ІНІЦІАТИВА З ПИТАНЬ ЗМІНИ КЛІМАТУ
CLIMATE CHANGE INITIATIVE

DELIVERABLE № 6, 2000

Training Program

Module 6: Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Prepared for:
The United States Agency for International Development
under Contract LAG-I-00-98-00005-00, Task Order 16

Prepared by:
PA Government Services Inc.
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September 2000
Updated September, 2002

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Module Contents

Overview

Background

The training will provide an overview of monitoring, evaluating, reporting, verifying, and certifying (MERVC) guidelines that are needed for projects claiming to achieve greenhouse emission reductions from investments in energy supply projects. The course agenda focuses on how to go about setting up appropriate protocols needed to enhance the credibility of projects with stakeholders.

Several topics and issues are addressed in the training. These include: a) the need to establish credible baselines; b) accounting for impacts outside project boundaries through leakage; c) net greenhouse gas emission reductions and other impacts; d) precision of measurement; e) MERVC frequency; f) persistence (sustainability) of savings and emissions reduction; g) reporting by multiple project participants; h) verification of greenhouse gas emission reduction units (ERUs); i) uncertainty and risk; j) institutional capacity in conducting MERVC; and k) costs.

The workshop is oriented toward the presentation of technical materials through a lecture format, coupled with ample time for group discussions and questions/answers. The focus is on Joint Implementation (JI) projects.

Participation

The course is to be offered to a diverse audience in power generation, industrial applications, government energy agencies, and other Ukrainian stakeholder organizations. Course size is limited to 50 people.

Objectives

The objective of the training is to provide Ukrainian professionals with an understanding of the principles and guidelines to accurately determine the GHG emission reductions and other benefits of project investments.

The long-term goal is an enhanced and lasting awareness of climate change issues, and the beginning of a functional consensus among key stakeholders on how to approach and manage climate change activities in Ukraine.

Module MERVC

- ***Duration***: 2 days
- ***Participants:*** 50
- ***Facilities (recommended):*** The module can be presented in any comfortable training facility. Adequate space for plenary presentations should be made available.
- ***Format:*** Workshop; fourteen sessions; each consisting of a (typically) 30-60 minute long presentation, including a question and answer period.
- ***Instructor:*** Between 2 and 4 Ukrainian experts
- ***Audio/Visual Needs:*** Overhead projector, overhead monitor
- ***Contacts:*** Natalia Kulichenko and Natalya Parasyuk of CCI, Dan Thompson (USAID), Bill Dougherty of Tellus Institute

Materials

The module provides several types of material for use during both the preparation of the workshop, and the workshop itself. This material is outlined below.

Session Overview: The session overviews are "blueprints" for each of the 14 sessions. The overview of each session provides a summary of the session, listing basic information, such as the general objective, total time, and type of activities involved.

Overhead transparencies: OHTs are divided into sets according to sessions. Each set of OHTs is numbered consecutively and has titles based on their content. Presenters are encouraged to give participants sufficient time to read and understand each OHT.

Participant Materials: This material consists of a series of handouts. Only one copy of each of the handouts is included in the workshop package. Copies of the handouts should be made prior to the workshop. Presenters are encouraged to make certain that enough copies of the handouts have been prepared, and to arrange the handouts so that they can be distributed with ease during the workshop.

Evaluation Process

Module Six will need be evaluated in order to improve the workshop package for more effective subsequent use. The evaluation can be conducted using a simple questionnaire, developed by the UNITAR CC: Train Program, which can be found at the end of the package. At the close of the workshop, the organizer should ask

the participants to take five to ten minutes to complete the evaluation form. Participants need to be asked to put down their names on the forms.

Agenda

The agenda for Module Six appears on the following page.

Proposed Agenda for Module 6: Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Session	Day 1:Topics to be covered	***Time***
Registration		9:00 - 9:30
Opening Remarks	Welcome to the participants, overview of training	9:30 – 9:45
1. Current International Negotiating Process	International negotiating process in the frames of UN FCCC and Kyoto Protocol	9:45 – 10:15
2. Overview of existing protocols	U.S. DOE's IPMVP (1997), U.S. DOE's Voluntary Reporting of Greenhouse Gases (1994),USIJI's Project Proposal Guidelines (1996), World Bank's Monitoring and Evaluation Guidelines (1994), Guidelines for MERVC (LBNL, 1999)	10:15 – 11:00
Break		11:00 – 11:15
3. Introduction to MERVC (Part I)	Linkages between MERVC components, main definitions	11:15 – 11:45
4. Introduction to MERVC Issues (Part II)	Monitoring domain, additionality, baseline, free riders, positive project spillover, market transformation	11:45 – 12:30
Discussion Session	*Q&A*	12:30 – 13:00
Lunch		13:00 – 14:00
5. Application of MERVC issues to energy supply projects	Types of energy supply projects, Q&A	14:00 – 14:45
6. Overview of Estimation Issues	Estimation process, methods, plan and institutional implications	14:45 – 15:20
Break		15:20 – 15:35
7. Overview of Monitoring and Evaluation	M&E processes, plans, costs	15:35 – 16:15
Discussion Session	*Q&A*	16:15 – 16: 45
Summary of Day 1		16:45 – 17:00

Session	Day 2:Topics to be covered	Time
Introduction to Day 2 Sessions		9:30 – 9:45
8. Overview of methods of data collection and analysis methods to energy supply projects	Engineering methods, basic statistical models, multivariate statistical models, end-use metering, short-term monitoring, integrative methods	9:45 – 10:15
Discussion Session	*Q&A*	10:15 – 10:30
9. Overview of IPMVP approaches	Application and cost of options A, B, C, D	10:30 – 11:15
Break		11:15 – 11:30
10. Additional issues of monitoring and evaluation	Quality assurance guidelines and applicability, emissions impacts, other environmental and socioeconomic impacts	11:30 – 12:00
11. Reporting GHG reductions	Uniform Reporting Format	12:00 – 12:30
Discussion Session	*Q&A*	12:30 – 13:00
Lunch		13:00 – 14:00
12. Verification and Certification	Verification and Certification processes and bodies	14:00 – 14:30
13. Next steps		14:30 – 15:30
Break		15:30 – 15:45
14. Panel discussion	*Overview of Ukraine's participation in IPMVP process*	15:45 – 16:45
Evaluation Session and Closing Remarks		16:45 – 17:00

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 1: Current International Negotiating Process

Overview

General Objectives:

Session 1 is intended to give a broad overview of the current international negotiating process under the United Nations Framework Convention on Climate Change, the Kyoto Protocol and may be other relevant international agreements. The presented in this package OHTs are the example because this Session should be updated according to current situation. By the end of the session, participants should have a basic understanding of:

- Urgent events concerning climate change;
- Key issues of discussion in the international negotiating process;
- Point of view of different countries in the international negotiating process and Ukraine's point of view;
- Ukrainian perspective on the elements and commitments under the Framework Convention and Kyoto Protocol.

Activities:

Presentation, followed by period of questions and answers.

Total Time:

30 minutes.

Materials:

Set of 13 OHTs.

Current International Negotiating Process

Session 1

Module 6: Training seminar

Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

The Main Steps

1992 – signing the Convention

1996 - ratification

1997 – becoming a Party

1998 – submitting the First National Communication

1999 – signing the Kyoto Protocol

1999 – establishing the Interministerial Commission on Climate Change

1999 – in-depth review mission

2000 - submitting national inventories for the period of 1991 – 1998

Nov. 2000 – participation in COP6

Slide 2

The Latest Event

Lyon, 11 - 15 September 2000

Thirteenth Session of Subsidiary Body for Implementation and Subsidiary Body for Scientific and Technical Advice

The Nearest Future

The Hague, 13 - 24 November 2000

Sixth Conference of the Parties of UN Framework Convention on Climate Change

Slide 3

Key issues in Lyon

- how to define carbon "sinks",
- how much credit developed countries can earn from investments in other countries through the Protocol's three flexible mechanisms,
- procedures and arrangements of realization of flexible mechanisms;
- how the non-compliance regime should work;
- what specific actions will be taken to address the special concerns of developing countries that are particularly vulnerable to climate change.

Slide 4

Provisional Agenda of COP6

- Organizational matters
- Reports of Subsidiary Bodies
- Review of the implementation of commitments
- Second review of the adequacy of Article 4.2(a) and (b) of the Convention
- Proposal to amend the lists in Annexes I and II to the Convention by removing the name of Turkey
- Preparations for the first session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
- Administrative and financial matters

Slide 5

Organizational matters

Among other organizational and procedural matters the key issue is that:

"The Conference may wish … to invite Parties to ratify or accede to the Protocol. The COP may also wish to invite Parties to provide to the secretariat any information regarding the expected timing of their ratification of Kyoto Protocol".

Slide 6

Review of the implementation of commitments of the Convention

- National communications from Annex I Parties;
- National communications from non-Annex I Parties;
- Report of Global Environmental Facility;
- Capacity building in developing countries and countries with economy in transition;
- Development and transfer of technologies;
- Implementation of Article 4.8 and 4.9 UNFCCC;
- Activities implemented jointly under the pilot phase.

Slide 7

Preparations for the first session of COP serving as the meeting of the Parties to the Kyoto Protocol

- National systems, adjustments and guidelines under Articles 5, 7 and 8 of the Kyoto Protocol;
- Matters relating to land-use, land-use change and forestry;
- Work program on flexible mechanisms;
- Procedures and mechanisms relating to compliance under the Kyoto Protocol;
- "Best practices" in policies and measures;
- Impact of single projects on emissions in the commitment period.

Slide 8

Key Issues for Ukraine

- Procedural arrangements for national inventory system, national registry and in-depth review;
- The pilot phase of AJI: experience, prospective;
- Procedures and limitations of flexible mechanisms;
- Methodological issues of land-use, land-use change and forestry;
- Obligatory or voluntary commitments of non-Annex I countries

Slide 9

Pilot Phase of AIJ

- Overall number of AIJ projects totals 140, a 15% increase being achieved over the year 1999;
- 70% of host countries - non-Annex I Parties, 60% of projects – EIT countries;
- The share of EIT host countries is decreasing;
- The majority of the projects is in the area of energy efficiency and renewable energy;
- Experience in assessing real, measurable and long-term environmental benefits;
- Revised uniform reporting format;
- Learning-by-doing.

Slide 10

Main areas of AIJ projects

- District heating (Russia, Estonia, Latvia, Lithuania, Czech Republic)
- Fuel switching from coal to gas or bioenergy (Poland, Slovakia, Estonia, Lithuania, Latvia)
- Cogeneration station (Czech Republic)
- Boiler modernization or replacement (Latvia, Lithuania)
- Increasing efficiency of power plant (Russia, Romania, Poland)

Slide 11

Main areas of AIJ projects (cont)

- Energy efficiency in the institutional buildings (Hungary, Estonia)
- Energy efficiency in drinking water supply, dairy industry, horticulture (Romania, Slovakia, Russia)
- Optimization of gas transportation (Russia)
- Modernization of cement factory (Czech Republic)
- Afforestation and reforestation (Russia, Czech Republic)
- Utilization of landfill gas (Russia)

Slide 12


Participation of EIT countries in AIJ
•Latvia (Sweden, the Netherlands, Germany) – 24 projects;
•Estonia (Sweden) – 21 projects;
•Lithuania (Sweden)- 9 projects;
•Russian Federation (USA, Germany, the Netherlands) - 9 projects;
•Czech Republic (France, the Netherlands, USA, Germany)– 4 projects;
•Slovak Republic (Switzerland, the Netherlands, Norway)– 4 projects;
•Romania (the Netherlands, Switzerland)– 4 projects;
•Hungary (the Netherlands, France) – 4 projects;
•Poland (the Netherlands, Norway)- 3 projects;
•Bulgaria (the Netherlands) – 1 project;
•Ukraine - 0 projects.
Slide 13

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 2: Overview of Existing Protocols

Overview

General Objectives:

Session 2 is intended to give a broad overview of the need and principles for MERVC protocols. Several existing examples will be reviewed, namely:

- US DOE's international performance measurement and verification Protocol
- US DOE's program for the voluntary reporting of greenhouse gas emissions
- USIJI project proposal guidelines
- The World Bank's monitoring and evaluation guidelines
- LBNL's monitoring and evaluation protocols

By the end of the session, participants should have a basic understanding of:

- Range of issues that need to be addressed in establishing a credible monitoring and evaluation regime in Ukraine,
- The key features, both strengths and weaknesses of the existing international protocols,
- How any local guidelines compare with the elements of protocols discussed.

Activities:

Presentation, followed by period of questions and answers.

Total Time:

45 minutes.

Materials:

Set of 10 OHTs.

Overview of Existing Protocols

Session 2

Module 6: Training seminar
Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Need for Protocols

- Accurately determine net greenhouse gas benefits and other benefits
- Increase the reliability of data for estimating benefits
- Provide real-time data for mid-course corrections of projects
- Introduce consistency and transparency across project types and reporters
- Enhance the credibility of projects with stakeholders
- Necessary element of emissions trading system

Slide 2

Principles for Protocols

- Consistent
- Technically sound
- Readily verifiable
- Objective
- Simple
- Relevant
- Transparent
- Cost effective

Slide 3

Monitoring & Evaluation Protocols (1)

- U.S. DOE's International Performance Measurement and Verification Protocol (1999)
  - U.S. Department of Energy's (DOE) International Performance Measurement and Verification Protocol (IPMVP) is a consensus document for measuring and verifying energy savings from energy-efficiency projects
  - The IPMVP is the preferred approach for monitoring and evaluating energy-efficiency projects for climate change mitigation
  - We will discuss the IPMVP in more detail later in the course

Slide 4

Monitoring & Evaluation Protocols (2)

- U.S. DOE's Voluntary Reporting of Greenhouse Gases (1994)
  - DOE prepared guidelines & forms for the voluntary reporting of GHG. It can be used by corporations, government agencies, households & voluntary organizations to report on actions taken that have reduced or avoided GHG emissions.
  - The documents offer guidance on recording historic and current GHG emissions & emissions reductions. The supporting documents contain limited examples of project analysis for the following sectors: electricity supply, residential and commercial buildings, industrial, transportation, forestry, & agriculture. Companies are allowed discretion in determining the basis from which their emissions reductions are estimated and can self-certify that their claims are accurate.

Slide 5

Monitoring & Evaluation Protocols (3)

- USIJI's Project Proposal Guidelines (1996)
  - The U.S. Initiative on Joint Implementation (USIJI) prepared project proposal guidelines for organizations seeking funding from investors to reduce GHG emissions.
  - The guidelines request information on the proposed project, including the identification of all GHG sources included in the emissions baseline as well as those affected by the proposed project, and net impacts.
  - The guidelines also ask for additional information, such as the estimates of GHG emissions, including methodologies, type of data used, calculations, assumptions, references and key uncertainties affecting the emissions estimates. The estimates include the baseline estimate of emissions of GHG without measures and the estimate of emissions of GHG with measures.

Slide 6

Monitoring & Evaluation Protocols (4)

- World Bank's monitoring and evaluation guidelines (1994)
  - The World Bank prepared monitoring and evaluation guidelines for the Global Environment Facility (GEF), a multilateral funding program created to support projects that yield global environmental benefits
  - The GEF supports four types of projects: biodiversity preservation, pollution reduction of international waters, GHG emission reduction and, to a limited extent, the control of ozone-depleting substances
  - These protocols have been revised for the World Bank's Prototype Carbon Fund (PCF)

Slide 7

Monitoring & Evaluation Protocols (5)

- LBNL's Guidelines (1999)
  - Guidelines for the MERVC of Energy-Efficiency Projects
  - Guidelines for the MERVC of Forestry Projects
  - MERVC stands for Monitoring, Evaluation, Reporting, Verification and Certification
  - The focus of this course
  - Been used in discussions at the international level - World Bank and UNFCCC
  - Been used for USAID training courses at LBNL (Lawrence Berkeley National Laboratory) in 1999 and 2000

Slide 8

Monitoring & Evaluation Protocols (6)

- UNFCCC Guidelines ???
  - Monitoring and evaluation manual ??

Slide 9

Participant Discussion

Any related guidelines in your country?

