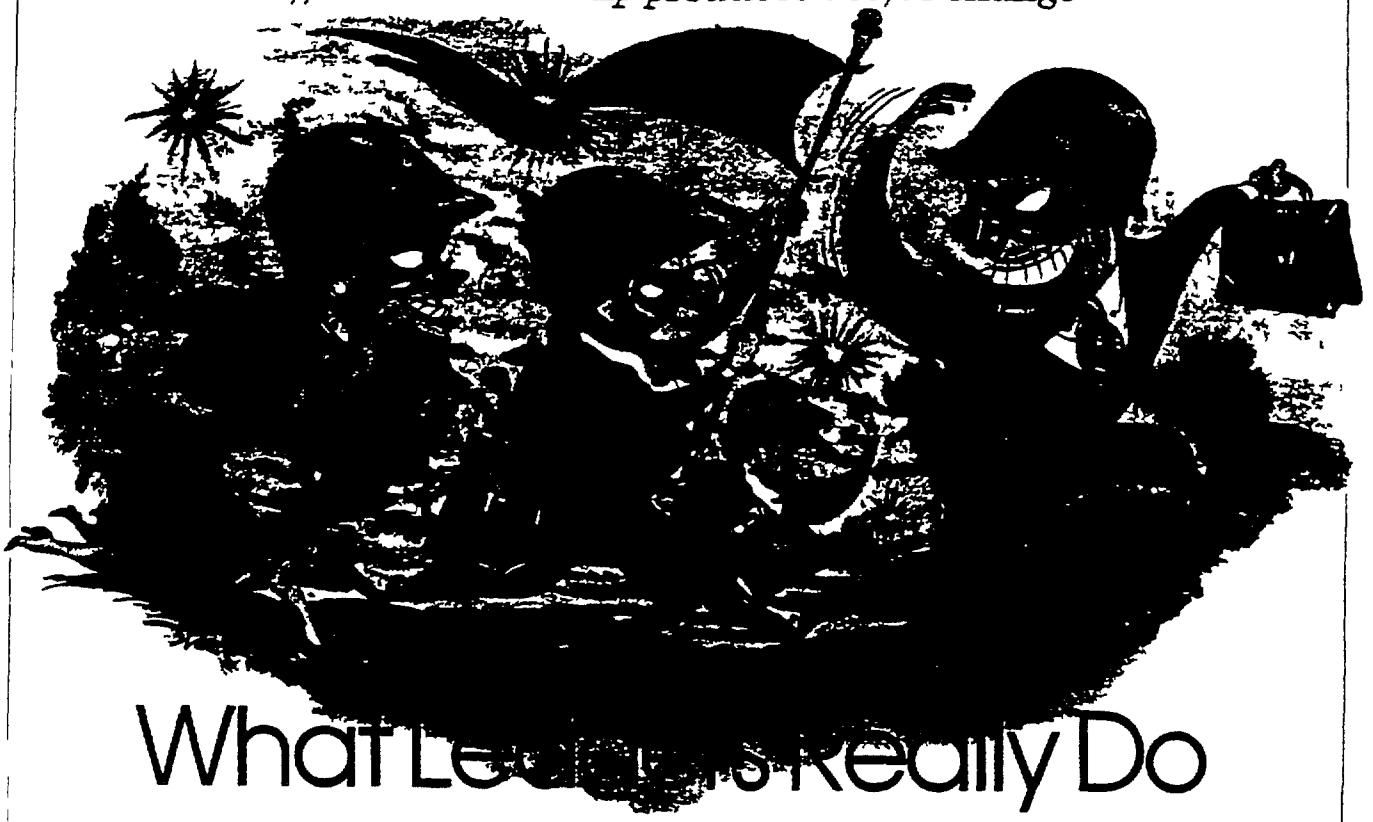
Good management controls complexity, effective leadership produces useful change



What Leaders Really Do

by John P Kotter

Leadership is different from management, but not for the reasons most people think Leadership isn't mystical and mysterious It has nothing to do with having "charisma" or other exotic personality traits It is not the province of a chosen few Nor is leadership necessarily better than management or a replacement for it.

Rather, leadership and management are two distinctive and complementary systems of action Each has its own function and characteristic activities Both are necessary for success in an increasingly complex and volatile business environment

Most U S corporations today are overmanaged and underled. They need to develop their capacity to exercise leadership Successful corporations don't wait for leaders to come along They actively seek out people with leadership potential and expose them to career experiences designed to develop that potential Indeed, with careful selection, nurturing, and encouragement, dozens of people can play important leadership roles in a business organization

> Leadership complements management; it doesn't replace it

But while improving their ability to lead, companies should remember that strong leadership with weak management is no better, and is sometimes actually worse, than the reverse The real challenge is to combine strong leadership and strong management and use each to balance the other

Of course, not everyone can be good at both leading and managing Some people have the capacity to become excellent managers but not strong leaders Others have great leadership potential but, for a variety of

John P Kotter is professor of organizational behavior at Harvard Business School and the author of The General Managers *(Free Press 1982)* Power and Influence *(Free Press 1985) and* The Leadership Factor *(Free Press 1988) His most recent book is* A Force for Change How Leadership Differs from Management *(Free Press 1990)*

reasons, have great difficulty becoming strong managers Smart companies value both kinds of people and work hard to make them a part of the team

But when it comes to preparing people for executive jobs, such companies rightly ignore the recent literature that says people cannot manage *and* lead. They try to develop leader-managers Once companies understand the fundamental difference between leadership and management, they can begin to groom their top people to provide both.

The Difference Between Management and Leadership

Management is about coping with complexity Its practices and procedures are largely a response to one of the most significant developments of the twentieth century the emergence of large organizations Without good management, complex enterprises tend to become chaotic in ways that threaten their very existence Good management brings a degree of order and consistency to key dimensions like the quality and profitability of products

Leadership, by contrast, is about coping with change Part of the reason it has become so important in recent years is that the business world has become more competitive and more volatile Faster technological change, greater international competition, the deregulation of markets, overcapacity in capital intensive industries, an unstable oil cartel, raiders with junk bonds, and the changing demographics of the work force are among the many factors that have contributed to this shift The net result is that doing what was done yesterday, or doing it 5% better, is no longer a formula for success Major changes are more and more necessary to survive and compete effectively in this new environment. More change always demands more leadership

Consider a simple military analogy a peacetime army can usually survive with good administration and management up and down the hierarchy, coupled with good leadership concentrated at the very top A wartime army, however, needs competent leadership at all levels No one yet has figured out how to manage people effectively into battle, they must be *led*

These different functions—coping with complexity and coping with change—shape the characteristic activities of management and leadership Each system of action involves deciding what needs to be done, creating networks of people and relationships that can accomplish an agenda, and then trying to ensure that those people actually do the job But each accomplishes these three tasks in different ways

Companies manage complexity first by *planning and budgeting*—setting targets or goals for the future (typically for the next month or year), establishing detailed steps for achieving those targets, and then allocating resources to accomplish those plans By contrast, leading an organization to constructive change begins by *setting a direction*—developing a vision of the future (often the distant future) along with strategies for producing the changes needed to achieve that vision.

