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**HYDRO POWER AND ENERGY
PLANNING PROJECT (HPEP)**

ENERGY STRATEGY OF GEORGIA (2015-2030)



JULY 2014



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STRATEGIC VISION

GEORGIA WILL BE A REGIONAL LEADER IN SUSTAINABLE & EFFICIENT ENERGY MARKET BY 2030

Georgia will achieve energy security;

Meet the long-term need for clean and affordable energy;

Establish fully competitive energy markets;

Ensure social and environmental protection.



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STRATEGY GOALS:

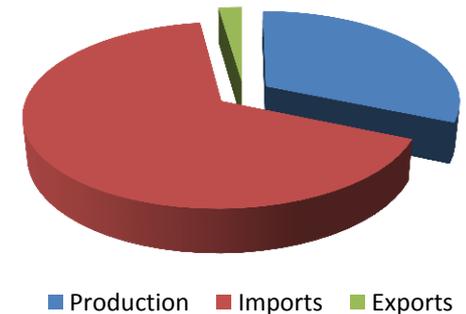
- Robust legislative and regulatory framework to attract private investment
- International level of human and institutional capacity of state-owned entities
- Established regulatory framework for energy markets
- Optimized production capacity and strengthened infrastructure
- Established demand-side management (DSM) programs
- Sustainable innovation and technology initiatives



CHALLENGES:

- The GoG will not take on additional liabilities for the energy sector
- Georgia is increasing gas dependence from Azerbaijan, possibly reaching 50% of total energy supply in the near future
- Increasing use of Enguri in Abkhazia
- Government-owned entities need institutional development in several areas
- Illegal wood cutting for residential heating, hot water and cooking is jeopardizing forests in Georgia
- Competitive forces are lacking in many aspects of the sector.

total primary energy supply of Georgia (2012)



The above could compromise national energy security and ability to provide affordable, sustainable and reliable energy.



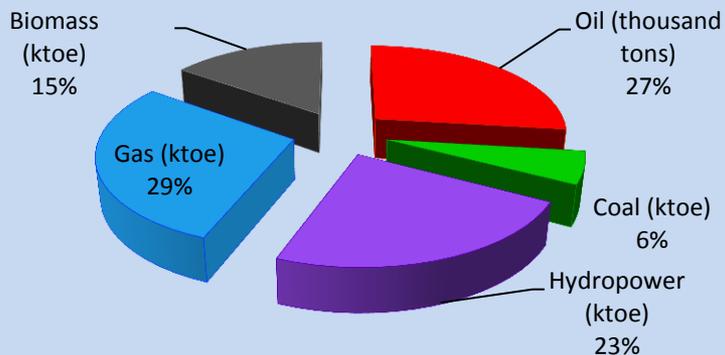
GEORGIA NEEDS A PRAGMATIC APPROACH TO ITS STRATEGY:

- Sector reviews and desk studies
- Cost Benefit Analyses (CBAs) & Strengths, Weaknesses, Opportunities & Threats (SWOT) analysis
- Reviews by sector experts and decision-makers
- Long-term Sector Analysis
 - ❑ Long range Energy Alternatives Planning program (LEAP)
 - ❑ Market Allocation (MARKAL) Georgia Model
- Training of Ministry staff on long-term (7 years plus) planning process
- Development of short (1-3 years) and medium (4-7 years) term strategies and a long term vision
- Development of a three year implementation action plan
- Civil Society Organizations (CSOs) and general public reviews