Slide 10

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 3: Introduction to MERVC (Part I)

Overview

General Objectives:

Session 3 is intended to give a broad overview of additional procedures for GHG emission reduction projects: estimation and registration, monitoring, evaluation, reporting, verification and certification of GHG reductions (MERVC). They envisage estimation and registration at the project development stage, reporting – at all project stages, all other procedures – during project implementation. This session includes main definitions of key concepts of these procedures and main requirements for their use.

By the end of the session, participants should have a basic understanding of:

- Range of issues that need to be addressed in development and implementation of emission reduction project,
- The key definitions of estimation and registration, monitoring, evaluation, reporting, verification and certification of GHG reductions,
- How MERVC procedures should be applied during development and implementation of joint implementation projects.

Activities:

Presentation, followed by period of questions and answers.

Total Time:

30 minutes.

Materials:

Set of 15 OHTs.

Introduction to Monitoring, Evaluation, Reporting, Verification and Certification (MERVC) issues

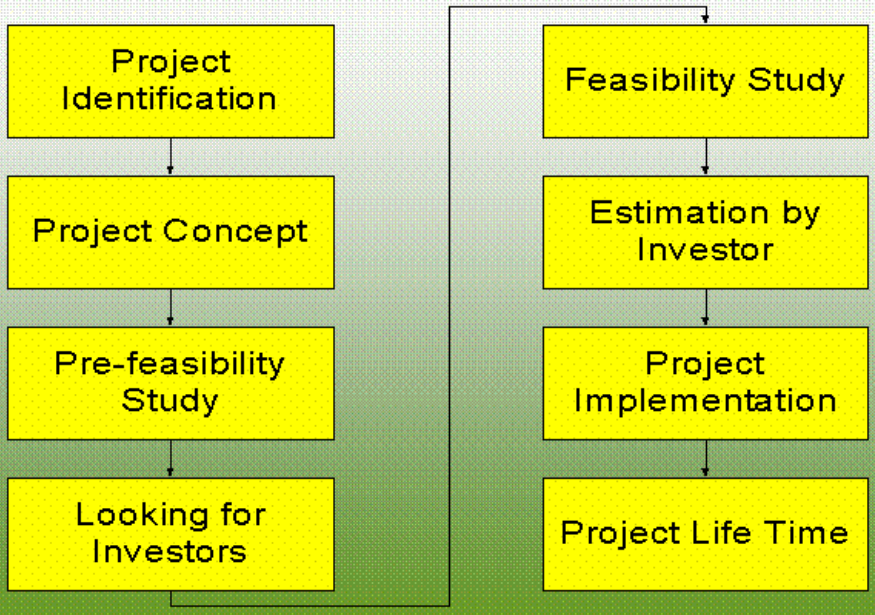
Session 3

Module 6: Training seminar

Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

The Main Steps of Investment Project



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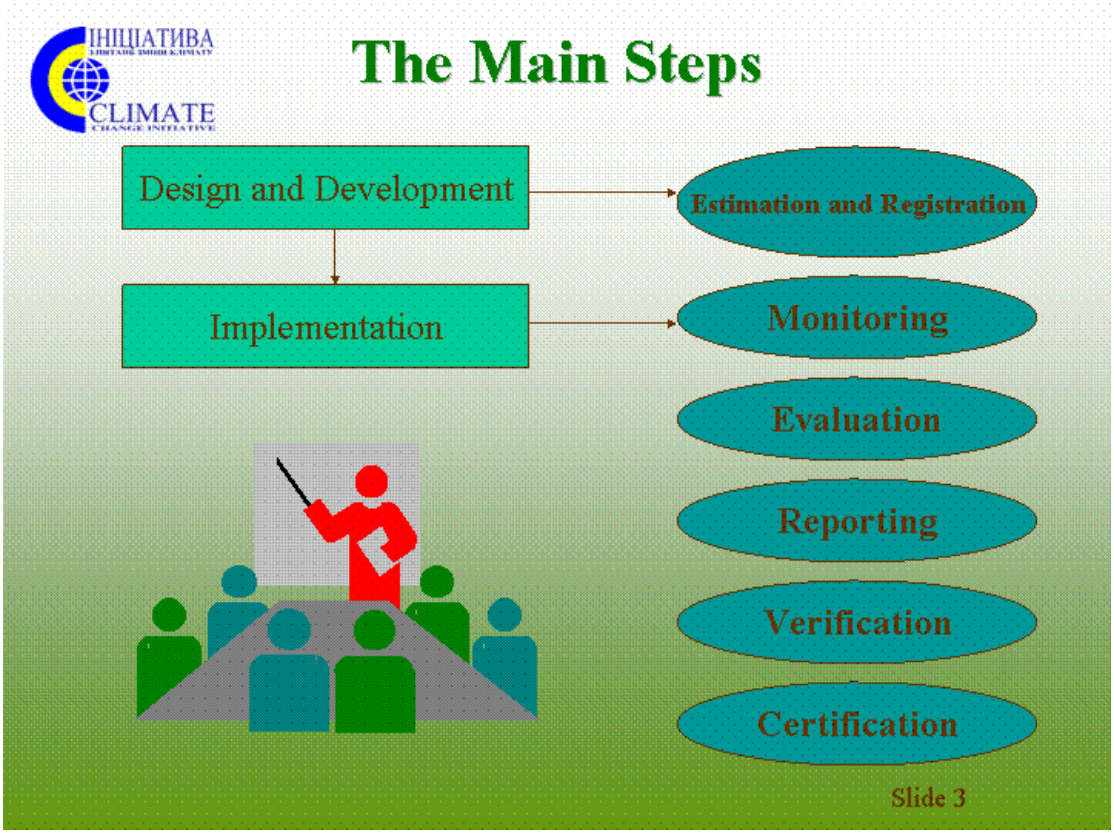
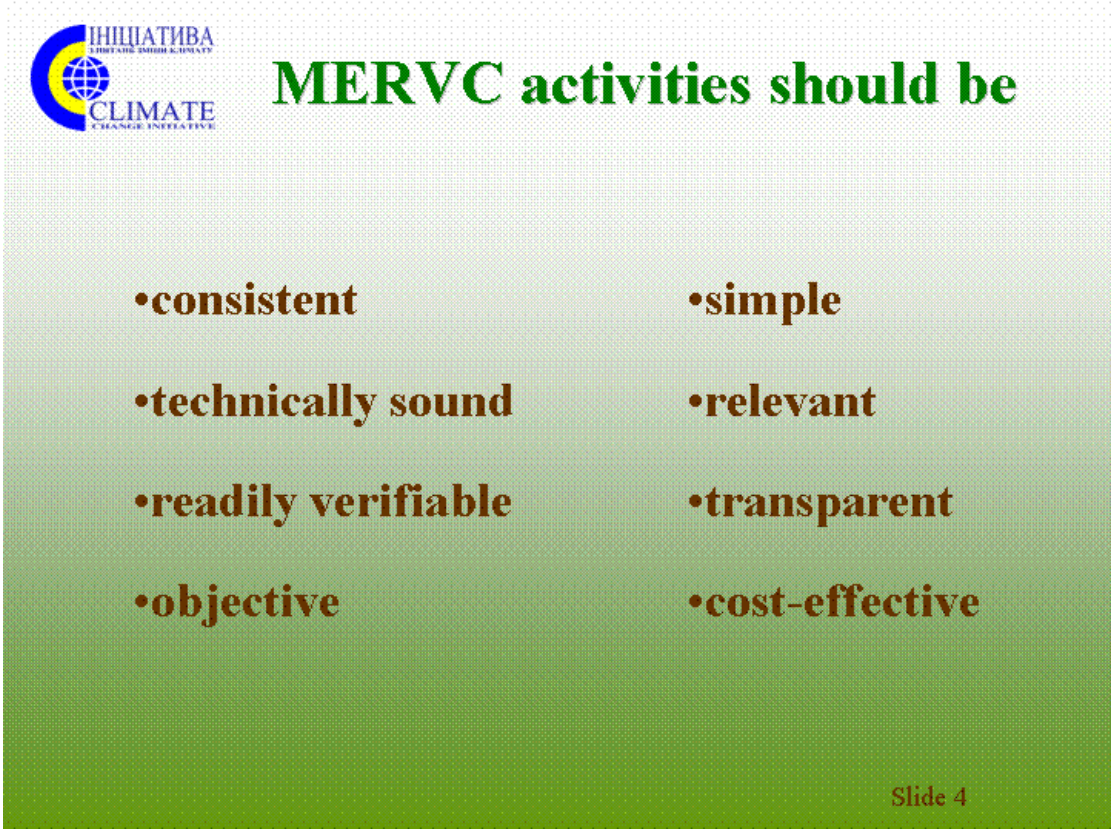

The Main Steps
Design and Development
Implementation
Estimation and Registration
Monitoring
Evaluation
Reporting
Verification
Certification
Slide 3


MERVC activities should be
•consistent
•technically sound
•readily verifiable
•objective
•simple
•relevant
•transparent
•cost-effective
Slide 4

Main Guidelines and Protocols

- U.S. DOE's International Performance Measurement and Verification Protocol (1997)
- U.S. DOE's Voluntary Reporting of Greenhouse Gases (1994)
- USIJI's Project Proposal Guidelines (1996)
- World Bank's Monitoring and Evaluation Guidelines (1994)
- Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification (MERVC) for Climate Change Mitigation (LBNL, 1999)
- UN FCCC Guidelines - COP6 ?????

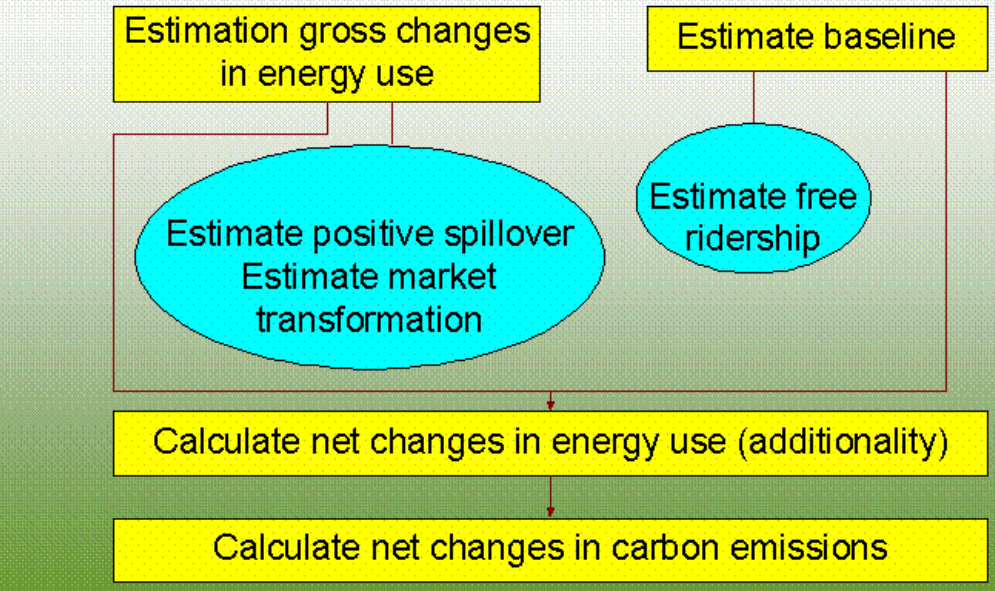
Slide 5

Project Design: Estimation

Estimation refers to making a judgement on the approximate stock of carbon, GHG emissions and costs in the with- and without-project (baseline) scenarios. Estimation can occur throughout the lifetime of the project, but plays a central role during the project design stage when the project proposal is being developed.

Slide 6

Estimation Overview



Slide 7

Project Implementation: Monitoring

Monitoring refers to the measurement of carbon stock, GHG emissions, and costs that occur as a result of the project. Monitoring does not involve the calculation of GHG reductions and does not involve comparisons with previous baseline measurements. Monitoring is often conducted internally, by the project developers.

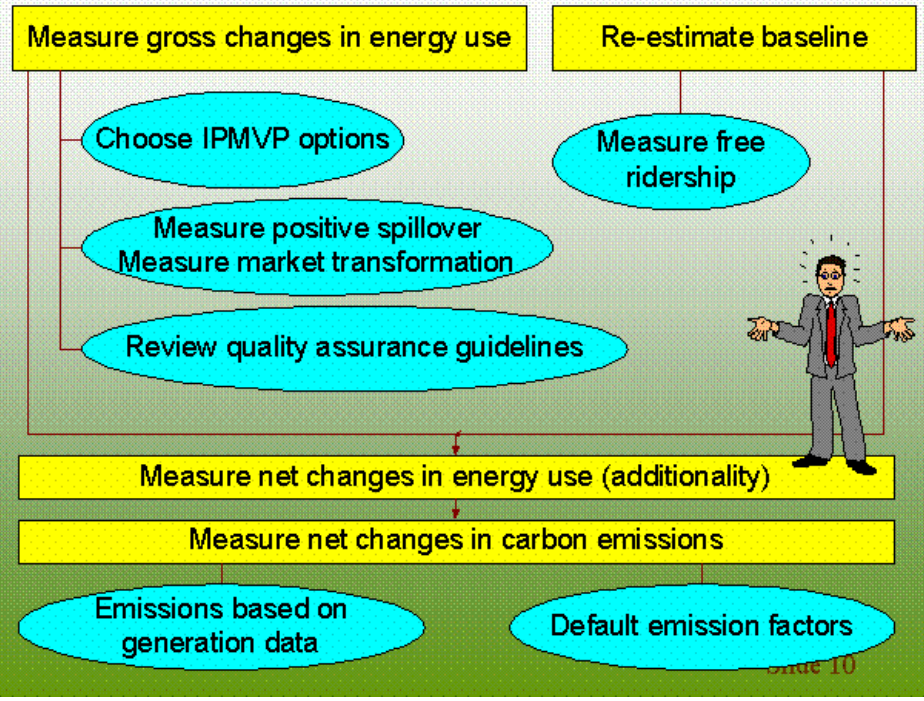
Slide 8

Project Implementation: Evaluation

Evaluation **refers to both impact and process evaluations of a particular project, typically entailing a more in-depth and rigorous analysis of a project compared to monitoring emissions. The calculation of GHG reductions is conducted at this stage. Project evaluation would include GHG impacts, and the re-estimation of the baseline, leakage, positive project spillover, etc., which were estimated during the project design stage. Evaluation organizes and analyzes the information collected by the monitoring procedures, compares this information with information collected in other ways, and presents the resulting analysis of the overall performance of a project.**

Slide 9

Evaluation Overview



Slide 10

Project Implementation: Reporting

Reporting refers to *measured* GHG impacts of the project (in some cases, organizations may report on their *estimated* impacts, prior to project implementation). Reporting occurs throughout the MERVC process (e.g., periodic reporting of monitored results and a final report once the project has ended).

Slide 11

Uniform Reporting Format

- Projected emissions for baseline and project activity scenario
- Cumulative effects for CO_2, CH_4, N_2O, and other GHG
- Environmental and socioeconomic benefits (quantitative and qualitative)
- Compatibility with national economic development, priorities and strategies
- Practical experience gained or technical difficulties, effects, impacts or other obstacles encountered

Slide 12

Project Implementation: Verification

Verification refers to establishing whether the measured GHG reductions actually occurred, similar to an accounting audit performed by an objective, accredited party not directly involved with the project. Verification can occur without certification.

Certification

Certification refers to certifying whether the measured GHG reductions actually occurred. Certification is expected to be the outcome of a verification process. The value-added function of certification is in the transfer of liability/responsibility to the certifier.