Management develops the capacity to achieve its plan by *organizing and staffing*—creating an organizational structure and set of jobs for accomplishing plan requirements, staffing the jobs with qualified individuals, communicating the plan to those people, delegating responsibility for carrying out the plan, and devising systems to monitor implementation. The equivalent leadership activity, however, is *aligning people* This means communicating the new direction to those who can create coalitions that understand the vision and are committed to its achievement.

Finally, management ensures plan accomplishment by *controlling and problem solving*—monitoring results versus the plan in some detail, both formally and informally, by means of reports, meetings, and other tools, identifying deviations, and then planning and organizing to solve the problems But for leadership, achieving a vision requires *motivating and inspiring*—keeping people moving in the right direction, despite major obstacles to change, by appealing to basic but often untapped human needs, values, and emotions

A closer examination of each of these activities will help clarify the skills leaders need.

Setting a Direction vs Planning and Budgeting

Since the function of leadership is to produce change, setting the direction of that change is fundamental to leadership

Setting direction is never the same as planning or even long-term planning, although people often confuse the two Planning is a management process, deductive in nature and designed to produce orderly results, not change Setting a direction is more inductive Leaders gather a broad range of data and look for patterns, relationships, and linkages that help explain things What's more, the direction-setting aspect of leadership does not produce plans, it creates vision and strategies These describe a business, technology, or corporate culture in terms of what it

should become over the long term and articulate a easible way of achieving this goal

Most discussions of vision have a tendency to degenerate into the mystical. The implication is that a vision is something mysterious that mere mortals, even talented ones, could never hope to have But developing good business direction isn't magic It is a tough, sometimes exhausting process of gathering and analyzing information People who articulate such visions aren't magicians but broad based strategic thinkers who are willing to take risks

Nor do visions and strategies have to be brilliantly innovative, in fact, some of the best are not Effective business visions regularly have an almost mundane quality, usually consisting of ideas that are already well known The particular combination or patterning of the ideas may be new, but sometimes even that is not the case

For example, when CEO Jan Carlzon articulated his vision to make Scandinavian Airline Systems (SAS) the best airline in the world for the frequent business traveler, he was not saying anything that everyone in the airline industry didn't already know Business travelers fly more consistently than other market segments and are generally willing to pay higher fares Thus focusing on business customers of- s an airline the possibility of high margins, steady ousiness, and considerable growth. But in an industry known more for bureaucracy than vision, no company had ever put these simple ideas together and dedicated itself to implementing them SAS did, and it worked.

What's crucial about a vision is not its originality but how well it serves the interests of important constituencies – customers, stockholders, employees – and how easily it can be translated into a realistic competitive strategy Bad visions tend to ignore the legitimate needs and rights of important constituencies – favoring, say, employees over customers or stockholders Or they are strategically unsound. When a company that has never been better than a weak competitor in an industry suddenly starts talking about becoming number one, that is a pipe dream, not a vision.

One of the most frequent mistakes that over managed and underled corporations make is to embrace "long-term planning" as a panacea for their lack of direction and inability to adapt to an increasingly competitive and dynamic business environment But such an approach misinterprets the nature of direction setting and can never work

ıng-term planning is always time consuming Whenever something unexpected happens, plans have to be redone In a dynamic business environment, the unexpected often becomes the norm, and long term planning can become an extraordinarily burdensome activity This is why most successful corporations limit the time frame of their planning activities Indeed, some even consider "long term planning" a contradiction in terms

In a company without direction, even short-term planning can become a black hole capable of absorbing an infinite amount of time and energy With no vision and strategy to provide constraints around the planning process or to guide it, every eventuality deserves a plan Under these circumstances, contingency planning can go on forever, draining time and attention from far more essential activities, yet without ever providing the clear sense of direction that a company desperately needs After awhile, managers inevitably become cynical about all this, and the planning process can degenerate into a highly politicized game.

Planning works best not as a substitute for direction setting but as a complement to it. A competent planning process serves as a useful reality check on direction-setting activities Likewise, a competent direction-setting process provides a focus in which planning can then be realistically carried out It helps clarify what kind of planning is essential and what kind is irrelevant.

Aligning People vs Organizing and Staffing

A central feature of modern organizations is interdependence, where no one has complete autonomy, where most employees are tied to many others by their work, technology, management systems, and hierarchy These linkages present a special challenge when organizations attempt to change Unless many individuals line up and move together in the same direction, people will tend to fall all over one another. To executives who are overeducated in management and undereducated in leadership, the idea of getting people moving in the same direction appears to be an organizational problem. What executives need to do, however, is not organize people but align them.

Managers "organize" to create human systems that can implement plans as precisely and efficiently as possible Typically, this requires a number of potentially complex decisions A company must choose a structure of jobs and reporting relationships, staff it with individuals suited to the jobs, provide training for those who need it, communicate plans to the work force, and decide how much authority to delegate and to whom Economic incentives also need to be constructed to accomplish the

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plan, as well as systems to monitor its implementation. These organizational judgments are much like architectural decisions It's a question of fit within a particular context.

Aligning is different. It is more of a communications challenge than a design problem. First, aligning invariably involves talking to many more individuals than organizing does The target population can involve not only a manager's subordinates but also bosses, peers, staff in other parts of the organization, as well as suppliers, governmental officials, or even customers Anyone who can help implement the vision and strategies or who can block implementation is relevant.

Trying to get people to comprehend a vision of an alternative future is also a communications challenge of a completely different magnitude from organizing them to fulfill a short-term plan It's much like the difference between a football quarterback attempting to describe to his team the next two or three plays versus his trying to explain to them a totally new approach to the game to be used in the second half of the season.

Whether delivered with many words or a few carefully chosen symbols, such messages are not necessarily accepted just because they are understood Another big challenge in leadership efforts is credibility—getting people to believe the message Many things contribute to credibility the track record of the person delivering the message, the content of the message itself, the communicator's reputation for integrity and trustworthiness, and the consistency between words and deeds

Finally, aligning leads to empowerment in a way that organizing rarely does One of the reasons some organizations have difficulty adjusting to rapid changes in markets or technology is that so many people in those companies feel relatively powerless They have learned from experience that even if they correctly perceive important external changes and then initiate appropriate actions, they are vulnerable to someone higher up who does not like what they have done Reprimands can take many different forms "That's against policy" or "We can't afford it" or "Shut up and do as you're told."

> Management controls people by pushing them in the right direction, leadership motivates them by satisfying basic human needs

Alignment helps overcome this problem by empowering people in at least two ways First, when a clear sense of direction has been communicated throughout an organization, lower level employees can initiate actions without the same degree of vulnerability As long as their behavior is consistent with the vision, superiors will have more difficulty reprimanding them Second, because everyone is aiming at the same target, the probability is less that one person's initiative will be stalled when it comes into conflict with someone else's

Motivating People vs Controlling and Problem Solving

Since change is the function of leadership, being able to generate highly energized behavior is important for coping with the inevitable barriers to change Just as direction setting identifies an appropriate path for movement and just as effective alignment gets people moving down that path, successful motivation ensures that they will have the energy to overcome obstacles

According to the logic of management, control mechanisms compare system behavior with the plan and take action when a deviation is detected. In a well-managed factory, for example, this means the planning process establishes sensible quality targets, the organizing process builds an organization that can achieve those targets, and a control process makes sure that quality lapses are spotted immediately, not in 30 or 60 days, and corrected.