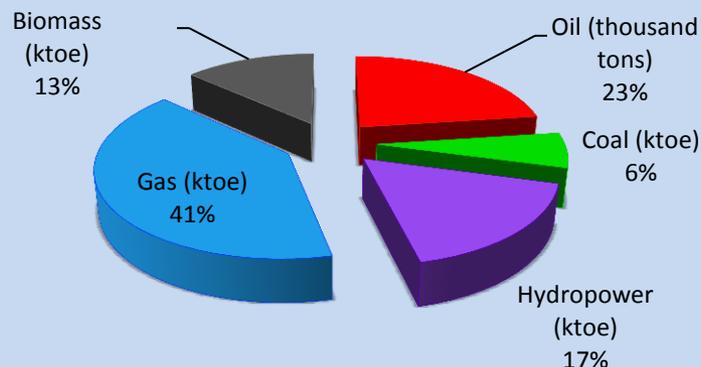


ENERGY SUPPLY OF GEORGIA BETWEEN 2010-2013¹

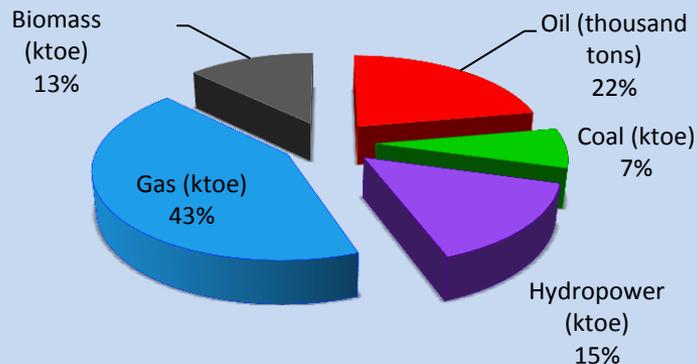
Total Primary Energy Supply (2010)



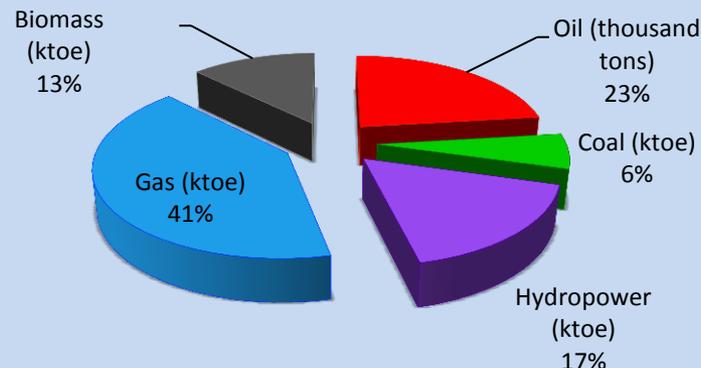
Total Primary Energy Supply (2011)



Total Primary Energy Supply (2012)



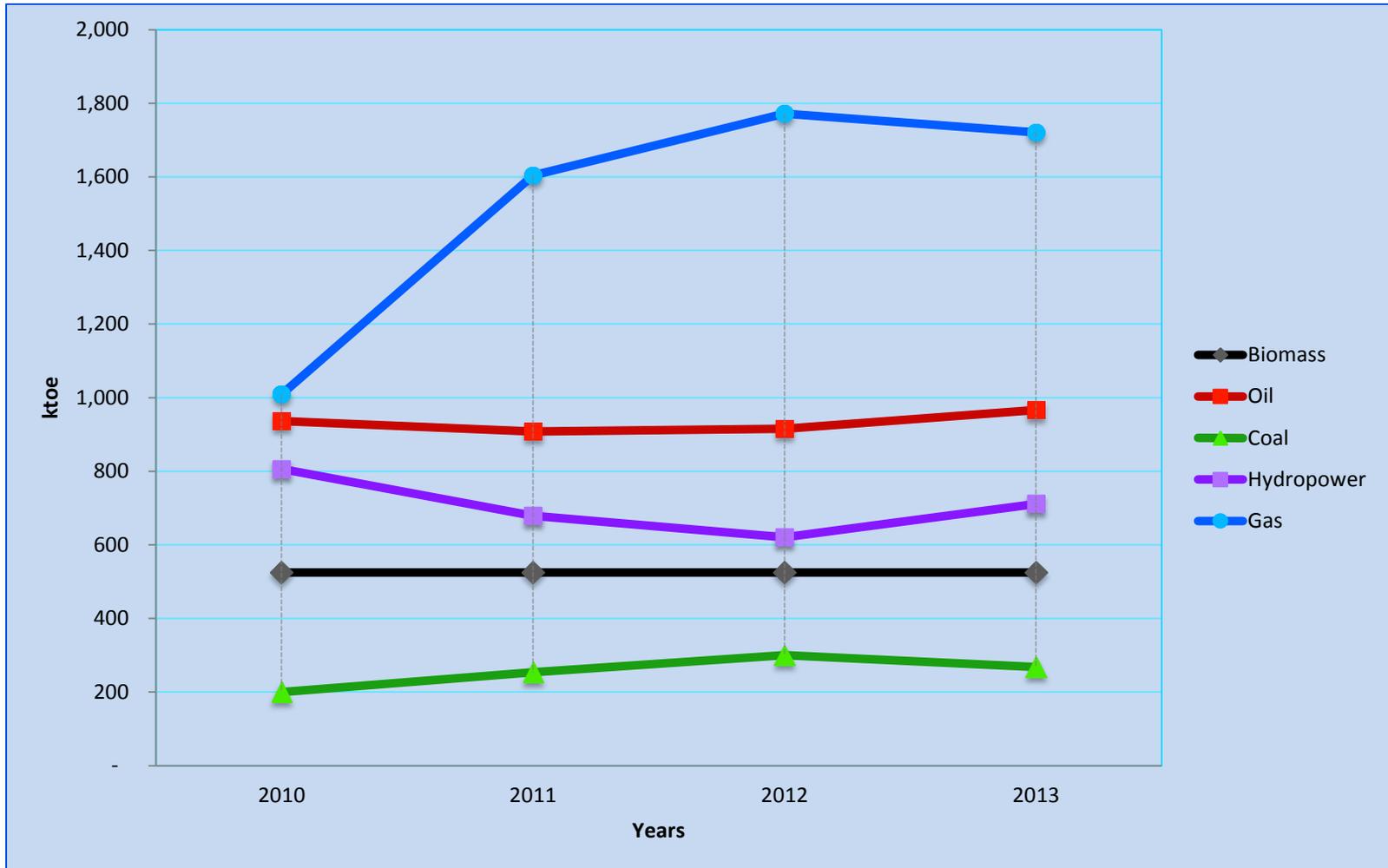
Total Primary Energy Supply (2013)