Slide 13

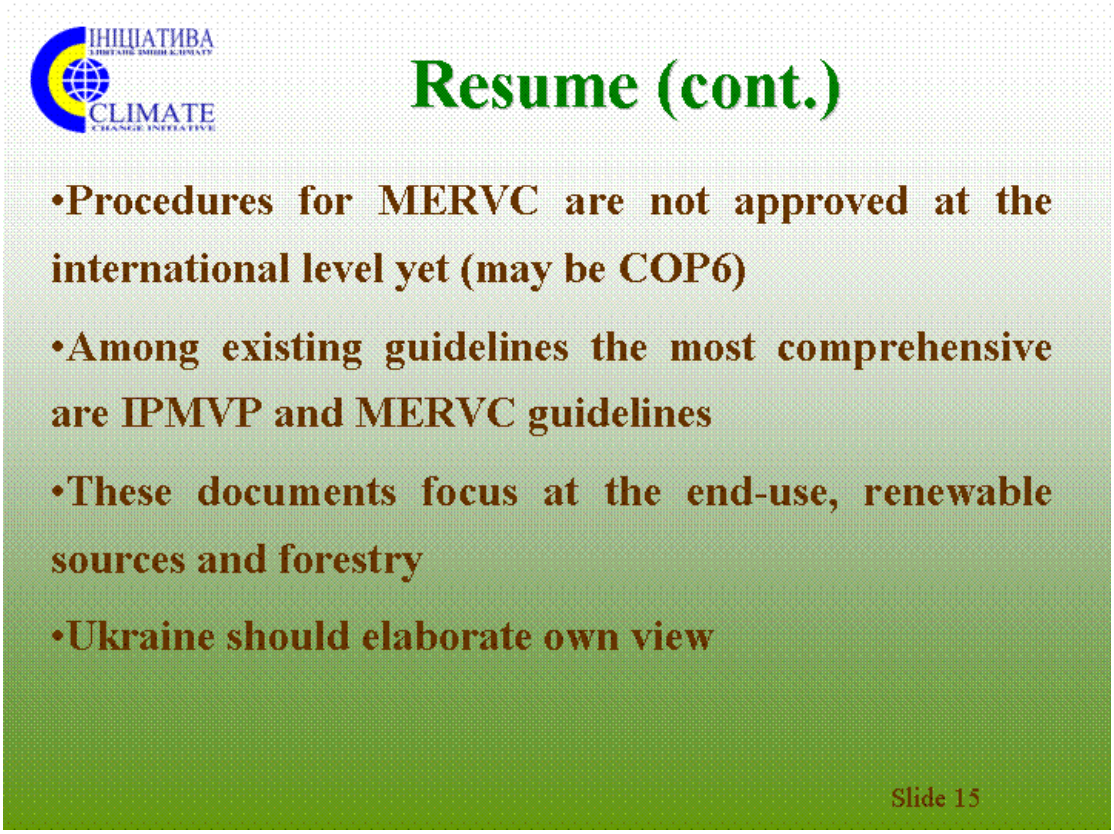
Resume

•Specific features of development and realizing JI projects: Estimation, Monitoring, Evaluation, Reporting, Verification and Certification

•Verification and Certification should be done by the third party

•MERVC activities should be consistent, technically sound, readily verifiable, objective, simple, relevant, transparent, and cost-effective

Slide 14


Resume (cont.)
•Procedures for MERVC are not approved at the international level yet (may be COP6)
•Among existing guidelines the most comprehensive are IPMVP and MERVC guidelines
•These documents focus at the end-use, renewable sources and forestry
•Ukraine should elaborate own view
Slide 15

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 4: Introduction to MERVC (Part II)

Overview

General Objectives:

Session 4 is intended to continue the presentation of basic MERVC issues that was started in the previous session. The session is focused on both providing a conceptual framework for establishing system boundaries and presenting the main issues related to how to incorporate each of the major estimation issues. The basic goals of the session are to:

- Review the monitoring domain (i.e., geographic and temporal aspects of where GHG emissions occur)
- Review the relevance of additionality in a JI context
- Review the basic approaches for establishing a credible baseline
- Discuss how "free riders" can be addressed in a baseline determination
- Address both positive and negative project spillover effects
- Discuss the need to account for how markets can be fundamentally changed

By the end of the session, participants should have a basic understanding of:

- the range of issues that have to be considered when establishing a monitoring domain
- the importance of establishing a credible baseline
- the difference between project spillover and market transformation
- What sorts of monitoring domain issues would be important in the context of JI investments in the Ukrainian energy supply sector

Activities: Presentation, followed by period of questions and answers.

Total Time: 45 minutes.

Materials: Set of 26 OHTs

Introduction to MERVC Issues (Part II)

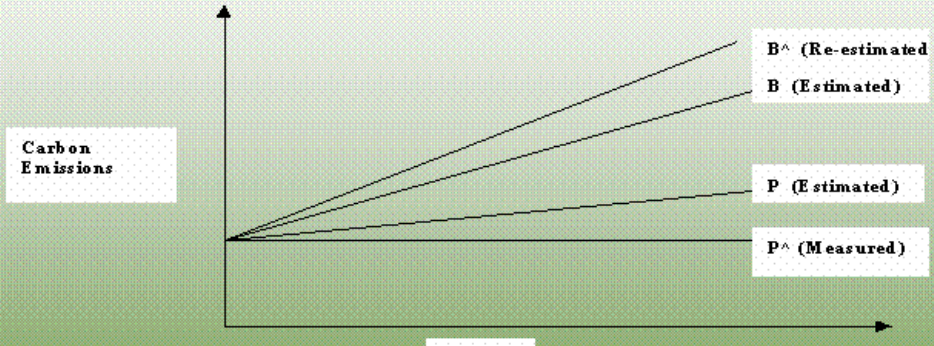
Session 4

Module 6: Training seminar

Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Conceptual Framework



P – B : Estimated net (additional) carbon savings

P^ - B^ : Calculated net (additional) carbon savings (after monitoring and evaluation of energy use)

Slide 2

What is to be Monitored?

Energy production and/or use, GHG emissions, and carbon stocks

- –Protocol: carbon dioxide, methane, nitrous oxide, HFCs, perfluorocarbons and sulfur hexafluoride

• Other environmental impacts

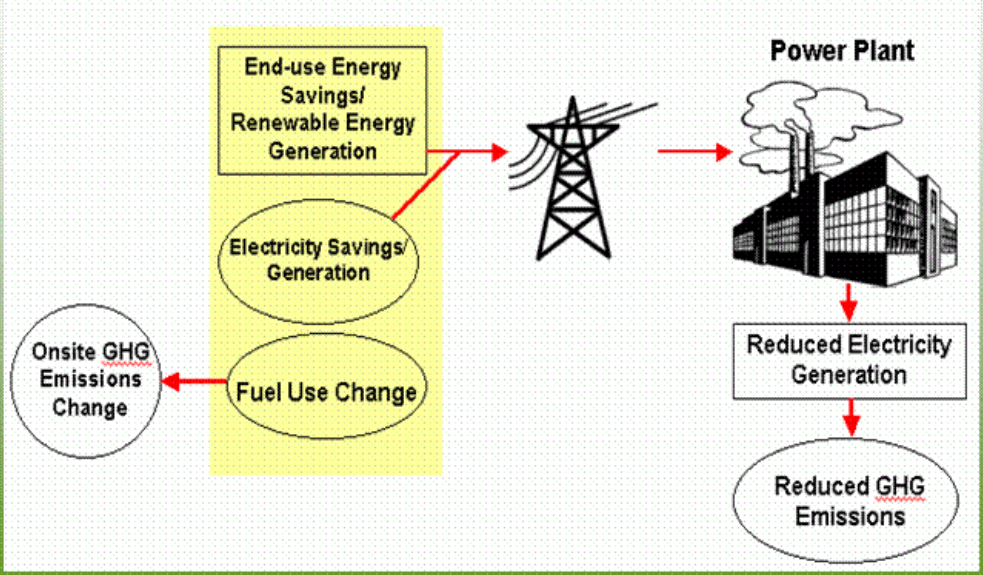
- –Changes in emissions of other gases and particulates, biodiversity, soil conservation, watershed management, sustainable land use, water pollution reduction, and indoor air quality

• Socioeconomic impacts

- –How will project impact stakeholders? What key social issues are likely to affect project performance? What social conflicts exist and how can they be resolved?

Slide 3

On- and Off-site Monitoring of Energy and GHG Flows



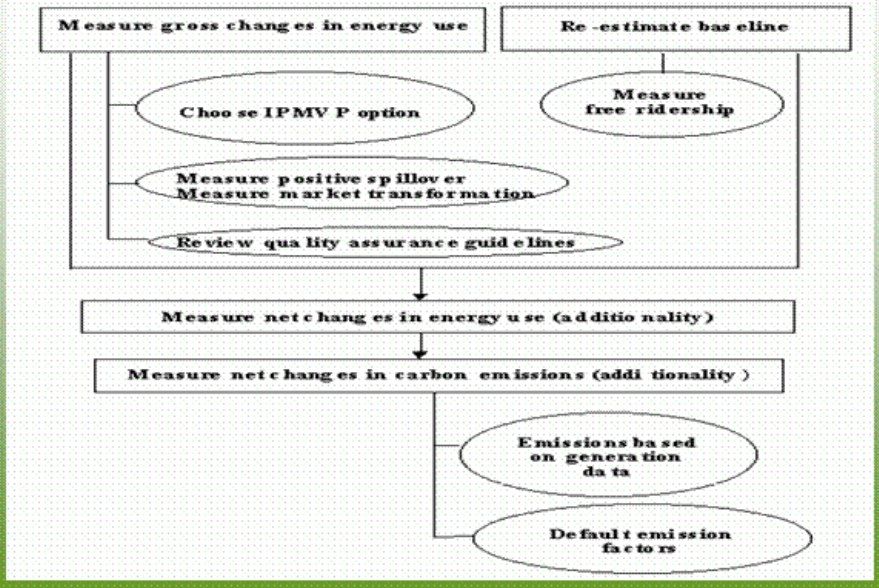
Slide 4

Graphic Of What Is To Be Monitored

- Picture showing energy savings or generation connected to an electricity generation plant
- Need to monitor energy savings and generation on site and emission savings off site
- Other monitoring domain issues: project spillover and market transformation
- Other environmental impacts: on and off site
- Socioeconomic impacts: mostly on site

Slide 5

Evaluation Overview



Slide 6

MERVC Issues

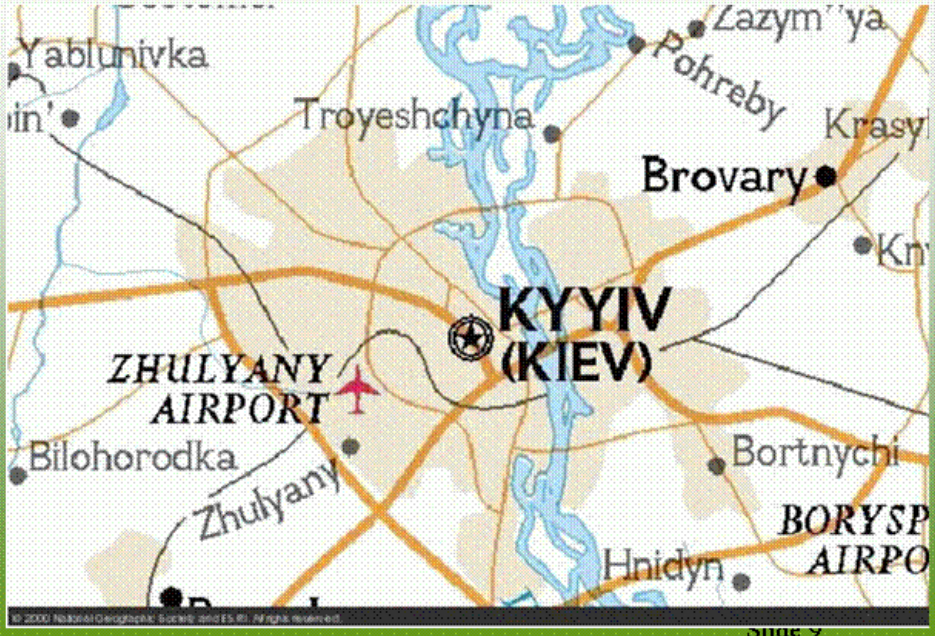
- Monitoring domain
- Additionality
- Baseline
- Free riders
- Positive project spillover
- Market transformation

Slide 7

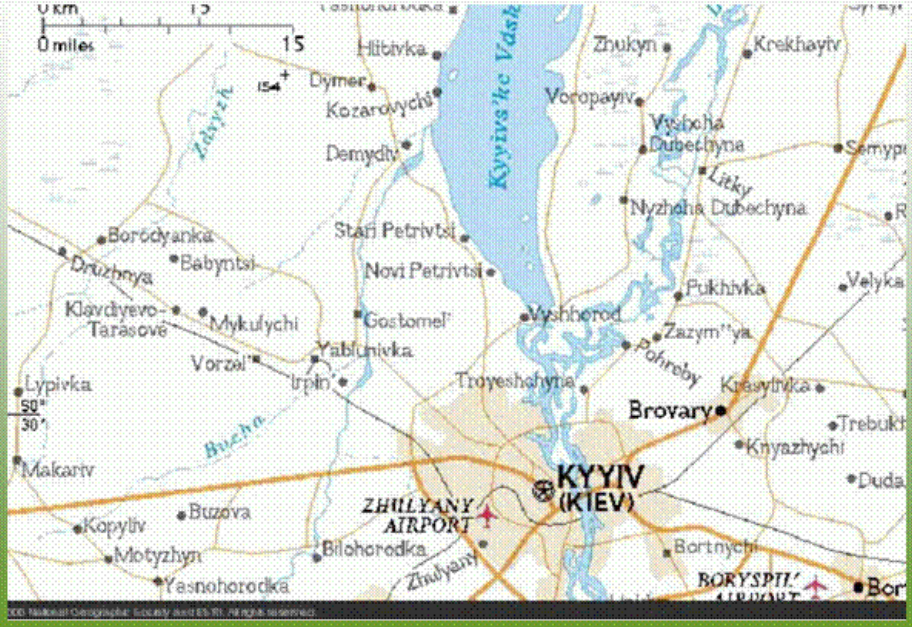
Monitoring Domain

- Geographic extent of project's direct impacts
  - Local versus regional impacts
- Temporal impacts
  - Energy projects: point of production, transmission, or end use
- Coverage of positive project spillover and market transformation
- Widening the system boundary
  - Greater MERVC costs
  - Tertiary and less direct effects included

Slide 8



Slide 9



Slide 10

Slide 11

Slide 12

Additionality

- Joint Implementation and CDM:
  - Emission reductions must be "additional to any that would otherwise occur" ["additionality criteria"] ["net emissions"]
- Determining additionality requires a baseline
- Financial additionality
  - Would the expenditures have been made without the project?
    - Sources of funding
    - Alternative uses of funding
    - Motivation for selecting project

Slide 13

Four Key Energy Estimation Issues

- Estimating the baseline
- Free riders
- [Positive project spillover]
  - Unintended consequence, unless project targets spillover
- [Market transformation]
  - Unintended consequence, unless project targets market transformation

Slide 14

Estimating a Credible Baseline

- Context:
  - Additionality criteria
  - What would have happened in the absence of a particular project? [counter-factual question]
  - Baselines must be credible and realistic to prevent/mitigate cheating
- Reference case
- Need to account, if possible, for growth, technological changes, input prices, product prices, policy or regulatory shifts, social and population pressure, market barriers, and other exogenous factors

Slide 15

Estimating Free Riders

- Activities are undertaken by participant(s) who would have conducted the same activities if there had been no project
- Savings from free riders are not "additional" to what would otherwise have occurred

Slide 16

Performance Benchmarks

- Concerns about arduous project-by-project review
- Approaches:
  - Reference or default baseline: an extension of existing technology, versus
  - Representing the high performance end (a goal to be achieved)
  - Region by project matrix

Slide 17

Four Key Energy Evaluation Issues

- Re-estimating the baseline
- Free riders
- Positive project spillover
- Market transformation

Slide 18

Re-estimating the Baseline

- Baseline is re-estimated based on M&E data
- Existing technologies and practices identified
- Full year of monitoring (exceptions)
- Account for free riders

Slide 19

Evaluation of Free Riders

- Evaluated either:
  - Explicitly
    - Interviews
    - Discrete choice models (yes/no decision to implement measure)
  - Implicitly
    - Utility bill analysis
- EPA's CVP: higher share of savings for more rigorous analysis of free riders (otherwise, net energy savings = 50% of 1st year savings)

Slide 20

Positive Project Spillover (1)

- Reflects savings from participants, additional to project design
- Reflects savings from nonparticipants
- Channels:
  - Individuals hear about project measures from project participants
  - Project participants undertake additional measures based on positive experience with project
  - Manufacturers change the efficiency or other characteristics of their products

Slide 21

Positive Project Spillover (2)

- Channels Cont'd.:
  - Retailers change the composition of their inventories
  - Governments adopt new building codes, appliance standards, forestry policies and legislation
  - Technology transfer efforts
- Evaluation methods are similar to those used in evaluating free riders

Slide 22

Market Transformation

- "The reduction in market barriers due to a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced or changed."
- Change is lasting, or at least that it will last after the project is scaled back or discontinued
  - Differentiates project spillover from market transformation

Slide 23

Market Transformation - Market Barriers

- Information or search costs
- Performance uncertainties
- Asymmetric information and opportunism
- Hassle or transaction costs
- Hidden costs
- Access to financing
- Bounded rationality
- Organization practices or customs
- Misplaced or split incentives
- Product or service unavailability
- Externalities
- Nonexternality mispricing
- Inseparability of product features
- Irreversibility

Slide 24

Market Transformation - Market Effects

- **Customers**
- Changes in purchasing energy-efficiency behaviour due to changes in: awareness, attitudes, knowledge, and decision making processes
- **Other Businesses**
- Changes in promotional practices (all)
- Changes in business strategies (all)
- Changes in service offerings (all)
- Changes in stocking and distribution practices (retail providers & wholesale distributors)
- Changes in design practices (design professionals)

Slide 25

Market Transformation - Market Effects (cont.)