For some of the same reasons that control is so central to management, highly motivated or inspired behavior is almost irrelevant Managerial processes must be as close as possible to fail-safe and risk-free. That means they cannot be dependent on the unusual or hard to obtain. The whole purpose of systems and structures is to help normal people who behave in normal ways to complete routine jobs successfully, day after day It's not exciting or glamorous But that's management

Leadership is different Achieving grand visions always requires an occasional burst of energy Motivation and inspiration energize people, not by pushing them in the right direction as control mechanisms do but by satisfying basic human needs for achievement, a sense of belonging, recognition, self-esteem, a feeling of control over one's life, and the ability to live up to one's ideals Such feelings touch us deeply and elicit a powerful response

Good leaders motivate people in a variety of ways First, they always articulate the organization's vision

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in a manner that stresses the values of the audience they are addressing This makes the work important to those individuals Leaders also regularly involve people in deciding how to achieve the organization's vision (or the part most relevant to a particular individual) This gives people a sense of control. Another important motivational technique is to support employee efforts to realize the vision by providing coaching, feedback, and role modeling, thereby helping people grow professionally and enhancing their self-esteem. Finally, good leaders recognize and reward success, which not only gives people a sense of accomplishment but also makes them feel like they belong to an organization that cares about them When all this is done, the work itself becomes intrinsically motivating

The more that change characterizes the business environment, the more that leaders must motivate people to provide leadership as well When this works, it tends to reproduce leadership across the entire organization, with people occupying multiple leadership roles throughout the hierarchy This is highly valuable, because coping with change in any complex business demands initiatives from a multitude of people Nothing less will work.

Of course, leadership from many sources does not necessarily converge To the contrary, it can easily conflict For multiple leadership roles to work together, people's actions must be carefully coordinated by mechanisms that differ from those coordinating traditional management roles

Strong networks of informal relationships – the kind found in companies with healthy cultures – help coordinate leadership activities in much the same way that formal structure coordinates managerial activities The key difference is that informal networks can deal with the greater demands for coordination associated with nonroutine activities and change The multitude of communication channels and the trust among the individuals connected by those channels allow for an ongoing process of accommodation and adaptation When conflicts arise among roles, those same relationships help resolve the conflicts Perhaps most important, this process of dialogue and accommodation can produce visions that are linked and compatible instead of remote and competitive All this requires a great deal more communication than is needed to coordinate managerial roles, but unlike formal structure, strong informal networks can handle it.

> Despite leadership's growing importance, the on-the-job experiences of most people undermine their ability to lead

Of course, informal relations of some sort exist in all corporations But too often these networks are either very weak – some people are well connected but most are not – or they are highly fragmented – a strong network exists inside the marketing group and inside R&D but not across the two departments Such networks do not support multiple leadership initiatives well. In fact, extensive informal networks are so important that if they do not exist, creating them has to be the focus of activity early in a major leadership initiative

Creating a Culture of Leadership

Despite the increasing importance of leadership to business success, the on-the-job experiences of most people actually seem to undermine the development of attributes needed for leadership Nevertheless, some companies have consistently demonstrated an ability to develop people into outstanding leader-managers Recruiting people with leadership potential is only the first step Equally important is managing their career patterns Individuals who are effective in large leadership roles often share a number of career experiences

Perhaps the most typical and most important is significant challenge early in a career Leaders almost always have had opportunities during their twenties and thirties to actually try to lead, to take a risk, and to learn from both triumphs and failures Such learning seems essential in developing a wide range of leadership skills and perspectives It also teaches people something about both the difficulty of leadership and its potential for producing change

Later in their careers, something equally important happens that has to do with broadening People who provide effective leadership in important jobs always have a chance, before they get into those jobs, to grow beyond the narrow base that characterizes most managerial careers This is usually the result of lateral career moves or of early promotions to unusually broad job assignments Sometimes other vehicles help, like special task force assignments or a lengthy general management course Whatever the case, the breadth of knowledge developed in this way seems to be helpful in all aspects of leadership So does the network of relationships that is often acquired both inside and outside the company When

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enough people get opportunities like this, the relationships that are built also help create the strong informal networks needed to support multiple leadership initiatives

> One way to develop leadership is to create challenging opportunities for young employees.

Corporations that do a better-than average job of developing leaders put an emphasis on creating challenging opportunities for relatively young employees In many businesses, decentralization is the key By definition, it pushes responsibility lower in an organization and in the process creates more challenging jobs at lower levels Johnson & Johnson, 3M, Hewlett-Packard, General Electric, and many other well-known companies have used that approach quite successfully Some of those same companies also create as many small units as possible so there are a lot of challenging lower level general management jobs available

Sometimes these businesses develop additional challenging opportunities by stressing growth through new products or services Over the years, 3M has had a policy that at least 25% of its revenue should come from products introduced within the last five years That encourages small new ventures, which in turn offer hundreds of opportunities to test and stretch young people with leadership potential.

Such practices can, almost by themselves, prepare people for small- and medium-sized leadership jobs But developing people for important leadership positions requires more work on the part of senior executives, often over a long period of time That work begins with efforts to spot people with great leadership potential early in their careers and to identify what will be needed to stretch and develop them.

Again, there is nothing magic about this process The methods successful companies use are surprisingly straightforward They go out of their way to make young employees and people at lower levels in their organizations visible to senior management Senior managers then judge for themselves who has potential and what the development needs of those people are Executives also discuss their tentative conclusions among themselves to draw more accurate judgments

Armed with a clear sense of who has considerable leadership potential and what skills they need to develop, executives in these companies then spend time planning for that development. Sometimes that is done as part of a formal succession planning or high-potential development process, often it is more informal In either case, the key ingredient appears to be an intelligent assessment of what feasible development opportunities fit each candidate's needs

> Institutionalizing a leadership-centered culture is the ultimate act of leadership.

To encourage managers to participate in these activities, well-led businesses tend to recognize and reward people who successfully develop leaders This is rarely done as part of a formal compensation or bonus formula, simply because it is so difficult to measure such achievements with precision But it does become a factor in decisions about promotion, especially to the most senior levels, and that seems to make a big difference When told that future promotions will depend to some degree on their ability to nurture leaders, even people who say that leadership cannot be developed somehow find ways to do it.