1. Ministry of Energy, Energy Department

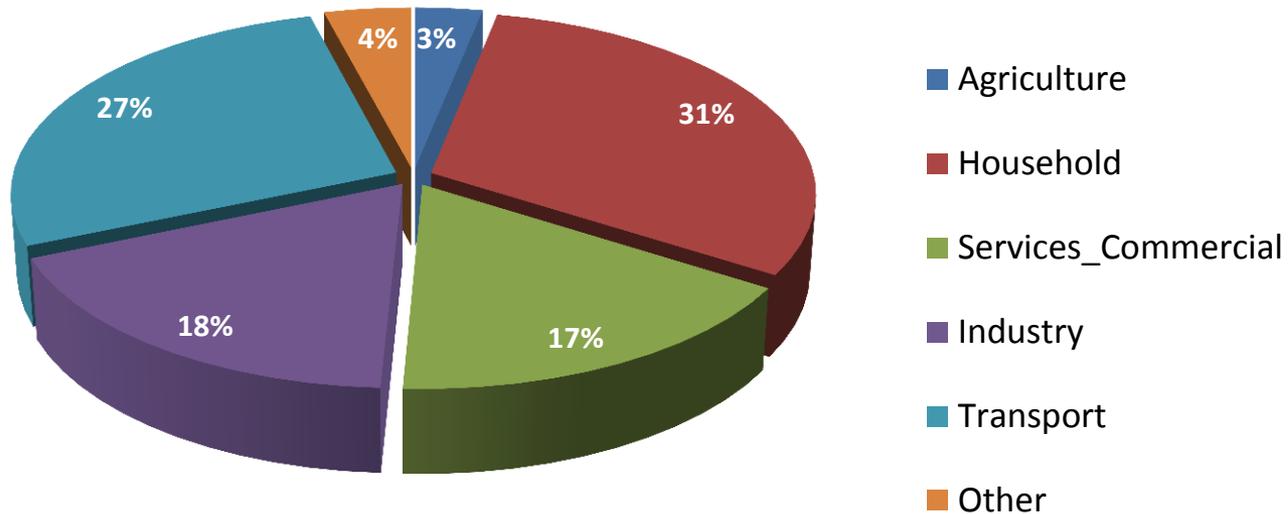


TOTAL PRIMARY ENERGY SUPPLY OF GEORGIA BETWEEN 2010-2013





ENERGY CONSUMPTION BY SECTOR (2012)