- **Manufacturers**
- Changes in product quality
- Development of new products
- Redesign of existing products
- Changes in promotion
- Changes in prices offered to retailers
- **Government**
- Changes in codes, standards, or regulations

Slide 26


ІНІЦІАТИВА
CLIMATE
Evaluation of Market Transformation
• Evaluation focuses on market effects and activities include:
– Measuring the market baseline
– Tracking attitudes and values
– Tracking sales
– Modeling of market processes
– Assessing the persistence of market changes
Slide 27

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 5: Application of MERVC Issues to Energy Supply Projects

Overview

General Objectives:

Session 5 is intended to explore MERVC issues as they apply to energy supply projects. The session is heavily focused on an informal question and answer format design to draw out participant perspectives on the unique challenges and issues related to monitoring and evaluation in the context of the electric supply sector in Ukraine. The basic goals of the session are to:

- Review the needs of monitoring and evaluation in the energy supply sector
- Explain how other countries are monitoring and evaluating emissions in the energy supply sector

By the end of the session, participants should have a basic understanding of:

- the type of monitoring and evaluation needed in the energy supply sector

Activities: Informal large group discussion.

Total Time: 45 minutes.

Materials: Set of 3 OHTs.

Application of MERVC Issues to Energy Supply Projects

Session 5

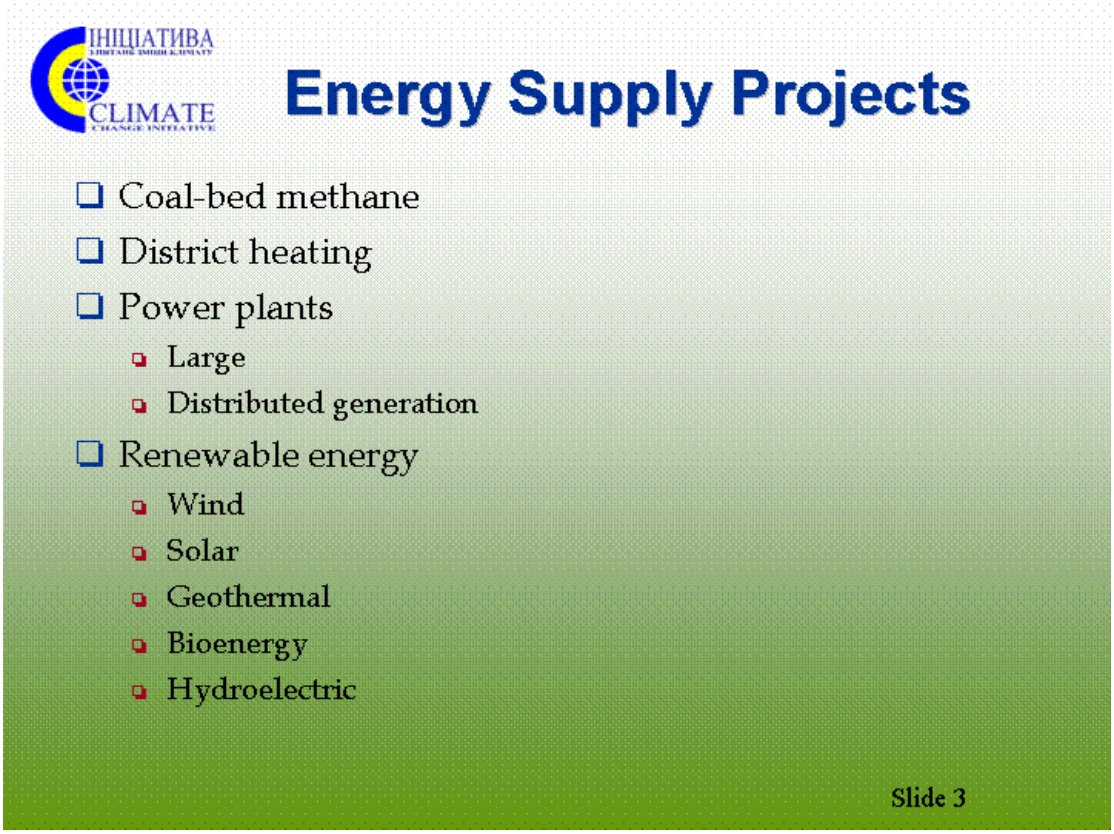
Module 6: Training seminar
Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

MERVC Issues

- Monitoring domain
- Additionality
- Baseline
- Free riders
- Positive project spillover
- Market transformation

Slide 2


Energy Supply Projects
Coal-bed methane
District heating
Power plants
Large
Distributed generation
Renewable energy
Wind
Solar
Geothermal
Bioenergy
Hydroelectric
Slide 3

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 6: Overview of Estimation Issues

Overview

General Objectives:

Session 6 is intended to give a broad overview of the estimation issues associated with the development of emission baselines for greenhouse gases from Joint Implementation projects. Various topics are addressed as follows:

- motivation, goals and steps involved in establishing emission baselines;
- Review of key issues affecting estimation such as establishing a project boundaries, free riders, program spillover, and market transformation
- Approaches to estimating avoided emission from electric supply projects and energy demand projects

By the end of the session, participants should have a basic understanding of:

- The range of issues that need to be addressed is establishing credible baselines
- The relevance of credible baseline determination to the emission reduction certification process

Activities:

Presentation, followed by period of questions and answers.

Total Time:

45 minutes.

Materials:

Set of 27 OHTs.

Overview of Estimation Issues

Session 6

Module 6: Training seminar
Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Why Estimate GHG Impacts of Energy Projects?

- JI projects
  - Gain understanding of amount of carbon credits a project may yield, which could help attract investors
- Other energy sector projects or policies
  - Government and/or outside investors may want to know GHG impacts of projects or policies
    - Annex 1 countries have emissions commitments to consider
    - Outside investors may want to consider GHG impacts in making loan decisions (e.g., World Bank)

Slide 2

Estimation of GHG Impacts: Bad News and Good News

- Bad news:
  - Project performance is uncertain
  - Projecting a baseline into the future is uncertain
- Good news:
  - Converting impacts on fossil fuel use into GHG impacts is relatively simple
  - Being somewhat wrong may not be critical - depends on investors and management of risk
    - Carbon credits will likely be granted retrospectively
    - Carbon credits not likely to be a major source of revenue

Slide 3

Estimation of GHG Impacts: The Basics

- Basic goal:
  - Estimate difference between GHG emissions with the project and without the project (the baseline) -- "emissions additionality"
- Need to consider:
  - On-site impacts
  - Off-site impacts (if significant)
- Need to estimate:
  - Performance of project over project life
  - Evolution of baseline over project life
    - On-site and off-site

Slide 4

Estimation of GHG Impacts: Type of Project

- One or a few sites
  - Installation occurs within short time period
  - Technology unit size is large
    - Examples: retrofit of power plant or district heating system
- Many sites
  - Installation may occur over several years
  - Technology unit size is small
    - Examples: appliances, industrial equipment
  - Need to describe typical application(s)

Slide 5

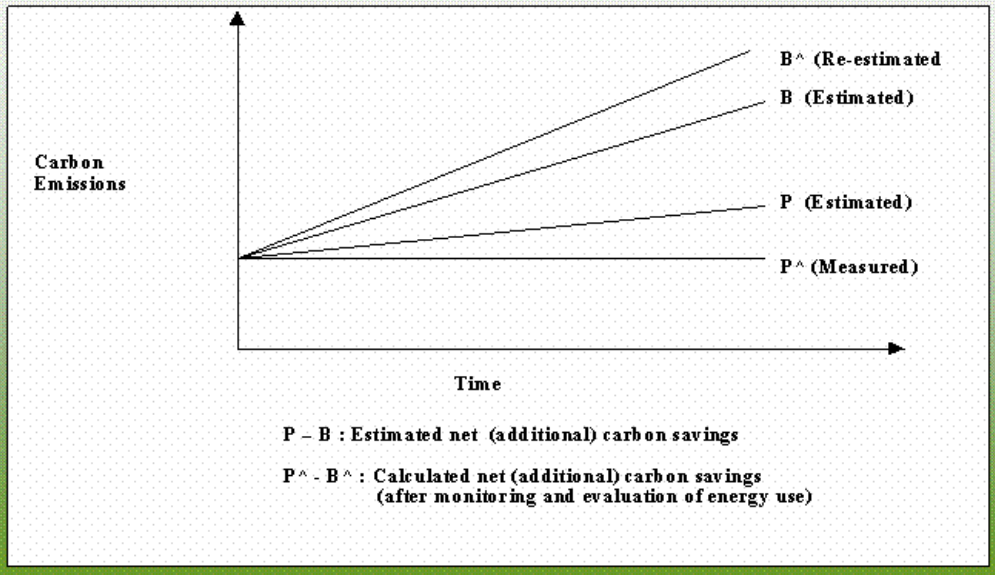
Estimation of GHG Impacts: Defining Project Boundaries

Off-site impacts are often important for:

- Electricity supply or conservation projects
- District heat supply or conservation projects
- Biomass supply or conservation projects
- Fuel switching to natural gas projects

Slide 6

Conceptual Framework

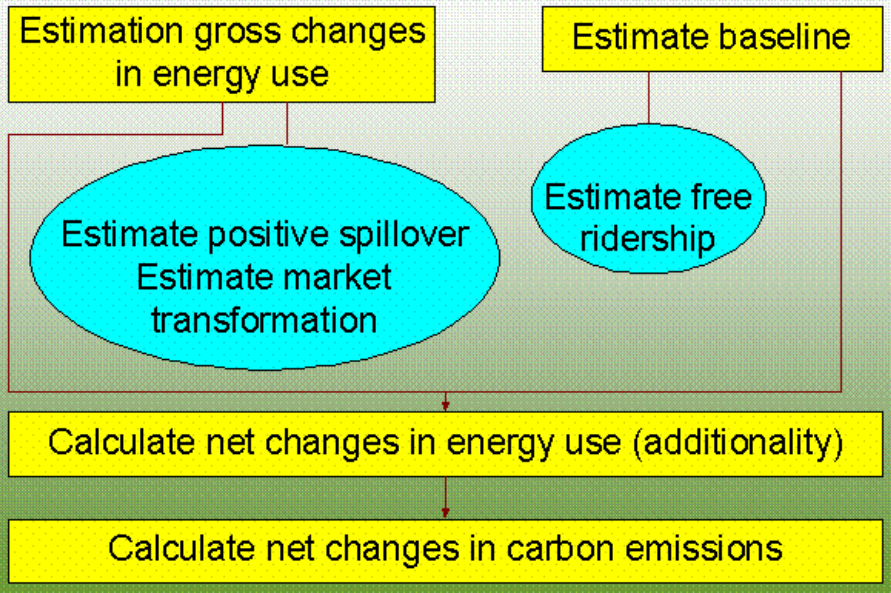


P – B : Estimated net (additional) carbon savings

P^ - B^ : Calculated net (additional) carbon savings (after monitoring and evaluation of energy use)

Slide 7

Estimation Overview



Slide 8

Four Key Energy Estimation Issues

- Estimating the baseline [focus of this session]
- Free riders [difficult to estimate but not impossible]
- [Positive project spillover]
  - Unintended consequence, unless project targets spillover
- [Market transformation]
  - Unintended consequence, unless project targets market transformation

Slide 9

Estimating a Credible Baseline

- Context:
  - Additionality criteria
  - What would have happened in the absence of a particular project? [counter-factual question]
  - Baselines must be credible and realistic to prevent/mitigate cheating
- Reference case
- Need to account, if possible, for growth, technological changes, input prices, product prices, policy or regulatory shifts, social and population pressure, market barriers, and other exogenous factors

Slide 10

Setting a Baseline

- On-site: easier than you think!
  - For retrofit projects: based on existing condition
    - Examples: a power plant or a steel mill
  - For new applications: based on current market behavior
    - Examples: appliances, industrial equipment
- Off-site: can be a challenge
  - Electricity and district heat production: What kind of production technology will be affected by the project?
  - Natural gas supply network: Will project increase fugitive methane emissions?

Slide 11

Setting a Baseline: Activity Level

- Activity refers to utilization of the technology
  - Examples:
    - Industry: tons of production
    - Households: varies with type of technology
    - Commercial buildings: floor area
- Guidance: Use current activity level if it is similar to the level expected over project lifetime

Slide 12

Performance Benchmarks

- Concerns about arduous project-by-project review
- Approaches:
  - Reference or default baseline: an extension of existing technology, versus
  - Representing the high performance end (a goal to be achieved)
  - Region by project matrix

Slide 13

JI Projects: Who Sets the Baseline? (1)

- "Benchmark" approach -- one size fits all!
  - Set by some "official" entity for a given country
  - Perhaps by host country government, using guidance from an international agency
  - Project sponsor simply uses the specified benchmark that is appropriate for the project
    - Example: tC/MWh of avoided electricity generation

Slide 14

JI Projects: Who Sets the Baseline? (2)

- "Project-by-project" approach - tailored to fit each case
  - Project sponsor makes the decisions, using guidance
- "Mixed" approach
  - Project-specific for on-site baseline
  - Benchmark for off-site baseline

Slide 15

Setting a Baseline: Static over Time vs. Changing Over Time

- Electricity system features may change
  - Mix of generation sources
- Off-grid conditions might change
  - Example: A city might install meters in apartments
- Rules for JI project baselines are not yet clear
- Seems prudent to account for expected changes in baseline
  - But precision is not necessary

Slide 16

What About Free Riders, Program Spillover and Market Transformation?