Such strategies help create a corporate culture where people value strong leadership and strive to create it. Just as we need more people to provide leadership in the complex organizations that dominate our world today, we also need more people to develop the cultures that will create that leadership Institutionalizing a leadership-centered culture is the ultimate act of leadership

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Management 581
Issues in Environmental Management
Fall,, 1996, Section 55553
University of Tennessee at Knoxville
Tuesday 6 30-9 10, G51

Course Coordinator	Jerry Fryxell	ph 974-1664
Co-Instructors	Chuck Bamford	ph 974-3161
	Iain Clelland	ph 974-1672
	Pete Counce (Eng)	ph 974-5318
	Tom Dean	ph 974-1673
	Tom Douglas	ph 974-3161

Class Time and Place

Tuesday, 6 30-9 10 P M
Glocker Business Building, Rm 51

Required Materials

Tibor, T & Feldman, I 1996 ISO 14000 A Guide to the New Environmental Management Standards Chicago Irwin (Hereafter referred to as "TIBOR")

Readings packet to be available at Graphic Creations, 1809 Lake Ave 5-6221 (in two sets an addendum will be printed for last third of class)

Course Content and Pedagogy

The natural environment has become a strategic issue for increasing numbers of firms and industries As a result, organizations that survive and prosper in the future must learn to blend economic as well as ecological criteria into their decision-making processes The overall aim of this course is to better prepare future managers to accomplish this Specifically, the objectives of this course are to

1) Make students more aware of the pervasiveness and complexity of environmental issues that confront modern businesses and to clarify their personal values regarding these issues
2) Provide students with several tools that are currently being used to integrate natural resource and pollution concerns into business decisions Foremost among the tools we will examine are the ISO 14000 standards ISO 14000 are environmental management standards for corporations which are expected to have a significant impact on both foreign

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and domestic firms

3) Have students explore the implications of taking a proactive approach to environmental issues in business and to explore the strategic implications thereof

Pedagogically we feel strongly that the learning occurs best through "learning by doing" and by active interaction between the students and the instructors We also view ourselves more as facilitators of your learning, rather than as the experts that lecture on the true nature of the world and these relationships Accordingly, we will utilize topical discussions with guest speakers, experiential exercises, simulations, videos, and cases to facilitate the learning process It is important that the students realize that this philosophy places greater responsibility on them to be prepared for class and to actively participate in the class exercises and discussions We expect that the class will learn from each other's education and experience, and encourage the students to express their knowledge in class discussions

Course Principles

1 Hard work Hard work and determination represent the foundation to personal progress and success

2) Positive Attitude and Humor A lighter, positive side exists to most daily activities and events, let's have some fun

3) Academic Integrity Students will uphold the university honor code in all matters pertaining to this course All work submitted must be original and all non-original concepts integrated into student papers must be referenced as such Cheating on examinations or other assignments will result, at a minimum, in an F grade on that assignment

4) Respect for Others We recognize the desire of others to be heard without interruption When a person is speaking, the remainder of the class should remain attentive During any controversial discussions that may ensue, we will attempt to use appropriate timing when presenting our thoughts (allow other to compete their argument before speaking on your own opinions)

5) Professionalism With each other, with the guest speakers, and with the companies involved in the field project

Course Requirements

Class Attendance and Participation (25%)

Class preparation and participation are a fundamental aspect of this course and crucial to your performance in the class The emphasis here cannot be understated Since much of your learning will occur as a result of class discussion, getting your value as a paying student and the success of the overall class are dependent upon your being prepared and demonstrating it in class (an interesting variant on the basic "commons problem" which will be discussed further in this introductory class session) In this regard, it is important to point out that quality of contribution is more important than sheer quantity (Indeed, noncontributory could actually take away from our learning goals) It is also obvious that you cannot participate in the class when you are not

present Thus, you are expected to attend all of the class periods

Participation will be evaluated by both peers and the course coordinator at the conclusion of each class period To increase the validity of these assessments, peer evaluators will be used This job will be rotated each class session, so that all class members will be involved over the term

State of the Art Environmental Practice Research Project (25%)

You likely have either business or technical training in a particular business function or activity At present, most firms are just beginning to extended environmental policies, programs, or methods to business operations such as accounting, purchasing, finance, and marketing The purpose of this individual research project is to give you and opportunity to study (i e , investigate (identify, categorize, analyze, and make recommendations) about the state of environmental practice in your particular area of interest Alternatively, this paper could have an industry focus

Consequently this project will involve library research, contact with the relevant professional or industry associations, and/or interviews with knowledgeable professionals In some cases (i e , finance) it may be difficult to identify environmentally-based methods currently in use If this occurs investigate what practices are bing proposed for adoption in the future What are the advantages and disadvantages of adopting this method? What are the key factors associated with successful implementation?

You will need to submit a one page proposal for the topic of the paper by Sept 17 The end product of this effort will be a 10-12 page (text) double-spaced, typed report If you have exhibits or figures, they may be added as appendices The paper is due in class on October 15, so you will need to start on it early Please submit two copies, non-reusable covers are unnecessary

Group Field Project (40%)

This project will provide an opportunity to apply what you have learned from your individual project and the course to a local organization On September 26, we will form cross-functional teams (3 or 4 on a team) based on your functional specialty and/or your interest in an available project Your team will be partnered with a local company in a consulting capacity

Ideally, your team's task is to evaluate the company's operations against state-of-environmental practices you previously identified in your individual papers and then present your recommendations to company management about what types of environmental practices could be implemented and how best to implement them Of course, one useful benchmark for this evaluation could be the ISO 14000 standards (which is the main reason they have been front-loaded in the schedule of assignments), however, the exact scope of the project can be adjusted according to the needs of the participating firm and the capabilities of the team

On October 15 you will be required to submit a one-page report discussing your team's first visit with the client and outlining the scope and depth of the project On December 3 your report will be due Moreover you will be required to present your evaluation, recommendations, and management's reactions to the class The presentation will contribute one-third to the overall

grade for this assignment The paper should be at least 12-15 (text) paged double-spaced report Please submit two copies Finally, the course coordinator will provide peer evaluation forms and these may be used to adjust your grade on group assignments

Reading Evaluations

From time to time you will be asked to write a short response to a question about that evenings readings The purpose of this is to measure the extent to which you are prepared for class This will be unannounced and may not be made up Consequently, the lowest score on these "quizzes" will be dropped

CLASS SCHEDULE AND ASSIGNMENTS

#1 8/27 Course Introduction

Instructor Jerry Fryxell

Objective Introduce students to the course, stimulate thinking about the problems associated with the exploitation of common resources and the social dynamics involved, various approaches to solving the problems, and individual obligations

Special activity Commons simulation

#2 9/3 Environmental Economics and Regulation

Instructor Tom Dean

Guest Speaker David Feldman, EERC

Objective Introduce students to the fundamental concepts of environmental economics This will help you to understand the economic causes of environmental degradation, provide a crucial perspective for analyzing environmental issues, and a context in which to review of national environmental legislation and the environmental regulatory structure

Preparatory Readings

Schmidheiny, S 1992 Changing course A global business perspective on development and the environment, Boston MIT Press Chapter 1 & 2 (pp 1-33)

Webber, D J 1990 United States (Chp 16) in International public policy sourcebook (V2) Education and environment , Frederic Bolotin (ed), Greewood Press 335-352

#3 9/10 Environmental Strategy and Environmental Management Systems (ISO 14000)

Instructors Tom Dean & Jerry Fryxell

Objective To understand the role environmental management may play in business and corporate strategy To acquaint students with the ISO14000

standards, their development, and the rationale for the process

Preparatory Readings

MEB Case Study Measuring Environmental Performance and the ISO/CD 14001 Environmental Management Systems--Specs -- a copy of the draft international standard (DIS) prior to July, 1996