- Program free riders are implicitly accounted for by making a realistic assessment of the market
  - Design program to minimize free riders
- Program spillover and market transformation are worth considering qualitatively
  - Eligibility for carbon credits is uncertain
  - But may be important to gaining approval of project
    - Should be a key issue for host country government

Slide 17

Estimating Avoided GHG Emissions for an Electricity System: Approaches

- Average GHG emissions per kWh for the entire system
  - Simple, but not very realistic
- GHG emissions per kWh from new generation
  - Single type or average of new sources
  - Fairly simple, but not very realistic
- GHG emissions avoided at the margin for the system
  - Harder to do, but most realistic
- Need to forecast over project lifetime

Slide 18

Estimating Avoided GHG Emissions for an Electricity System: Methods

- "Good guess" approach
  - May be adequate if system is not too complex
  - Use own judgement or consult with utility company
- Avoided Carbon Factor (estimated by an official entity)
  - tC/MWh avoided
- Benchmark technology (established by an official entity)
  - Example: natural gas combined cycle @ 45% efficiency

Slide 19

Estimating Avoided GHG Emissions for an Electricity System: Issues of Timing (1)

- Supply or savings from project may fluctuate by season
  - Example: mini-hydro that has more production in wet season
  - Example: coal supply might be more available during summer and less available in winter

Slide 20

Estimating Avoided GHG Emissions for an Electricity System: Issues of Timing (2)

- Supply or savings from project may fluctuate by time of day
  - Example: load reduction from residential lighting efficiency is concentrated in the evening
- Consider timing issues only if it makes a significant difference
  - If the generation mix of the electricity system has considerable temporal fluctuation

Slide 21

Energy Conservation: Electricity from the Grid (1)

- Examples:
  - Commercial building electric efficiency improvement
  - Residential lighting efficiency improvement (e.g., CFLs)
- Establish baseline for project site(s)
  - Site-specific: based on metered electricity consumption for a typical period
  - Generic technology: based on typical technology use
    - May require a survey of users
- Estimate project performance
  - Site-specific: usually based on energy audit
  - Generic technology: based on engineering estimates

Slide 22

Energy Conservation: Electricity from the Grid (2)

- Estimate avoided electricity generation
  - Need to consider avoided T&D losses:
    - Avoided electricity generation = End-use savings/T&D loss %

Slide 23

Energy Conservation: District Heat (1)

- Establish baseline for project site(s)
  - Few sites: based on metered heat consumption
  - Many sites: based on metered or calculated heat consumption
- Estimate project performance
  - Few sites: typically based on energy audit
  - Many sites: based on engineering estimates

Slide 24

Energy Conservation: District Heat (2)

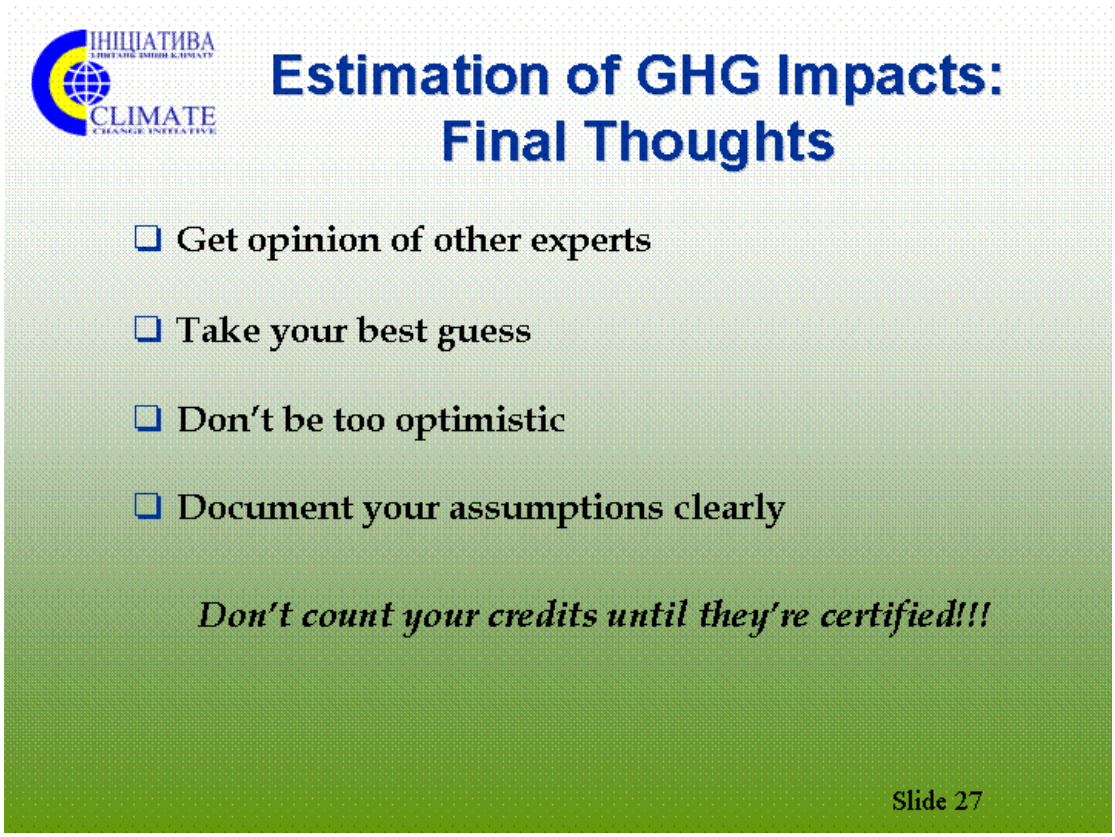
- Estimate avoided fuel inputs for district heat production
  - Need to consider avoided T&D losses:
    - Avoided heat production = End-use savings/T&D loss %
  - If heat is from a large network, estimation requires similar methods as for electricity generation

Slide 25

Energy Conservation: On-Site Fossil Fuel

- Examples:
  - Industrial energy efficiency improvement (single site)
  - Industrial boiler efficiency improvement (multiple installations)
- Establish baseline for project site(s)
  - Site-specific: based on measured fuel consumption
  - Generic technology: based on typical technology in use
- Estimate project performance
  - Site-specific:typically based on energy audit
  - Generic technology: based on engineering estimates

Slide 26


Estimation of GHG Impacts:
Final Thoughts
Get opinion of other experts
Take your best guess
Don't be too optimistic
Document your assumptions clearly
Don't count your credits until they're certified!!!
Slide 27

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 7: Overview of Monitoring and Evaluation

Overview

General Objectives:

Session 7 is intended to review the framework for developing an monitoring and evaluation framework for greenhouse gas emission from JI projects. The various elements of an evaluation are discussed, together with a discussion of the data collection, analysis, and management aspects. Specifically, the basic goals of the session are to:

- Explain the context and types of monitoring and evaluations that an be conducted
- Define the essential elements in an evaluation.
- Review sampling development, techniques, and documentation
- Review the role of uncertainty

By the end of the session, participants should have a basic understanding of:

- The essential elements of a monitoring and evaluation program
- The need and steps involved in developing a monitoring and evaluation plan

Activities:

Presentation, followed by period of questions and answers.

Total Time:

45 minutes.

Materials:

Set of 24 OHTs.

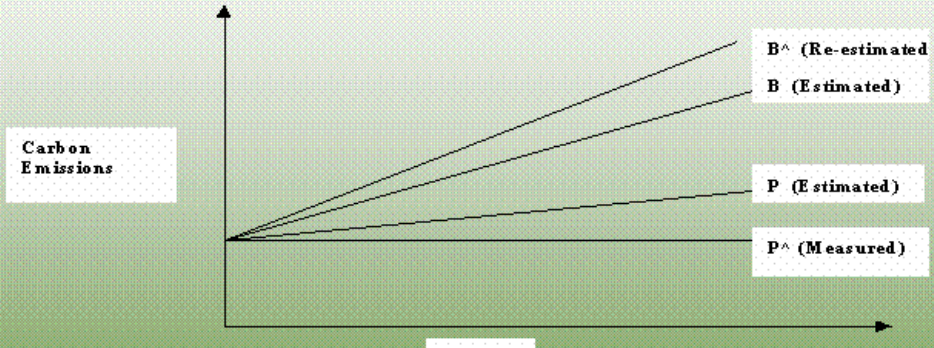
Overview of Monitoring and Evaluation

Session 7

Module 6: Training seminar
Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

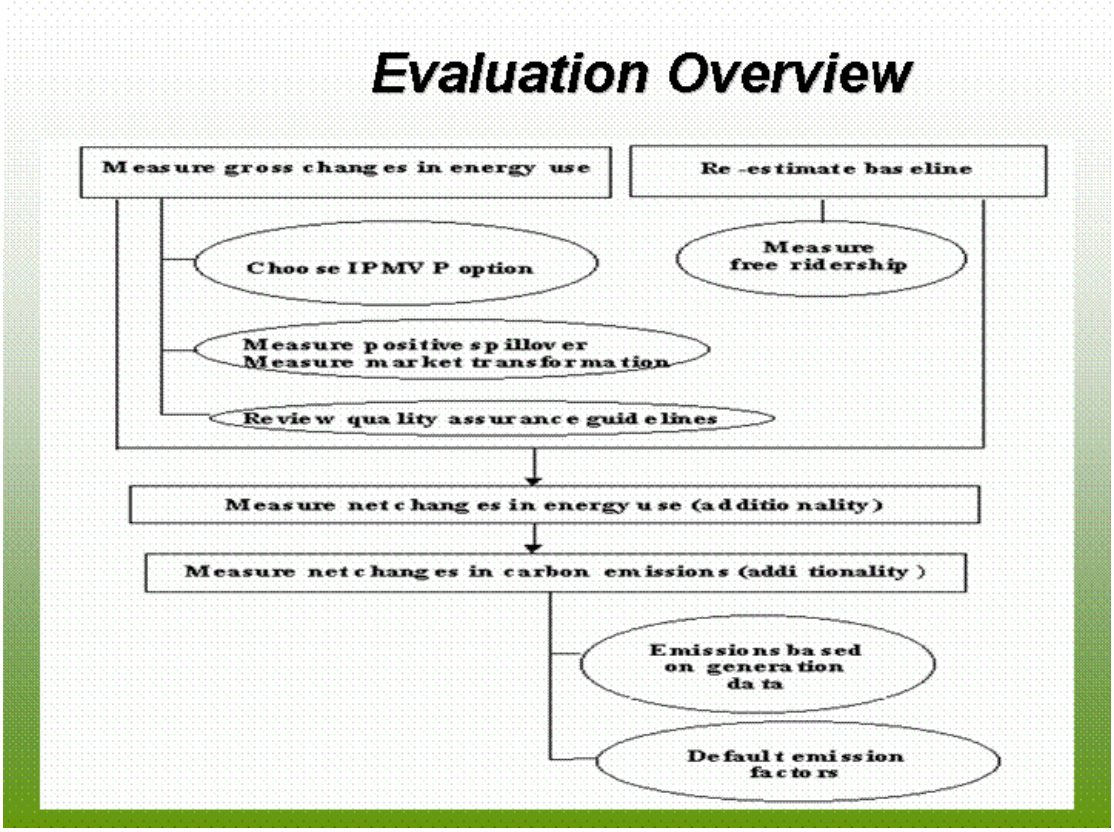
Conceptual Framework

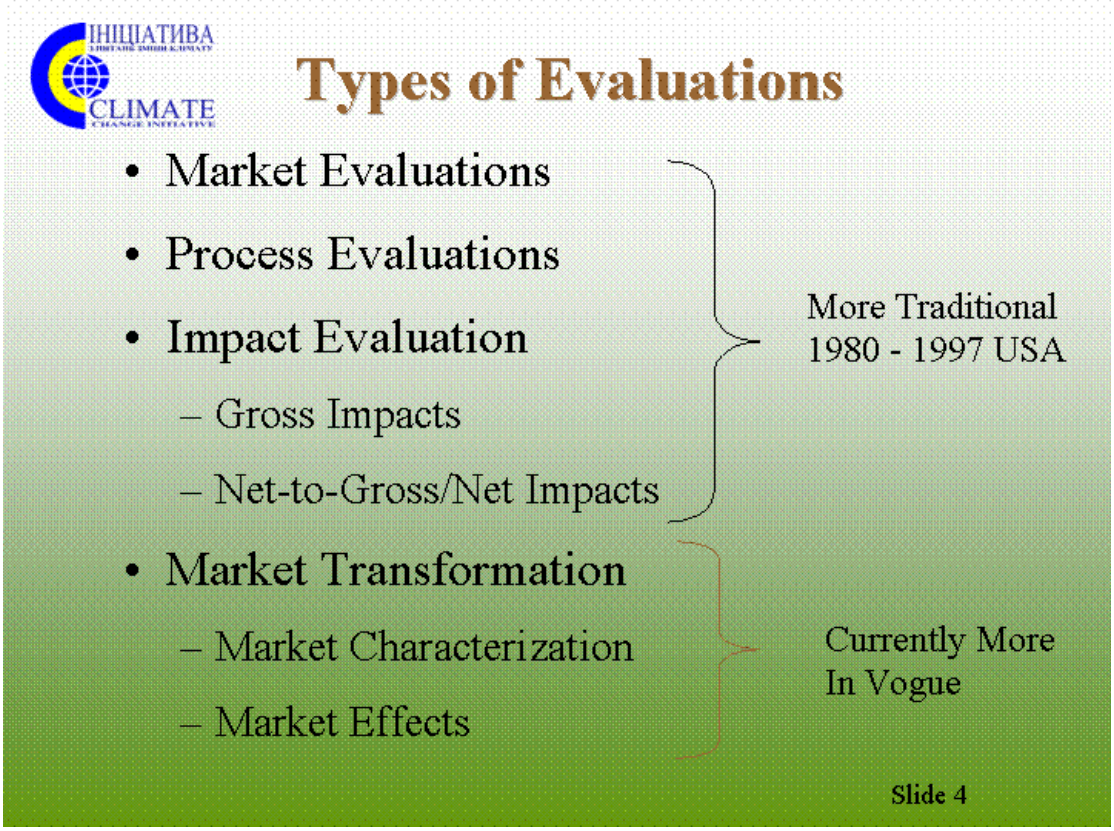


P – B : Estimated net (additional) carbon savings

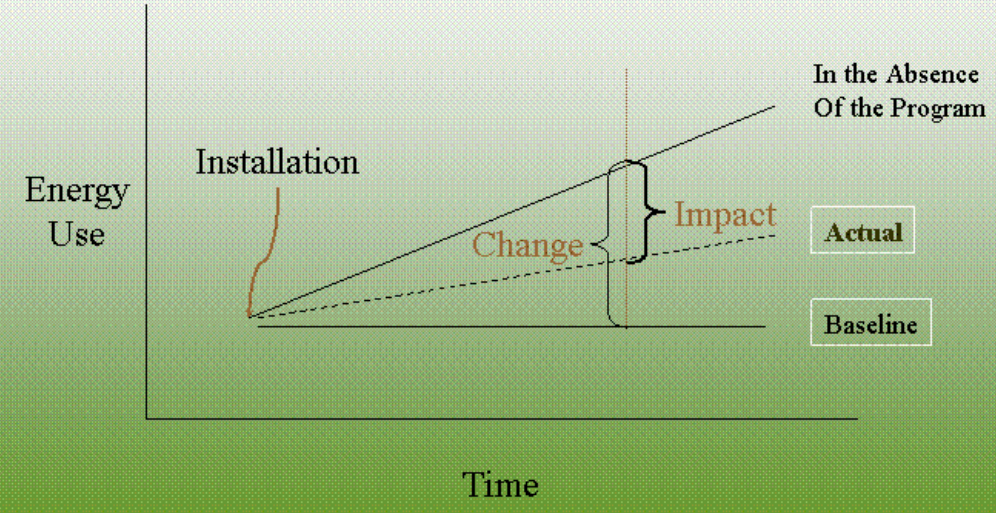
P^ - B^ : Calculated net (additional) carbon savings (after monitoring and evaluation of energy use)

Slide 2


Evaluation Overview
Measure gross changes in energy use
Re-estimate baseline
Choose IPMVP option
Measure free ridership
Measure positive spillover
Measure market transformation
Review quality assurance guidelines
Measure net changes in energy use (additionality)
Measure net changes in carbon emissions (additionality)
Emissions based on generation data
Default emission factors


Types of Evaluations
• Market Evaluations
• Process Evaluations
• Impact Evaluation
– Gross Impacts
– Net-to-Gross/Net Impacts
• Market Transformation
– Market Characterization
– Market Effects
More Traditional
1980 - 1997 USA
Currently More
In Vogue
Slide 4

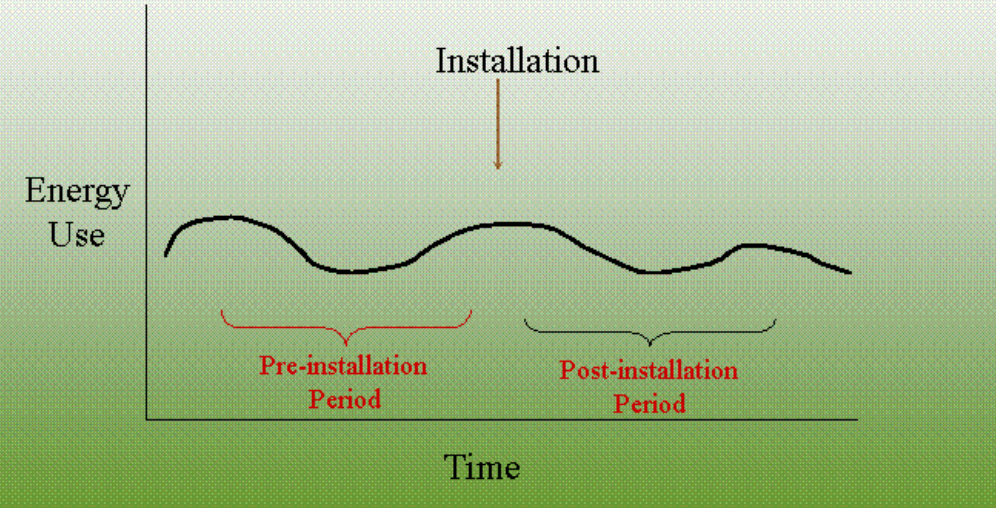
Change vs. Impact



Slide 5

When Do You Evaluate?

(Impact Evaluations Only)



Slide 6

Types of Impact Evaluations

Number of Sites for Evaluation	Type of Evaluation Possible	
	Engineering Analysis	Statistical Analysis
Single	X	
Small (2-30 buildings)	X	
Medium (30-75 buildings	X	X
Large (>75 buildings)	X	X

Slide 7

Elements of an Evaluation

Evaluation Elements	Single Site	All Others
Project Initiation Meeting	X	X
Research Plan	?	X
Sample Development	?	X
Pre-test & Instrument Finalization	X	X
Data Collection	X	X
Data Analysis	X	X
Draft Report	X	X
Final Report	X	X
Verification	X	X
Project Management	X	X

Slide 8

Project Initiation Meeting Purposes

- Review program participation and evaluation segmentation (if data is available).
- Review evaluation objectives
- Identify existing data available for use in evaluation & planned additional data gathering
- Review gross evaluation approach
- Discuss strategy for any deviations from regulations
- Review evaluation schedule
- **Establish a working rapport with the evaluation and program staff**

Slide 9

Elements of a Research Plan

Large	Small
Introduction and Review of Issues	Same
Evaluation Methodology	-
Evaluation Data Sources	Data Sources
Sampling Plan	
Data Collection Plan	
Analysis Plan	Analysis Approach
Detailed Outline of Evaluation Reports	Same
Detailed Work Plan, Budget, and Schedule	Same
Project Management Plan	Same
Appendices	Same
Data Collection Instruments	Same
Initial Data Collection Sample	Same
Sources and Uses Chart	Same

Slide 10

Sample Development

- Participant sampling
  - No sample - single site
  - Census sample - small/medium projects
  - Sample frame - medium/large projects
- Measure sampling
- Improper sampling can invalidate results
- Clear documentation of sample attrition

Slide 11

Purpose of Pre-testing

- Obtain feedback from the survey instrument(s) so the evaluator is sure that the information being collected is sufficient and what is expected.
- Small number of sites for pre-tests.
- Allows the client to listen to the survey responses and get a "feel" for the survey.

Slide 12

Essential Elements of Data Collection

- Clean sample data sets
- Tracking sample
- Training of data collection team
- Tracking progress
- Real time checking of data
- Documentation of data sets
- Bringing to completion (what is completion?)
  - Asymptotic towards end of sample, cost may not be worth the effort)

Slide 13

Good Project Management Practices

- Real Estate is:

  Location, Location, and Location.

- Project Management is:

  Communication,

  Communication,

  and

  Communication

Slide 14

Good Project Management Practices

- Monthly written progress summaries stating:
  - Progress during the month,
  - Planned progress during the next month,
  - Issues requiring attention/resolution (by who) that could impair progress,
- Monthly invoices that reconcile to the work performed in the written progress summary.
- Periodic (weekly or bi-weekly) telephone status discussions with reports on progress and issue resolution.

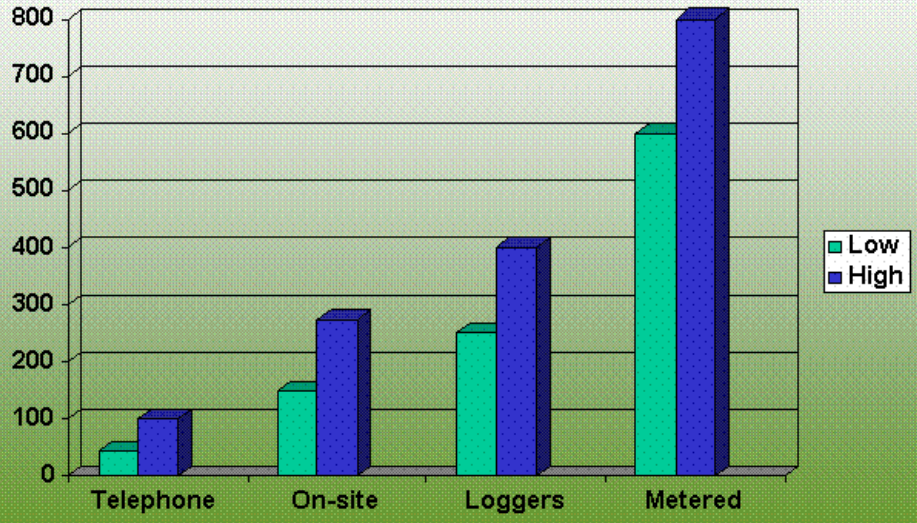
Slide 15

Words of Wisdom on Project Management

- Don't hesitate to fund it. It is what makes the rest of the project operate at maximum efficiency. Typically 7.5% to 10% of project.
- Be sure that you are personally comfortable with the Evaluation Team project manager. He/she is your primary contact with the project.
- Be sure project has adequate calendar time. Stress for the contractor = stress + $ for you.
- Stay in touch with the project. Track its timeliness and budget performance.

Slide 16

Relative Costs of Data Collection
(per point)



Slide 17

Uncertainty

- Uncertainties in measurement of GHG reductions
  - Use of simplified representations with averaged values (e.g., emission factors)
  - Uncertainty in the scientific understanding of the basic processes leading to emissions and removals
  - Uncertainty in measuring items that cannot be directly measured (e.g., project baselines)
  - Vary by project type and length of project
- Other types of uncertainty:
  - Project development and construction uncertainty
  - Operations and performance uncertainty
  - Environmental uncertainty
  - Stability of political and social conditions

Slide 18

Precision

Evaluators need to report the precision of their estimates:

- Quantitatively (standard deviation around mean, or confidence intervals around mean estimates)

Or

- Qualitatively (low, medium, high)

Slide 19

Evaluation of Uncertainty

- Evaluate the project's contingency plan
- Identify and discuss key uncertainties affecting all emission estimates
- Assess the possibility of local or regional political and economic instability and how this may affect project performance
- Provide confidence intervals around mean estimates

Slide 20

Frequency and Duration of Monitoring and Evaluation

- Frequency of monitoring and evaluation will be linked to schedule of payments for carbon credits
- Monitoring period may last longer than project period
- Persistence of energy savings is critical and needs to be encouraged
  - Institutional (community participation)
  - Technical (operations and maintenance, spare parts, technical expertise)
  - Contracts (provisions for debiting if project does not last)

Slide 21

U.S. Environmental Protection Agency (EPA) - Conservation Verification Protocols

- Designed to verify electricity savings from utility demand-side management (DSM) programs for the purpose of awarding sulfur dioxide allowances under EPA's Acid Rain Program
- Options for promoting the persistence of savings
  - Monitoring
  - Default
  - Inspection

Slide 22

Options for promoting the persistence of savings

Monitoring option

By monitoring over the life of the measure, one obtains credit for a greater fraction of the savings and for a longer period of time. Biennial verification in subsequent years 1 and 3 (including inspection) is required, and savings for the remainder of physical lifetimes are the average of the last two measurements. The monitoring option requires a 75% confidence in subsequent-year savings.

Default option

By relying on default (stipulated) savings, allowable savings are restricted: credit is only for 50% of first-year savings, and limited to one-half of the measure's physical lifetime.

Inspection option

By inspecting (confirming) that measures are both present and operating, credit is allowed for 75% of first-year savings and is limited to one-half of the measure's physical lifetime (with biennial inspections), or 90% of first-year savings for physical lifetimes of measures that do not require active operation or maintenance (e.g., building shell insulation, pipe insulation and window improvements).

Slide 23

Summary

- **Plan carefully. Don't skip elements for expediency:**
  - **Project initiation meeting**
  - **Research plan**
  - **Pre-test**
  - **Data collection**
  - **Data analysis**
  - **Project management**

Slide 24

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 8: Overview of methods of data collection and analysis methods to energy supply projects

Overview

General Objectives:

Session 8 is intended to provide an overview of the various methods available for monitoring energy savings from JI projects. Each of the six basic methods is discussed and practical examples/applications provided. Specifically, the session addresses the following methods:

- Engineering methods
- Basic statistical models
- Multivariate statistical models
- End-use metering
- Short-term monitoring
- Integrative methods

By the end of the session, participants should have a basic understanding of:

- The advantages and disadvantages of each of the data collection and analysis methods
- Which methods are appropriate for particular project types

Activities:

Presentation, followed by period of questions and answers.

Total Time:

30 minutes.

Materials:

Set of 9 OHTs.

Overview of methods of data collection and analysis methods to energy supply projects

Session 8

Module 6: Training seminar
Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Methods For Monitoring Energy Savings

- Engineering methods
- Basic statistical models
- Multivariate statistical models
- End-use metering
- Short-term monitoring
- Integrative methods

Slide 2

Engineering Methods

- Estimates of energy savings based on technical information from manufacturers on equipment in conjunction with assumed operating characteristics of the equipment
- Approach 1: Engineering algorithms (equations)
- Approach 2: Engineering building simulations
  - Computer programs that model the performance of energy systems in buildings
  - Use information on building occupancy patterns, building shell and orientation, and equipment
  - Best for heating, cooling and ventilation measures
- Most appropriate for: (1) first year of project implementation; (2) projects with small savings expected; (3) industrial projects; (4) new construction; and (5) certain types of retrofits

Slide 3

Basic Statistical Models

- Statistical models that compare energy consumption before and after the installation of energy-efficiency measures
- Monthly billing data & weather normalization
- Comparison of energy use and savings for participants and non-participants (comparison group)
- Most appropriate for many projects or buildings

Slide 4

Multivariate Statistical Models

- Multivariate regression analysis
  - Collect data on factors that may influence energy use
- Conditional demand analysis
  - Complete inventory of equipment
  - Possibility for greater measurement error, sample error and non-response error
- Statistically adjusted engineering models
  - May omit some key variables

Slide 5

End-Use Metering

- Metering of specific equipment or end uses
- Conducted before and after a retrofit to characterize the performance of the equipment under a variety of local conditions
- Data normalization (operations, weather, etc.)
- Accurate measurements - reduction in measurement error
- Requires specialized equipment and expertise
- Usually based on small samples
- A data collection method (rather than an evaluation method)

Slide 6

Short-term Monitoring

- Measurements are done instantaneously or over a short time period
- Examples: spot watt measurements of efficiency measures, run-time measurements of lights or motors, temperature measurements, or demand monitoring
- Most appropriate when operating hours do not change after a retrofit
- A data collection method (rather than an evaluation method)

Slide 7

Integrative Methods

- Combine one or more of the above methods to create a stronger analytical tool
- Most common: combine engineering and statistical models where the outputs of engineering models are used as inputs to statistical models
  - Statistically Adjusted Engineering or Engineering Calibration Approaches
- Best to leverage high cost data with less expensive data (ratio estimation)

Slide 8

Slide 9

Table 9. Advantages and Disadvantages of Data Collection and Analysis Methods

Methods	Application	Advantages	Disadvantages
Engineering Methods	Individual buildings and groups of buildings	Relatively quick and inexpensive for simple engineering methods. Most useful as a complement to other methods. Methods are improving. Useful for baseline development.	Relatively expensive for more sophisticated engineering models. Need to be calibrated with onsite data. By themselves, not good for evaluation of spillover.
Basic Statistical Models	Primarily for groups of buildings	Relatively inexpensive and easy to explain.	Assumptions need to be confirmed with survey data and other measured data. Limited applicability. Cannot evaluate peak impacts. Large sample sizes needed.
Multivariate Statistical Models	Primarily for groups of buildings	Can isolate project impacts better than basic statistical models.	Same disadvantages as for basic statistical models. Relatively more complex, expensive, and harder to explain than basic statistical models.
End-use Metering	Individual buildings and groups of buildings	Most accurate method for measuring energy use. Most useful for data collection, not analysis.	Can be very costly. Small samples only. Requires specialized equipment and expertise. Possible sample biases. Difficult to generalize to other projects. Does not, by itself, calculate energy savings. Difficult to obtain pre-installation consumption.
Short-term Monitoring	Individual buildings and groups of buildings	Useful for measures with relatively stable and predictable operating characteristics. Relatively accurate method. Most useful for data collection, not analysis.	Limited applicability. Using this method alone, energy savings cannot be calculated.

Methods	Application	Advantages	Disadvantages
Integrative Methods	Primarily for groups of buildings	Relatively accurate.	Relatively more complex, expensive, and harder to explain than some of the other models.

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 9: Overview of IPMVP approaches

Overview

General Objectives:

Session 9 is intended to provide an overview of the A, B, C, D approaches of IPMVP Protocol. Their key patterns are as follows:

- They allow user flexibility in cost and methods;
- Options differ on level and duration of measurements;
- Each option has advantages and disadvantages;
- Each M&V option is applicable to different situations (particularly defined by risk-sharing);
- Methods are generic, not project specific; M&V approach is applied to a specific energy conservation measures (ECM) technology.

By the end of the session, participants should have a basic understanding of:

- The advantages and disadvantages of each of the IPMVP approaches
- Which approaches are appropriate for particular project types

Activities:

Presentation, followed by period of questions and answers.

Total Time:

45 minutes.

Materials:

Set of 26 OHTs.

Overview of IPMVP Approaches

Session 9

Module 6: Training seminar
Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Who Defines Monitoring and Verification (M&V)?

- Government - Federal, State, Local
- Utilities
- ESCOs (Energy Service Companies)
- NAESCO (National Association of Energy Service Companies)
- ASHRAE (American Society for Heating, Refrigeration and Air Conditioning Engineers)
- AEE (Association of Electrical Engineers)
- Universities

Slide 2

Short History of M&V Protocols

- New Jersey, NAESCO
- 1995 EPA Conservation Verification Protocols
- 1995 LoanSTAR (Texas) Protocols
- 1996 NEMVP (North American Monitoring & Verification Protocols)
- 1996 FEMP (Federal Energy Management Program) M&V Guideline
- 1997 IPMVP (next slide)
- 2000 ASHRAE 14-P (draft) guidelines
- 2000 MVP ?