TIBOR Chps 1-3

#4 9/17 EMS (ISO 14000) -- Gap analysis and Environmental Policies, Objectives and Targets

Instructors Tom Dean & Jerry Fryxell

Objective To begin applying the ISO14000 standards through a "gap analysis," the development of an environmental policy, and setting objectives/targets

Preparatory Readings

TIBOR Chp 4

#5 9/24 Environmental Auditing & Accounting

Instructors Iain Clelland

Guest Speaker Harold Roth (Acct)

Objective Good monitoring and reporting systems are critical to a firm pursuing excellent environmental performance Two of the most common tools that firms are establishing (or expanding on) are environmental auditing and accounting methods and policies This class will review how these methods operate and their relationship with reporting requirements

Preparatory Readings

TIBOR Chp 6

Jones, L & Baldwin, J 1994 Evaluating corporate environmental performance Corporate Environmental Policy and Government Regulation 45-61

DIS ISO/CD 14011/1 2 "Guidelines for Environmental Auditing " [possible addition from H Roth unavailable at time of packet]

#6 10/1 Global Environmental Issues and Sustainable Development

Instructor Chuck Bamford

Objective To examine the complexities, opportunities, and potential pitfalls of environmental issues that impact international business efforts To develop a basic understanding of issues involved in sustainable development projects/programs

Preparatory Readings

TIBOR Chp 7

Speth, J G 1986 A new environmental agenda Forum for Applied Research and Public Policy 22-35

Ruckleshaus W D 1989 Toward a sustainable world Scientific American 166-175

Repetto R 1987 Managing natural resources for sustainability In T J Davis & I A Schirmer (eds) Sustainability issues in agricultural development 166-175

Special activity "Double Death Dilemma"

#7 10/8 Stakeholder Issues in Environmental Management

Instructor Jerry Fryxell

Objective To understand the legitimacy of stakeholder viewpoints on environmental issues and to learn a more systematic process for incorporating stakeholder views into a company's environmental strategy

Preparatory Reading

Chp 3 in Wood, D J 1990 Business and Society Glenview, Ill Scott, Foresman & Co 76-106

Special activity "Rainforest Negotiation Exercise"

Advance Assignment for 10/15 A one page write-up of green product, service, or advertisement

Advance Assignment for 10/22 Research on Eco-labelling

#8 10/15 Env Marketing

Instructor Tom Dean

Objective This class is designed to introduce students to the issues surrounding the concept of green marketing and the nature of green consumers Case analysis will be used to show how one firm used environmental considerations to its advantage in marketing products We will also address the hazards and problems associated with green marketing and recent trends in the area.

Preparatory Readings

Case study Loblaw Companies Limited

Ottman, J 1993 Green marketing NTC Business Books, Chps 1&2

Rice, F 1993 Who scores best on the environment? Fortune 114-122

Special Activity Green consumer quiz

Preparatory Assignments

A one page write-up of green product, service, or advertisement

Advanced Assignments for 10/22 and 10/29

• Obtain and complete Environmental Attitudes Survey (to be turned in 10/22 for tabulation and discussion on 10/29)

• Assess another class you are taking this semester with the "Sustainable Values" questionnaire Bring result to class on 10/29

#9 10/22 Life Cycle Analysis (LCA) and Env Labelling

Instructor Iain Clelland

Guest Speaker Representative from UT Center for Clean Products & Technology)

Objective To understand how the evolving tool of LCA is applied to help companies understand the environmental impacts associated with their products, processes, and activities To understand how seal-of-approval, single-attribute certification, and product environmental information programs operate as forms of third-party environmental labelling

Preparatory Readings

TIBOR Chps 8-10

Preparatory Assignment

a) Research on eco-labelled product using Internet seal-of-approval organizations, and comparative shopping End product is brief group-based presentation of findings Instructions will have been distributed two weeks earlier

#10 10/29 Environmental Ethics and Philosophy

Instructor Iain Clelland

Guest Speaker Steve Smith (U S Congressional Candidate)

Objective Environmental issues involve questions of human values as well as of science The purpose of this class is to explore moral implications of environmental issues We will examine how a corporation balances notions of efficiency with environmental and social equity In addition, the class will provide you with an opportunity to identify and compare your environmental values with those of others

Preparatory Reading

Kempton, W , Boster, J & Hartley J 1995 Environmental values Chap 5 in Environmental values in American culture by same authors

Jackson, J 1996 Greenpeace gets real Time, June 10 53-58

Special activity Discussion of "Sustainable Values" and

"Environmental Attitudes" surveys

#11 11/5 TQM and Environmental Management

Instructor T Douglas

Objective This session will review and update TQM's relationship to management practice It will extend TQM to encompass environmental concerns and will present a corporate example using TQEM Finally, it will relate this concept to real world applications and use a participative exercise to reinforce the concepts

Preparatory Readings

Grant, R , Shani, R & Krishnan, R 1994 TQM's challenge to management theory and practice Sloan Management Review Winter 25-35

Thompson, F 1992 Statistical measures for management oversight to achieve continuous improvement at Monsanto Chemical Co in GEMI's Corporate quality and environmental management conference proceedings 11-17

Special activity Play-Doh simulation

ADDENDUM TO SYLLABUS WILL FOLLOW WITH A READINGS SUPPLIMENT ALSO TO FOLLOW

#12-3 11/12&19 Waste Minimization/Risk Assessment -- PC (Engineering TBA)

#14 11/26 Environmental Management Systems -- Implementation

[Read TIBOR Chps 11-12]

#15 12/3 Group Project Presentations

1) Clayton Homes (Norris Facility)

[Project involved analysis and recommendations regarding problem involving wood waste]

2) North American Phillips (Greenville Printed Circuit Board Plant)

[Project involved formulated position paper on State policies toward ISO 14000 and discussions of actual audit procedure]

(NOTE There may be a distance learning conference on ISO 14000 on Oct 24 More information will be available later)

APPENDIX C

Summary of Workshop Evaluation Forms

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Phase 2

PROGRAM EVALUATION
Content Modules

Please indicate how effective you believe the following sessions were in terms of their relevance in terms of content and pedagogy

	This was mostly irrelevant	I will probably use something	I will use some content	I will use much content	I will use almost all of this content	This module had no effect on how I will teach in the future	I liked this session and how it was taught	I liked this session and will try this approach
Saturday Module II-- Jendrucko Linkages to environmental management, Teaching in an open society	0	2	8	5	4	0	10	9
Saturday Module III-- Fryxell Common simulation	1	2	8	5	3	1	15	5
Sunday Module I -- Jendrucko Historical evolution of U S legal framework Impact on engineering	0	3	10	1	4	1	12	6
Sunday Module II -- Bamford Role of the case study in env management	0	3	8	4	3	1	12	7
Sunday Module III -- Bamford 'Double Death"--a negotiation exercise	2	1	5	9	1	2	9	8
Monday Module I -- Jendrucko Identificaiton of energy efficiency improvements	0	1	4	8	7	0	10	9
Monday Module II -- Jendrucko Financial analysis	0	4	5	5	5	0	12	8
Monday Module III -- Stanelle Opportunities for practice-oriented study training	0	0	2	2	0	0	3	1
Monday Module III -- Jendrucko Overview of UT Industrial Assessment Center	0	2	4	7	6	0	10	11
Tuesday Module I -- Fryxell TQEM	0	2	8	2	6	0	13	5
Tuesday Module II-- Fryxell ISO 14000	0	2	3	7	6	0	11	7
Tuesday Module III -- Bamford Play-doh exercise	1	4	9	5	0	2	12	5
Wed Module I -- Jendrucko Networking and information exchange	0	0	5	3	7	0	7	8
Wed Module II -- Stanelle Guidance in course design	0	0	3	2	1	0	3	3

PROGRAM EVALUATION
General Questions

1) I am from

Liberec [7] Ostrava [6] Prague [5] guest 1 total 19

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
2) Overall, this program provided information that will be useful to the energy curriculum at my university	6	11	2	0	0
3) The content of this program was appropriate and clear	13	5	1	0	0
4) This program was well organized	17	2	0	0	0

Preferences for Phase II?

If you could travel to the US for a program in energy management when would be the most preferable time period? Rank order the following choices from 1-4 (1= most favorable 4 = least favorable)

		1	2	3	4 ← RANK ORDER
March 1-15	[ ]	2	0	2	11
March 8-22	[ ]	1	1	9	4
April 5-19	[ ]	7	8	0	1
April 12-26	[ ]	9	3	1	2

APPENDIX D

Detail Program for Curriculum Development and Participant List

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Technical Training and Municipal/NGO/University Networking for Energy Efficiency Study-Tour
April 5-April 18, 1997
Technical University of Liberec
Technical University of Ostrava, and
Czech Technical University in Prague

revised 4/4/97

SATURDAY, APRIL 5

Participants depart Prague, Saturday, April 5 (12 05pm, Delta Flight #81)
Arrive Knoxville 8 03pm, Delta Flight #996 [DH/cb to pick up]
Lodging Radisson Summit Hill, 401 West Summit Hill, Phone 522-2600

Key·[initials indicate lead responsibility (uppercase),and support (lowercase)]
CB=Chuck Bamford, PC=Pete Counce, JF=Jerry Fryxell, DH=Dave Hake, RJ=Rich Jendrucko, DK=Dianne Knief, BS=Bob Stanelle

SUNDAY, APRIL 6

11 00	Meet in lobby for informal sightseeing [JF, CB]	
17 30	**Reception.** UT Faculty Club [DK] **Special Welcome** Victor Ashe, Mayor of Knoxville	**Faculty Club**

MONDAY, APRIL 7

8.30	pickup at hotel [BS]	
9 00	**Welcome to The University of Tennessee** [DH, rj, cb, bs] Issues in Curriculum for Engineering & Business Education Professor, **Wayne Claycombe**, Industrial Engineering, College of Engineering Professor **Warren Neel**, Dean, College of Business Administration	**Int'l House/Great Rm**
10.00	break	
10.15	review of the Tennessee program [RJ,CB,dh,bs]	**Int'l House/Great Rm**
11 30	Lunch at the **UT ARENA** Participants, RJ, DH, BS, **Aubrey Mitchell**, Assoc Dean, UT Libraries, **Larry Markel, Electrotek, Joan Markel** **(Menu: Croissant Sandwich, soup, tortilla chips & salsa, iced tea/coffee @ $8.04/ea)**	**Dining Room E**
13 00	tour of Hodges Library **Hosts** Aubrey Mitchell, UTK Libraries and JFDP Scholars, **Elena Kozlova and Sonya Slutzkaya**	**Hodges Library**
13 30	UT Assessment Center briefing [RJ] The Center, directed by Prof Jendrucko, is part of a national program funded by the U S Department of Energy The UT Center is one of 30 nationwide Faculty-student teams provide technical assistance to regional manufacturing plants in energy efficiency, waste management and productivity enhancement	**Int'l House/Great Rm**
15 00	Break	
15 30	UT Assessment Center briefing continued	**Int'l House/Great Rm**
16.30	return to Radisson	
18.00	Supper [BS, RJ] (Tjarda's in Old City)	

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STANELLE TO CONFIRM LOCATION

TUESDAY, APRIL 8

8 30	pickup at hotel [RJ]	
9.00	Energy Assesment at Clayton Homes Manufacturing [RJ]	
11:30	Lunch on the road	
15.00	Energy Assessment Debriefing [RJ]	**408SMC**
17.15	Supper at the Copper Cellar [RJ]	
18 30	Participate in **Management** 401 to witness classroom use of the Case technique (Business Policy for L&WB majors) [JF, cb] The case concerns a financial analysis of net present value associated with the "Greenlights Program."	**Glocker 205**

WEDNESDAY, APRIL 9

8 45	pickup at hotel [RJ]	
9 00	Energy curriculum development [RJ] Speaker **Michael Simek**, Office of Industrial Productivity and Energy Assessment, Rutgers University, New Jersey Mr Simek will present the national administrative program structure for the Industrial Assessment Center Program.	**602SMC**
10 00	break	
10 15	Energy curriculum development, continued [RJ, PC]	
11 30	lunch the University Center Attending 9 Participants, PC, JF **[COUNCE & FRYXELL TO CONFIRM]** **Menu: Barbecue Buffet: Barbecue, cole slaw, chips, brownie, coffee, iced tea @ 8 70/ea**	**203 UC**
14.00	Plant tour of Parker Hannifin Corporation **Frank Hartman**, Plant Environmental Engineer (423-787-2420, x261) supper on the road**[PC,JF]**	

THURSDAY, APRIL 10

8.15	pickup at hotel [BS]	
8.30	Discussion on experiential education in engineering, co-op programs and other joint activities involving industry, government and university [PC, BS]	**Int'l House/Great Rm**
10.00	Break	
10 15	**Walter Odom**, Director of Engineering Co-op Programs, University of Tennessee	
11 00	Lunch at the **UT ARENA** Attending 9 Participants, BS, PC **Menu. Croissant Chicken salad sandwich, salad, tortilla chips, salsa @ 8.04/ea**	**Dining Room E**
12 15	depart for visit to Tennessee Valley Authority (TVA) Kingston coal-fired steam plant for electric generation Tour site, presentation and discussion with plant executives [RJ] {contact Clerlinda Clabough, Int'l Services, 632-4337}	

17 00 Return to Radisson
18 00 supper [DH, RJ] **Buddy's Barbeque**

FRIDAY, APRIL 11

8.45 pickup at hotel [BS]
9 00 Briefing on distance education by **Laurel Thomas** and **Rick Lichtwardt,** Continuing Education [BS] — **321 Comm Bldg Teleclassroom B**
10 10 Observe distance education class of Profs Jendrucko and Counce — **Teleclassroom A**
NOTE Participants will observe from Teleclassroom B
11 30 depart for Oak Ridge (lunch off campus) and Oak Ridge, Tennessee [PC, rj] **COUNCE TO CONFIRM**
?? **Vince Adams**, TASCA
15 30 b) K-25 Visit/Jeff Christian
in energy efficiency area, Martin Marietta Energy Systems
[Jendrucko to pick up UT car for Monday Trip]
18 30 **buffet supper at Hake's** All project group invited with spouse, guest **RSVP BY 4/9/97**
[Delegation needs driver to Daves]

SATURDAY, APRIL 12 - Trip to Nashville

Nashville Lodging ClubHouse Inn 2435 Atrium Way, Nashville Phone 883-0500
Contact Tracy McDonald or Jesse Crowe, reserved 5 dbls/1sgl.
Note: Each guest receives a complimentary breakfast buffet & manager's cocktail reception served daily in the Clubhouse area.