Slide 3

Overview of IPMVP (1)

- International Performance Measurement and Verification Protocol (IPMVP)
  - (was) North American Measurement and Verification Protocol
  - Sponsored by the U.S. Department of Energy (US DOE)
  - North American energy service companies have adopted the IPMVP as the industry standard
  - Several states require use of IPMVP for state-level energy efficiency retrofits
  - FEMP uses IPMVP for federal buildings
  - Many countries have adopted it; translated into many languages including Ukrainian

Slide 4

Overview of IPMVP (2)

- General guideline: provides an overview of procedures with examples
- Provides a framework and definitions for M&V
- Contains established engineering techniques, in a new package. No new engineering information.
- Provides references for additional information on M&V

Slide 5

Current Structure of IPMVP

- Purpose
- Finance discussion
- Overview of M&V
- Examples
- Other M&V issues
- New buildings
- Emissions trading
- M&V application (FEMP version 1.0)

Slide 6

What the Protocols Do Not Cover

- Operations and maintenance
- Detailed metering specifications, or instrumentation guidance
- Calculating the cost of M&V
- Balancing the costs and benefits of M&V

Slide 7

Next Version of IPMVP - ipMVP

- Proposed Structure- Four Volumes
  - Vol 1 Energy Savings Determination
  - Vol 2 Indoor Environmental Quality
  - Vol 3 Applications
    - New Construction, Industrial, Renewables, Water
  - Vol 4 Emissions Trading
- Volume 1 due fall 2000

Slide 8

Issues to Answer for MVP

- Compliance - What does it mean to comply with MVP?
- Consistency in Definition of Options
- Confidence (Uncertainty)

Slide 9

Four IPMVP Options

- Allows user flexibility in cost and methods
- Options differ on level and duration of measurements
- Each option has advantages and disadvantages: no option is necessarily better or more/less expensive than another
- Each M&V option is applicable to different situations (particularly defined by risk-sharing)
- Methods are generic, not project specific; M&V approach is applied to a specific ECM technology

Slide 10

Summary of M&V Methods by Technology and M&V Approach

&V Method Name and apter Ref.	Technology	M&V Option	Method
E-A-01, Chapter 5	Lighting Efficiency	Option A	no metering
E-A-02, Chapter 5	Lighting Efficiency	Option A	spot metering of fixture wattage
E-B-01, Chapter 10	Lighting Efficiency	Option B	continuous metering of operating hours
E-B-02, Chapter 11	Lighting Efficiency	Option B	continuous metering of lighting circuits
E-C-01, Chapter 18	Lighting Efficiency	Option C	utility billing analysis
C-A-01, Chapter 6	Lighting Controls	Option A	no metering
C-A-02, Chapter 6	Lighting Controls	Option A	spot metering of fixture wattages
C-B-01, Chapter 12	Lighting Controls	Option B	continuous metering of operating hours
C-B-02, Chapter 13	Lighting Controls	Option B	continuous metering of lighting circuits
LM-A-01, Chapter 7	Constant Load Motors	Option A	spot metering of motor kW
LM-B-01, Chapter 14	Constant Load Motors	Option B	continuous metering of motor kW
LM-C-01, Chapter 18	Constant Load Motors	Option C	utility billing analysis
SD-A-01, Chapter 8	VSD Retrofit	Option A	spot metering of motor kW
SD-B-01, Chapter 15	VSD Retrofit	Option B	continuous metering of motor kW, speed frequency, or controlling variables
SD-C-01, Chapter 18	VSD Retrofit	Option C	utility billing analysis
H-A-01, Chapter 9	Chiller Retrofit	Option A	no metering
H-A-02, Chapter 9	Chiller Retrofit	Option A	verification of chiller kW/ton
H-B-01, Chapter 16	Chiller Retrofit	Option B	continuous metering of new chiller
H-B-02, Chapter 16	Chiller Retrofit	Option B	continuous metering of new chiller and cooling load
H-C-01, Chapter 18	Chiller Retrofit	Option C	utility billing analysis
H-C-02, Chapter 19	Chiller Retrofit	Option C	computer simulation
VL-B-01, Chapter 17	Generic Variable Load Project	Option B	continuous metering of end-use energy use
VL-C-01, Chapter 18	Generic Variable Load Project	Option C	utility billing analysis
VL-C-02, Chapter 19	Generic Variable Load Project	Option C	computer simulation

Slide 11

Overview of Options A/B/C/D

Measurement Levels

- System — Options A, B
- Whole Building — Option C

Measurement Duration

- Periodic — Option A
- Continuous — Option B, C

Slide 12

Option A Measured Performance-Stipulated Operation (1)

- Measure **performance** before and after retrofit
- Determine **operation** for baseline
- Calculate Savings based on **stipulated operation** and **measured performance**

Slide 13

Option A Measured Performance-Stipulated Operation (2)

- Key performance factors (e.g., lighting wattage or "motor" efficiency) are measured on a snapshot or short-term basis.
- Operational factors (e.g., lighting operating hours or motor runtime) are stipulated based on analysis of historical data or spot/short-term measurements.
- Initial cost: 0.05-3%
- Annual operating cost: 0.01 to 0.5%

Slide 14

Option A Verification

- Were proper equipment/systems installed?
- Are the systems performing to specification, i.e., working correctly?
- Does the equipment continue to **perform** through the term of the contract?

Slide 15

Option A Issues

- Savings are determined based on measured performance and stipulated operation
  - Option A will not tell you about the actual operation of the retrofit
- Option A cannot measure interactions between systems (lighting and cooling)
- Option A will tell you whether the equipment is still performing to specification
- Option A can be very inexpensive

Slide 16

Option B
Measured Performance, Measured Operation

- Same procedures as Option A plus continuous measurement of post-installation energy use
- Savings are determined by end use, using measured data throughout the term of the contract
- Intended for individual energy conservation measures (retrofit isolation) with a variable load profile.
- Initial cost: 2-8%
- Annual operating cost: 0.05 to 3%

Slide 17

Option B
Issues

- The Option B approach cannot measure interactions between systems (lighting and cooling)

- Option B will always involve specialized end-use metering and subsequent data analysis

Slide 18

Option C
Whole Facility Measurement (1)

- Intended for whole-building M&V where energy systems are interactive (e.g. efficient lighting system reduces cooling loads) rendering measurement of individual ECMs inaccurate
- Requires utility bill whole-facility meter analysis, or hourly whole-building data
  - Performance factors are determined at the whole-building or facility level with continuous measurements.
  - Operational factors are derived from hourly measurements and/or historical utility meter (electricity or gas) or sub-metered data
- Baseline is often normalized to weather or other independent variables (regression model)

Slide 19

Option C
Whole Facility Measurement (2)

- Same procedures as Option A plus measuring actual whole-building energy use (and other variables) throughout the term of the contract
- Initial cost: 0.05-3% (utility bill analysis), 2-8% (hourly data)
- Annual operating cost: 0.05 to 3%

Slide 20

Option C Issues

- All the metering you need is often installed (utility billing meter)
- Inexpensive, due to reduced data collection
- Seeing results in the utility bill increases confidence (but does not necessarily prove that the retrofit worked)
- Captures interactive effects
- Can you identify the factors that influence energy use and create a model?
- Can you see the savings at this level?

Slide 21

Option D Calibrated Simulation (1)

- Uses a calibrated building simulation tool (e.g., DOE-2) to estimate "before" and "after" energy use
- Typically employed for verification of saving in new construction and in comprehensive retrofits involving multiple measures at a single facility where pre-retrofit data may not exist.
- In new construction, performance and operational factors are modeled based on design specification of new, existing and/or code complying components and/or systems.

Slide 22

Option D
Calibrated Simulation (2)

- Measurements (end-use or whole building data) should be used to confirm simulation inputs and calibrate the models.
- Initial cost: 2-8% (utility bill analysis), 2-8% (hourly data)
- Annual operating cost: 0.05 to 3%

Slide 23

Option D
Issues

- This option can be expensive and resource intensive
- Requires trained experts to run models and collect data
- Development of credible baseline is critical

Slide 24

Review of Options

- Option A: Verifying installation and performance of retrofit, with periodic checks. **Operation is stipulated**
- Option B: Verifying installation, performance, and operation at the system level.
- Option C: Whole-building method. Utility bill, or hourly whole-building data.
- Option D: Calibrated simulation. Computer model, adjusted to match measured data.

Slide 25

To Obtain the IPMVP

http://www.ipmvp.org

Slide 26

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 10: Additional issues of Monitoring and Evaluation

Overview

General Objectives:

Session 10 is intended to provide an overview of some of the additional issues that are important to consider in the establishment of MERVC protocols. Specifically, the session addresses the following issues:

- Establishment of quality assurance guidelines
- Greenhouse gas emission impacts
- Other environmental effects whose impacts are local in nature
- Socioeconomic impacts

By the end of the session, participants should have a basic understanding of:

- How the additional monitoring and evaluation issues can and should be addressed in a program
- The importance of addressing such issues when developing protocols in Ukraine

Activities:

Presentation, followed by period of questions and answers.

Total Time:

30 minutes.

Materials:

Set of 8 OHTs.

Additional MERVC Issues

Session 10

Module 6: Training seminar
Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Additional MERVC Issues

- Quality assurance guidelines
- Emission impacts
- Environmental impacts
- Socioeconomic impacts

Slide 2

Quality Assurance Guidelines

Table 11. Quality Assurance Issues for Data Collection and Analysis Methods[1]

(✓ = applicable; blank = not applicable)

	Engineering Methods	Basic Statistical Models (2)	Multivariate Statistical Models (3)	End-use Metering	Short-term Monitoring	Integrative Methods (4)
Calibration	✓					✓
Data type and sources	✓	✓	✓	✓	✓	✓
Outliers		✓	✓			✓
Missing data		✓	✓	✓	✓	✓
Triangulation			✓			✓
Weather		✓	✓			✓
Engineering priors			✓			✓
Interactions	✓	✓	✓			✓
Measurement duration				✓	✓	✓
Sample and sampling		✓	✓	✓	✓	✓
Specification and error			✓			✓
Collinearity			✓			✓
Comparison group		✓	✓			✓

[1] Quality assurance issues (rows) are described in Appendices B and C, and the data collection and analysis methods are described in Section 4.2

[2] Primarily for analysis of groups of buildings; includes statistical comparison methods

[3] Primarily for analysis of groups of buildings; includes conditional demand analysis models

[4] Primarily for analysis of groups of buildings; includes engineering calibration approaches

Slide 3

Evaluation of Emission Impacts

- Default carbon emissions factors to estimate carbon savings
  - Based on fuels
  - Based on utility or non-utility estimates
- Based on generation data
  - Utility dispatch models: link energy savings to the marginal hourly or daily unit that is affected
- Utility company could publish carbon emissions factors

Slide 4

Carbon emissions coefficients (1996)

(Million metric tons of carbon per quadrillion Btu)

Petroleum	
Motor gasoline	19.38
LPG	16.99
Kerosene	19.72
Coal	
Residential/Commercial	26.00
Industrial coking	25.53
Other industrial	25.63
Electric utility	25.74
Flare gas	14.92
Natural gas	14.47
Crude oil	20.25

Source: EIA (1997)

Slide 5

Environmental and Socioeconomic Impacts

- A primary goal: sustainable development
- Importance of individuals and local organizations in project area
  - Sustainability of project
- Diverse group of stakeholders
  - Multiple interests

Slide 6

Environmental Impacts

- Dams and reservoirs
- Effluents from power plants
- Hazardous and toxic materials
- Indoor air quality
- Industrial hazards
- Insurance claims
- Occupational health and safety
- Water quality
- Wildlife and habitat protection or enhancement

Slide 7

Socioeconomic Impacts

- Cultural properties (archeological sites, historic monuments, and historic settlements)
- Distribution of income and wealth
- Employment rights
- Gender equity
- Induced development and other sociocultural aspects (secondary growth of settlements and infrastructure)
- Long-term income opportunities for local populations plants (jobs)
- Public participation and capacity building
- Quality of life (local and regional)

Slide 8

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 11: Reporting GHG Emission Reductions

Overview

General Objectives:

Session 11 is intended to provide an overview of different reporting formats concerning GHG emission reductions. UN FCCC Subsidiary Body on scientific and technical advice (SBSTA) has developed a Uniform Reporting Format (URF) for pilot phase of activity implemented jointly.

Here are the major headings of the revised draft URF for AIJ pilot phase:

A. Governmental acceptance, approval or endorsement;
B. Summary of AIJ project;
C. General compatibility with and supportiveness of national economic development and socio-economic and environment priorities and strategies;
D. Environmental, economic and social and cultural impacts;
E. Calculation of real, measurable and long-term environmental benefits related to the mitigation of climate change that would not have occurred otherwise;
F. Financing;
G. Contribution to capacity-building and the transfer of environmentally sound technologies and know-how;

H. Additional comments.

By the end of the session, participants should have a basic understanding of:

- What are the main issues of reporting concerning GHG emissions reductions

Activities: Presentation, followed by period of questions and answers.

Total Time: 30 minutes.

Materials: Set of 10 OHTs.

Reporting GHG emission reductions

Session 11

Module 6: Training seminar

Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Reporting

Reporting refers to *measured* GHG impacts of the project (in some cases, organizations may report on their *estimated* impacts, prior to project implementation). Reporting occurs throughout the MERVC process (e.g., periodic reporting of monitored results and a final report once the project has ended).

Slide 2

Uniform Reporting Format

- COP6 adopted URF (decision 10 CP.3) contained in the report of SBSTA on its fifth session.
- At the eleventh sessions of the subsidiary bodies, a draft URF was considered (FCCC/SB/1999/5/Add.1). By its decision 13/CP.5, the COP invited Parties to submit further views by 31 March 2000 and requested the secretariat to prepare a further draft revision of the uniform reporting format and a set of guidelines for its use. The draft revised URF for activities implemented jointly under the pilot phase, including draft guidance on how to complete the URF, has been prepared based on six submissions.

Slide 3

The Major Headings

A. Governmental acceptance, approval or endorsement

B. Summary of AIJ project

C. General compatibility with and supportiveness of national economic development and

socio-economic and environment priorities and strategies

D. Environmental, economic and social and cultural impacts

E. Calculation of real, measurable and long-term environmental benefits related to the mitigation of climate change, that would not have occurred otherwise

F. Financing

G. Contribution to capacity-building and the transfer of environmentally sound technologies and know-how

H. Additional comments

Slide 4

A. Governmental acceptance, approval or endorsement

A report (first, interim or final) shall be submitted to the secretariat by the designated national authority (DNA) of a participating Party with proof of concurrence, on official letterhead paper, of all other DNAs involved in the project. The AIJ project activity is then considered to be "mutually agreed". The submitting Party may forward reports to the UNFCCC secretariat by electronic mail. The proof of concurrence shall be faxed by the submitting Party at the same time. All documents must be made available subsequently to the UNFCCC secretariat in original form.

Reporting sections shall be reproduced and completed for AIJ project sub-activities whenever they differ in, for example, the way greenhouse gas (GHG) reductions are calculated or their impacts on national strategies and priorities.

Slide 5

B. Summary of AIJ project

B.1 Title of project
B.2 Participants
B.3 Activity summary
- B.3.1 General description
- B.3.2 Type of activity
- B.3.3 Location (e.g. city, region, state)
- B.3.4 Stage of activity
- B.3.5 Lifetime

B.4 Determination of the baseline
- B.4.1 Date of completing the baseline determination:
- B.4.2 Carried out by (name):
- B.4.3 Type of baseline methodology applied and described in detail in section E.1
- B.4.4 Project boundary: degree of aggregation

Slide 6

D. Environmental, economic and social and cultural impacts

D.1 Environmental impact (positive and/or negative)

D.2 Economic impact (positive and/or negative)

D.3 Social and cultural impact (positive and/or negative)

Whenever possible, *quantitative information* shall be provided. Failing that, a *qualitative description* shall be given. Indicators (qualitative and quantitative) applied shall reflect the impact of the AIJ project activity in an interconnected manner.

Slide 7

E. Calculation of real, measurable and long-term environmental benefits

E.1 Assumptions and characteristics of the baseline

- **E.1.1 Assumptions of the baseline and its project boundary**
- **E.1.2 Describe the baseline**
- **E.1.3 Reasons for selecting a baseline and its methodology**
- **E.1.4 Calculation of values reported in 'Baseline scenario'**

E.2 Revision of the baseline for the project

E.3 Assumptions and characteristics of the project scenario

- **E.3.1 Assumptions for the AIJ project activity and its boundary**
- **E.3.2 Describe the project scenario**
- **E.3.3 Please explain why the AIJ project activity would not have taken place anyway**
- **E.3.4 Calculation of values reported in 'Project scenario'**

E.4 Scope and performance of the actual project

E.5 Tables on real, measurable and long-term GHG emission reductions or removals by sinks (in CO_2 equivalent)

E.6 Mutually agreed assessment procedures

E. 7 Cost (to the extent possible)

Slide 8

F. Financing

F.1 Financial additionality

Note: The financing of AIJ shall be additional to financial obligations of Parties included in Annex II to the Convention within the framework of the financial mechanism, as well as to current official development assistance (ODA) flows (decision 5/CP.1).