10.30 van departs for trip to Nashville, TN [BS, DH] lunch along the way
18.30 Grand Ole Opry Reservations in the name of Hake at ticket office Can pay cash at window

SUNDAY, APRIL 13
Lodging ClubHouse Inn **Reserved 5 doubles.**
10 00 Tour **Opryland Hotel** [BS, dh]
About Opryland Hotel A University of Tennessee graduate in Agriculture is the head of landscaping at this hotel which features four acres of botanical garden under roof ringed by interior rooms of the hotel The Hotel is known for its innovations in energy efficiency and environmental design
13 00 Sunday Brunch at Opryland Hotel
14 30 Open
{Hake returns to Knoxville Sunday night}

MONDAY, APRIL 14- {RJ and JF to drive over early from Knoxville} **FRYXELL TO CONFIRM**

TBA Tennessee State government visits [JF, rj, bs] Tennessee Department of Environment and Conservation Discussion of state regulatory policies regarding energy usage and energy production especially from coal fired plants Review state policies for energy efficiency and changes relative to ISO 14000 [contact Cynthia Oliphant, 615-741-2994]

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TBA/PM Visit to Nashville Thermal Pant for lecture and demonstrations of trash-to-energy conversion [RJ, jf, bs] supper on the road **JENDRUCKO TO CONFIRM**

EVENING travel to Chattanooga, TN [BS, jf] {**Jendrucko returns to Knoxville**}
Lodging **Radisson Reed House** (across from TVA)
Martin Luther King and Broad Street
Chattanooga **Contact** Allison Fox, **Phone** 423-266-4121

TUESDAY, APRIL 15

TBA Visit Electric Transit Vehicle Institute in Chattanooga [JF, bs] **FRYXELL**
12 00 lunch
13 30 Visit Tennessee Acquarium / IMAX [JF, BS]
16 30 depart Chattanooga for trip back to Knoxville [BS] (Fryxell/class that evening)
18 30 supper (**moderate price**)[BS, dh]

WEDNESDAY, APRIL 16

8 30 pickup at hotel [BS]
Note first session is downtown at UT Conference Center
9 00 Presentation and discussion Marketplace Game **Ernest Cadotte,** Professor of Marketing **UT Conference Ct**
Presenters **Martin Klima, Miro Factor, Jaroslav Dusa,** Research Associates, **Room 237**
Marketplace Game
11 30 lunch downtown
13 30 Meeting and discussion with **George Smelcer**, UT Center for Industrial Services **I-House/Great Rm**
(UTCIS) on the Hazardous Waste Extension Program. [PC]
18 00 supper at Regas [RJ, PC]

THURSDAY, APRIL 17

8 30 (checking out of hotel) [DK,bs]
9 30 depart for Rohm and Haas [BS, pc]
10 00 Visit to Knoxville's plant of Rohm and Haas Inc [PC, rs] This firm produces resins, emulsions and other industrial intermediates at a factory in central Knoxville near high density residential and commercial neighborhoods Plant tour and background on Rohm and Haas 'community linkage program.'
12 00 attend regularly scheduled noon meeting of the Rohm and Haas Citizens Advisory Committee
13 30 depart Rohm and Haas, lunch en route to Washburn, Tennessee and the Narrow Ridge Center for Energy Efficiency [JF, rs]
Purposes of the visit a) to learn about alternative energy sources The Center has only self-contained solar dwellings, some made of unusual materials (e g , straw bale construction) **b)** to experience social implications of living "off-the-electric-grid" based on holistic philosophy embracing conservation and simpler lifestyles **c)** to witness a "land trust" which buys land and imposes covenants under which no power lines may pass over or under the properties of the trust

18 00 supper at **Narrow Ridge Center** Begin wrap-up discussions for this current phase of the project Lodging will be at Narrow Ridge Center in their energy efficient dormitory

FRIDAY, APRIL 18

8.00 breakfast at Narrow Ridge Center
9 00 depart Narrow Ridge for UT [JF]
10 00 **Summary discussion** for Project Phase 3 and planning for project Phase 4 (final phase, May 16-26, 1997[**JF, DH, BS**] (AID Project Phase 4, will involve UT team visits to Czech Tech in Prague, Tech Univ of Liberec in Liberec, and Tech Univ of Ostrava in Ostrava curriculum integration followup visits with university faculty, students and university leaders) **605 Hodges Library CONFIRM IF YOU CAN MAKE THIS**
12 00 lunch on UC Plaza joining **International Food Fest** [BS]
15 20 depart for Knoxville airport for return **Delta Flight 1027** to Czech Republic [BS] (BS TO RETURN VAN TO UT MOTORPOOL)

SATURDAY, APRIL 19
AFTERNOON Czech delegation arrive Czech Republic

NOTES Need system for hand-off of Van Keys

Technical Training and Municipal;/NGO/University Networking for Energy Efficiency
Energy Efficiency Study Tour
April 5-18, 1997
Participant List

Jiri TUMA, Professor
Czech Technical University in Prague
Faculty of Electrical Engineering, Department Power Engineering
Vice - dean for research and science
Affiliation big power producers and distributors As teacher interested in the large scale, power generation and distribution and in environmental care and management on energy economy of large system and industrial plants

Karel KABELE, Assistant Professor
Czech Technical University in Prague
Faculty of Electrical Engineering, Department Power Engineering

Jan KYNCL, Assistant Professor
Czech Technical University in Prague
Faculty of Electrical Engineering, Department of Power Engineering
Affiliation Research of heat transfer, energy efficiency in metallurgy As teacher interested in heat recovery in furnaces in use of electric energy and its modeling electrodynamics of metals

Jiri KRATOCHVIL, Professor
Technical University of Liberec
Head of the Department of Power Engineering
Affiliation Lecturer in Fluid Mechanics, Gas Dynamics, Power Engineering and Machinery, Fluid Machinery

Miroslav OLEHLA, Associate Professor
Technical University of Liberec
Head of the Department of Applied Cybernetics
Affiliation Lecturer in Technics of Cybernetics, Simulation and Identification, Computers and Programming

Jaroslav SULC, Senior Lecturer
Technical University of Liberec
Department of Power Engineering
Affiliation Lecturer in Environmental Protection, Technical Measurements, Ecological Aspects of Power Processes

Pavel KOLAT, Professor
Technical University of Ostrava
Faculty of Power Engineering Head of Department
Specialization Heat and mass transfer Nuclear engineering, thermal power plants, Waste incineration

Zdenek TOMAN, Associate Professor
Technical University of Ostrava
Specialization Thermal engineering, Industrial energetic

Leos PCHALEK, Assistant Professor
Technical University of Ostrava
Specialization Thermal Engineering, Cogeneration

APPENDIX E

Summary of Curriculum Development Evaluation Forms

Phase 3

PROGRAM EVALUATION
Content Modules

Please indicate how effective you believe the following sessions were in terms of their relevance in terms of content and pedagogy

	This was mostly irrelevant	I will probably use something	I will use some content	I will use much content	I will use almost all of this content	I would definitely retain this module in any future programs in energy efficiency	This activity was enjoyable and interesting but peripheral	This activity should probably be eliminated
Monday April 7 PM-- UT Assessment Center Briefing [JENDRUCKO]		2		2	5	8	1	
Tuesday April 8 AM-- Energy Assessment at Clayton Homes		3	1		5	7	2	
PM-- Classroom Use of Case Technique Green Lights Economics [BAMFORD/FRYXELL]		1	4	2	1	7	1	1
Wednesday April 9 AM-- National Structure of Industrial Assessment Center Program [SIMEK]		1	3		4	6	3	
PM-- Parker-Hannifin Co Tour		1	4		3	5	3	
Thursday April 10 AM-- Curriculum Development [COUNCE]		2	2	3	2	4	3	
[STANELLE]		2		1	4	4	2	
Co-op Program Development [ODOM]		2	2	2	3	5	3	
PM-- TVA s Bull Run Coal-fired Steam Plant		1	2	1	5	5	2	
Friday April 11 AM-- Distance Education [THOMAS & LICHTWARDT]		1	2	3	2	5	2	
Observation of Distance Ed Class [JENDRUCKO & COUNCE]		3		2	3	5	3	
PM-- Oak Ridge National Labs (ORNL)		2		3	3	8	1	
Sunday April 13 Tour of Opryland Hotel		1	1	2	5	6	2	

Monday April 14--AM Tour of Nashville Thermal Plant	1	3	2	1	2	3	4	
PM-- Discussions with State Officials		3	1	3	1	3	4	1
Tuesday April 15--AM Electric Transit Vehicle Institute in Chattanooga	1	1	1	3	3	4	3	
PM-- TVA s Missionary Ridge Center		2		3	3	4	2	
Fullbright Association Dinner & Internet Presentation	2	4		1	3	6	3	
Wednesday April 16--AM Marketplace Simulation [KLIMA&FACTOR&DUSA]	1	2	1	4	1	5	3	
PM-- UT Center for Industrial Services [SMELCER]		3	1	3	2	5	2	
Thursday April 17--AM Rohm & Haas factory visit		3	1	2	3	4	3	
Rohm & Haas Citizen s Advisory Committee	1	2	2	2	2	2	5	
Narrow Ridge Center Program	1	1	1	3	3	5	3	

PROGRAM EVALUATION
General Questions

1) I am from

Liberec [3] Ostrava [3] Prague [3]

	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
2) Overall this program provided information that will be useful to the energy curriculum at my university	5	3	1		
3) The content of this program was appropriate and clear	6	3			
4) This program was well organized	9				

APPENDIX F

Detail Schedule for Implementation Support

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The general schedule for Phase 4 is as follows Emergency contact persons are noted for each city

Wed , May 14

Counce, Fryxell, Hake and Jendrucko depart Knoxville 15 20 on Delta through Atlanta and Amsterdam.

Thursday, May 15

arrive Prague, 10 00 on Delta Flight #80 from Amsterdam.
Meet Miroslav Olehla at Prague airport for van ride to Liberec
Lodging at Zlaty lev Hotel in downtown Liberec
CONTACT person Prof Jiri Kratochvil, Dept of Power Engineering, Halkova 6 Work tel (42-48) 25441 or (4248) 25462 Private (4248) 510-1817

Friday through Monday night, May 19

meetings at Liberec Technical University and visits in area

Tuesday, May 20

Counce, Fryxell, Hake and Jendrucko depart Liberec for Ostrava
arrive Ostrava in evening Lodging unknown
CONTACT person Prof Pavel Kolat, Head, Dept of Power Engineering, Ostrava-Poruba, 17 listopadu,, 708 33 Czech Republic tel 4269-669-4403 or 669-2301

Wed , May 21

Meetings at Technical University of Ostrava

Thursday, May 22

Meetings, continued
Hake departs Ostrava for Prague, arriving in evening Lodging Hotel Krystal, J Martiho 2/407, 160 41 Praha 6 (422) 316-2761

Friday, May 23

Counce, Fryxell, and Jendrucko continue with meetings in Ostrava
Hake meets with officals at Czech Technical University in Prague
15 00 Hake meets at U S Embassy with AID officals, Bob Posner and/or Jan Pisko

Saturday, May 24

Counce, Fryxell, and Jendrucko continue with meetings in Ostrava
Hake departs Prague for Alliance board meeting

Sunday, May 25

Counce, Fryxell, and Jendrucko depart Ostrava for Prague arriving late afternoon
Lodging students hostel "Hlavkova kolej" at Jenstejnska street

Monday, May 26

Counce, Fryxell, and Jendrucko meetings at Czech Technical University in Prague
CONTACT person Prof. Jiri Tuma, faculty of Electrical Engineering, Technica 2, Prague 6 tel (420 2) 2431-0386, fax (420 2) 2341-0784
Alternate contact Mr Jan Pozar, Dept of Foreign Relations, Czech Tech, Zikova 4, CZ-166 35, Praha 6 tel (420 2) 2435-3465, fax 2431-1042

Tuesday, May 27

meetings at Czech Tech

Wed , May 28

Counce, Fryxell, and Jendrucko depart Prague for U S

APPENDIX G

Fax from Professor Adam Gula

Message from FEWE

Date:	7	July	'97

Polish Foundation for Energy Efficiency — Fundacja Efektywnego Wykorzystania Energii

To:	Dave HAKE UTK MANAGEMENT DEPT
Tel	+001 423 974 3161
Fax	+001 423 974 3163

From:	Adam Gula Director FEWE, Centre in Krakow ul Floriańska 55, 31-019 Kraków tel (48-12) 21 39 89, 21 37 81
Fax numbers	
FEWE Katowice	(48-32) 103 51 14/20
FEWE Warsaw	(48-22) 273 271
FEWE Kraków	(48-12) 21 30 70

No of pages	1

Dispatch notes	Sent by		date			hour		

Dear Dave,

Thank you very much for your fax of 30 June
I am very glad that your project has a good chance to be extended to Poland I shall be only very happy to organise the whole event and my faculty has already expressed great interest in taking part in the project
Referring to the visit of people from Liberec They visited us on Wednesday, 2 July We had a good meeting with my Dean and both his deputies as well as with a few more professors The meeting was successful enough to draft a rather far-reaching project of Czech-Polish co-operation We have realised how many problems we have in common both as countries and as technical universities We have decided that after the Polish part of your project has been completed we shall continue co-operation basing on its results We shall most likely strive to establish a Czech-Polish Centre for Energy End-Use Problems (or Energy Efficiency Problems) that would involve Prague, Ostrava and Liberec on the CZ part and Krakow with Gliwice and Wrocław on the PL side
I have promised to jot down some preliminary ideas that emerged during the meeting and consult them with Liberec and my Faculty, to present them to Larry when he comes (and to you, of course)
I shall contact you soon

Best regards

Adam

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