F.2 Project development

F.3 Project implementation

Slide 9

G. Contribution to capacity-building and the transfer of technologies

G.1 Identification of environmentally sound technology and know-how

G.2 Characteristics of environmentally sound technology

G.3 Impact of the AIJ project on capacity-building and transfer of environmentally sound technology and know-how

Slide 10

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 12: Verification and Certification

Overview

General Objectives:

Session 12 is intended to provide an overview of the characteristics of good verification and certification programs. The session is focused on the objectives, processes, and institutional needs for establishing such programs. Specifically, the session addresses the following issues:

- Basic definitions
- Review of the principles, considerations, specifications, and timing for verification and certification programs
- Review of the role of government and third parties

By the end of the session, participants should have a basic understanding of:

- the importance of such programs given that project developers and investors may have strong tendencies to overstate GHG emissions reductions
- The basic elements and issues that will need to be addressed in Ukraine in order to set up an effective program in verification and certification of future JI investments.

Activities:

Presentation, followed by period of questions and answers.

Total Time:

30 minutes.

Materials:

Set of 22 OHTs

Verification and Certification

Session 12

Module 6: Training seminar

Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Project Developers and Investors May Have an Incentive to Overstate GHG Emissions Reductions and Carbon Sequestration

Slide 2

Verification is Not an Isolated Process

Slide 3

MERVC Definitions

- **Verification** refers to establishing whether the measured GHG reductions actually occurred, similar to an accounting audit performed by an objective, accredited party not directly involved with the project. Verification can occur without certification.

- **Certification** refers to certifying whether the measured GHG reductions actually occurred. Certification is expected to be the outcome of a verification process. The value-added function of certification is in the transfer of liability/responsibility to the certifier.

Slide 4

Verification Programs

- Principles/Considerations
  - Transparent
  - Comprehensive documentation
  - Objective and unbiased
  - Independent
  - Replicable
  - Consistent
  - Technically sound
  - Simple (not too burdensome) (impact on participation)
  - Not too costly (impact on participation)

Slide 5

Verification

- Based on an assessment of the project's compliance with defined eligibility criteria
- Single set of eligibility criteria
  - Prepared by government
  - Based on information requirements

Slide 6

Specification of Verification (1)

- Pre-project approval
  - Verification process and forms should be identified and described
  - Specify verification process and forms
    - Indicate level of documentation needed for procedures, methodologies, assumptions and results

Slide 7

Specification of Verification (2)

- Verification involves inspections, spot measurement tests, interviews, or assessments, as well as requesting documentation on key aspects of the project

- Ask questions such as:
  - Are the methods well documented and reproducible?
  - Have the results been checked against other methods?
  - Have the results been compared for reasonableness with outside or independently published estimates?
  - Have the sources of emissions factors been well documented, and compared with other sources?

Slide 8

Specification of Verification (3)

- Verifier should
  - Review data or documentation, including interviews with project personnel
  - Inspect or calibrate measurement and analytical tools
  - Repeat sampling and measurements
  - Assess quality and comprehensiveness of the data used in estimating baselines and offsets
  - Assess risks associated with the project and its carbon benefits
  - Identify presence or absence of non-GHG impacts (environmental and socioeconomic impacts)
  - Review continued compliance of the project operator with the agreed procedures for project maintenance and monitoring

Slide 9

Degree of Verification

- Degree of rigor, reflected in the quantity and quality of data required (for verification, depends on past M&E)
- Two tiers:
  - Tier1 - most rigorous standards; mainly direct measurement
  - Tier 2 - less rigorous standards; some direct measurement
- No self-reporting for crediting
- Accuracy/credibility versus costs
  - More assumptions and less measurement lead to lower costs and less accuracy

Slide 10

M&E Effort	Verification Effort
High	Less
Low	More

Slide 11

Timing of Verification

- Verification form and guidelines should be available at time of project design
  - Verifiers should NOT be working with project designers and implementers
- Verification starts when credits are desired
  - Frequency of verification will be based on crediting frequency

Slide 12

Self-Assessment

- Not for verification

Slide 13

Third-Party Verification

- Model for verification
  - Provides confidence to stakeholders
- Eliminate conflict of interest
- No connection to estimation, monitoring and evaluation of project
  - For all projects?? Only does verification?
- No financial connection to project sponsors
  - World Bank "verification" of Ilumex project is **not** verification

Slide 14

Institutional Needs for Third-Party Verification

- Individuals best suited
  - Skills and expertise: analytical
  - Statistician (sampling)
  - Certified (training certification needed)
  - Multidisciplinary team is best (social scientists, engineers, foresters, etc.)
- Organizations best suited
  - Must be accredited by an accreditation organization and "approved" by UNFCCC (e.g., CDM Executive Board)

Slide 15

Training and Certification

- Training and certification for verifiers
- Accreditation for organizations who then certify verifiers or verification organizations

Slide 16

Accreditation

- Accreditation body has to set rigorous procedures and standards to evaluate whether verifiers can provide an independent and competent verification service
- The body has to set principles and criteria for verification
- Verifiers may operate internationally and verify any type of energy project
- Verifiers will visit the project site each time the developer reports GHG values to the UNFCCC

Slide 17

Implied Liability of Third Party Verifiers

- Verifier assumes liability
- Verifiers obtain insurance (money, credits, buffers)
- Certifiers assume liability from verifiers, if different organizations

Slide 18

Role of Government in Verification

- As verifiers
  - But cannot verify their own projects!
- Reviewers of self-assessments or third-party verification reports
  - Can review their own projects, but submit as input to the third-party verifiers
- Accreditation organizations
- Developer of verification protocol and guidelines
  - Generic baselines or performance benchmarks
- Conduct training on verification
  - Maybe best left to verifiers & accreditation organizations

Slide 19

Primary MERVC Actors

	Monitoring	Evaluation	Reporting	Verification	Certification
Projectdevelopers	X	X	X		
Consultant organizations	X	X		X	X
Non-governmental organizations	X	X		X	X
Governmental agencies			X	X	X
International organizations			X	X	X

1 Consultants and nongovernmental organizations(NGOs) must first be accredited by a government organization or industry association to be able to verify a project or to issue a certificate.

Slide 20

The Cost of Verification

- Costs will vary by size of area, scope of project, type of verification method, frequency of verification, etc.
- Tradeoff: cost and precision
- Costs of verification by third parties can be reduced
  - A single set of eligibility criteria accompanied by standardized accounting and reporting methodologies will reduce the costs of developing such services
  - Definition of accepted confidence intervals will enable project developers to maximize their sampling efficiency and verifiers minimize their sampling costs

Slide 21

After Verification

- Dispute resolution
  - Mediation
  - Courts
- Discounting of credits
  - IPMVP Adjustments Committee
    - 30 international members
    - Started in May 2000
    - Five options starting to be reviewed

Slide 22

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 13: Next steps

Overview

General Objectives:

Session 13 is intended to be an exercise for launching the setup of a MERVC program in Ukraine for JI projects. The session is focused on the particular steps that would be involved and bring together the many concepts and elements discussed in previous sessions. Specifically, the session addresses the following issues:

- Near term issues related to setting up a process for creating MERVC guidelines that can be applied to energy supply projects that reduce GHG emissions.
- Longer-term issues related to creating investor confidence in Ukraine for energy supply projects that reduce GHG emissions.

By the end of the session, participants should have a basic understanding of:

- the importance of networking among relevant government, private, and non-governmental institutions for creating MERVC guidelines
- Major practical steps that will be necessary in Ukraine for establishing a credible MERVC regime for JI projects.

Activities: Presentation, followed by period of questions and answers.

Total Time: 60 minutes.

Materials: Set of 19 OHTs

Next Steps

Session 13

Module 6: Training seminar

Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Slide 1

Next Steps (Less than 6 weeks) [1]

- Meeting with USAID
  - Presentation/orientation of MERVC issues and potential projects for JI
  - Policy issues
  - Training
  - Project development
- Training
  - JI project development, MERVC issues, regional workshops
- Project development
  - Funding
  - Networking
  - Negotiations
  - Project design (including analysis)

Slide 2

Next Steps (Less than 6 weeks) [2]

- Networking
  - Forming a MERVC Working Group
  - Research projects as basis for networking
  - Negotiated agreements, leading to projects
  - NGOs take the lead on networking
  - Maintaining contact with LBNL and course participants
- Stakeholders (long-term, too)
  - Identify
  - Hold separate and joint meetings with them
  - Combine efforts with government and other organizations

Slide 3

Next Steps (Less than 6 weeks) [3]

- Career development
  - Review current job responsibilities
  - Prepare new job responsibilities pertaining to MERVC
  - Delegate to staff MERVC responsibilities
- Communication within your own organization
  - Seminars (staff, other scientists and institutes)
  - Meetings (national climate change)
  - Reports (to USAID and to supervisors)
  - Presentations to staff
  - Newsletter
  - Web sites

Slide 4

Next Steps (More than 6 weeks) [1]

- Institutional Issues
  - Policy focus/direction for JI (leading to projects)
  - Scale: within country, for region in country, for 2 or more countries, for Eastern Europe, etc.
  - Will involve coordination, collaboration, and cooperation
- Information exchange (within country)
  - Meetings and conferences
  - MERVC Working Group
  - Magazines, newsletters, etc.
- Education
  - Universities
  - Formal (curriculum development, including MERVC)
  - Informal (promoting awareness of issues in the private sector)

Slide 5

Next Steps (More than 6 weeks) [2]

- Work with stakeholders
- Participation in planning of energy resources
  - Public/government process at national level
- Verification agency formation
  - Training
  - Information exchange
- Procedures in submitting and selecting proposals
- Guidelines for project design and approval, monitoring and evaluation, reporting, verification and certification, and an appeal process
  - Rules of the game
  - International (IPCC, UNFCCC) and national (modify existing ones or create new ones)

Slide 6

Next Steps (More than 6 weeks) [3]

- Private sector
  - Investors (for small and large projects)
    - Brokers
    - Large NGOs
    - Tax credits and deductions
    - Use for matching funds
    - Collaboration with government (loans and credits)

Slide 7

Case Studies

Slide 8

Zelenograd (Russian Federation) District Heating (DH) System Improvements (1)

- AJI project - with USIJI
- Currently:
  - No heat exchangers
  - Manual controls for sub-stations
  - Infrequent adjustments to valve settings (twice a year; valves in poor condition)
- New controls, valves, pumps and heat exchangers
  - Installed at 28 sub-stations and 1 boiler facility
  - More efficient space and hot water heating, leading to reduction of natural gas

Slide 9

Zelenograd (Russian Federation) District Heating (DH) System Improvements (2)

- Space heating
  - Add heat exchangers in substations between the heating distribution system and the space heating loads
  - Add pumps to circulate space heating water to buildings
  - Add control valves and control systems to regulate flow of hot water from DH system through the new heat exchangers to maintain water temperature
- System operations
  - Install central control system & data acquisition system in boiler house #2 for remote monitoring & control of sub-station operation

Slide 10

Zelenograd (Russian Federation) District Heating (DH) System Improvements (3)

- Domestic hot water heating
  - Add heat exchangers between the distribution network and the domestic hot water heating loads
  - Add control valves & control systems to regulate flow of hot water through the new heat exchangers to maintain temperature
  - Increase capacity of cold potable water distribution system to provide adequate supply of cold water to be heated in new exchangers & in hot water heating loads

Slide 11

Zelenograd (Russian Federation) District Heating (DH) System Improvements (4)

- Monitoring and verification
  - Measure fuel consumption & energy from each substation to each building
  - Control system measures amount of heat delivered from each substation [comparison check]

Slide 12

on project in rino (1)

renovation

systems, water treatment

ement of steel pipes with

DH renovati Lutkar

- Boiler house and central heating r
  - Oxygen meter, ultrasonic cleaning s filters, heat and flow meters, replac polymer pipes, variable speed drives (VSDs), and plate heat exchangers
- Municipal and public service buildings
  - Heat and cold water flow meters, heat consumption controls, radiator heat meters, and heat films
- Housing stock

Slide 13

DH renovation project in Lutkarino (2)

- Monitoring and verification
  - Monitoring every 3 months
  - Heat production and fuel and power consumption data collected at 3 boiler houses
  - Heat consumption data
    - Measured through heat meter readings at central heating points and at customer locations (e.g., hospitals, schools, municipal buildings)
  - Fuel purchase data
    - From contracts and invoices between local natural gas distribution company and municipal heat supply company

Slide 14

DH renovation project in Lutkarino (3)

- Monitoring and verification continued
  - Heat purchase data
    - From heating bills and contracts between municipal heat supply company and facilities
  - Fuel structure and gas analyses
    - From heat supply company's quarterly statistical reports
  - Energy auditing and potable gas analyzer for gas operation mode test analyses at the boilers
  - Power savings from VSDs - based on electricity bills and power meter readings
  - Collect information on reduction of heat losses at pipelines, windows, doors, walls, etc.

Slide 15

Coal Mining and Methane (1)

- Trapped methane released during mining process when coal seam is fractured
- Amount of methane released depends on:
  - Coal rank (stage of coal formation) (positive correlation)
  - Coal seam depth (positive correlation)
  - Method of mining (surface mining; strata fracturing nearby)
    - Underground coal mining releases more methane than surface or open-pit mining
- Two systems for removing methane from underground
  - Ventilation systems
  - Degasification systems (methane recovery possible)

Slide 16

Coal Mining and Methane (2)

- Additional methane emissions
  - During post-mining handling, processing and transportation
  - Emissions from coal waste piles and abandoned mines
- Total emissions =
  - (Emissions from underground mines + emissions from surface mines + emissions from post-mining emissions) - emissions avoided due to recovery

Slide 17

Coal Mining and Methane (3)

- Underground mining
  - Periodic sampling of methane concentrations or flow rate (depends on variability of emissions)
  - Sampling should be representative of typical mining conditions
    - Not during temporary stop in coal production
  - Ventilation air measurements are not possible when methane concentrations are below detectable levels (e.g., 0.1% of overall volume)
  - For degasification or drainage systems
    - Timing issue: before, during and after coal seam mined
    - Emissions measured on basis of recovery efficiency

Slide 18

Coal Mining and Methane (4)

- Uncertainty
  - Mine ventilation data: ±20% (Australia)
  - Emissions measurement from underground mines:
    - "Good practice": collect data every 2 weeks: ±10-15% [IPCC]
    - "Better practice": daily measurements - higher quality
    - "Best practice": continuous monitoring of emissions: ±5% [IPCC]
  - More uncertainty associated with recovery efficiency of degasification systems

Slide 19

MODULE VI: MONITORING, EVALUATION, REPORTING, VERIFICATION AND CERTIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS

Session 14: Panel Discussion

Overview

General Objectives:

Session 14 is intended to be an informal discussion of how MERVC issues can be addressed in the Ukraine. Specifically, the session addresses the following issues:

- Key energy supply issues that need to be monitored and evaluated

By the end of the session, participants should have a basic understanding of:

- How the IPMVP is being used in the Ukraine
- Ukrainian participation in the next meeting of the COP
- Opportunities for working on MERVC issues in the Ukraine

Activities: Panel discussion involving questions and answers.

Total Time: 60 minutes.

Materials: None.

Training Module Evaluation Form

Title of Module: Monitoring, Evaluation, Reporting, Verification and Certification of Greenhouse Gas Emission Reductions

Module # 6 Date:

For each statement below, mark the circle on the scale that corresponds to your opinion.

		Evaluation score					
		1	2	3	4	5	
1. The presentation of this module was	Unclear	O	O	O	O	O	Clear
2. The objectives of this module were	Not important	O	O	O	O	O	Important
3. The information presented in this module was	Not sufficient	O	O	O	O	O	Sufficient
4. The information presented in this module was	Not useful	O	O	O	O	O	Useful
5. The exercises in this module were	Not interesting	O	O	O	O	O	Interesting
6. The knowledge acquired through this module was	Insignificant	O	O	O	O	O	Important
7. Participating in this module enable you to learn	Nothing new	O	O	O	O	O	Many new things

What did you like most about this module? _____

_____

What did you like least about this module? _____

_____

What is your opinion on presenters? _____

_____

What is your opinion on organization of this module? _____

_____

On what themes presented in the module would you like to get more information? _____

_____

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What module themes would be interesting for you in the future? _____

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Comments: _____

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