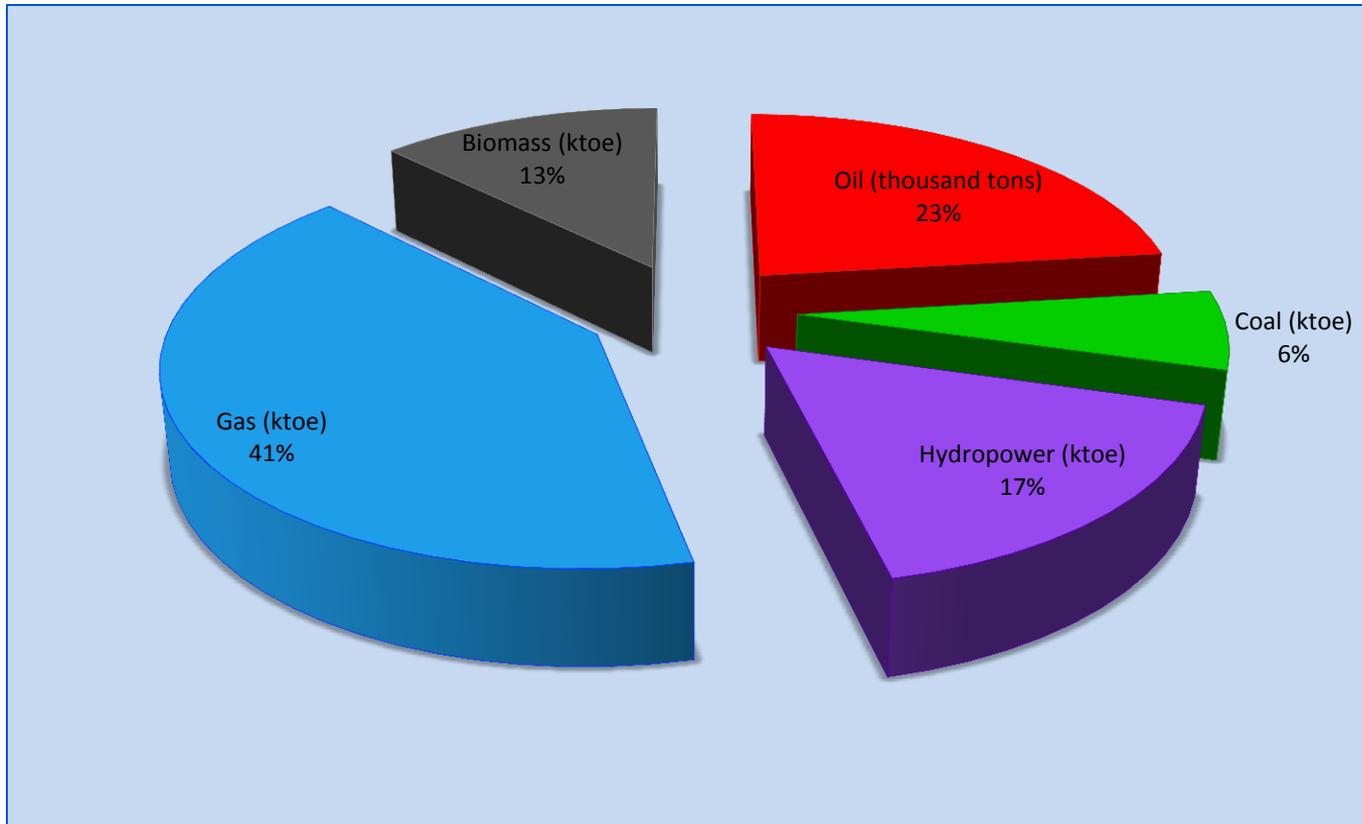


FORECASTED ENERGY GROWTH

- 6.6% forecast real GDP growth rate (2014-2020)¹
- **Agriculture** is a focus economic growth target, which is not an energy intensive sector
- Second important sector is **Logistics** – trucks (oil) and railroads (electricity) are biggest energy users of the sector
- Energy Efficiency (EE) will reduce energy demand growth as the GoG promotes new measures such as efficient wood stoves, insulation, efficient windows ...
- New, lower-priced solar (hot water, PV) can replace natural gas and wood-heated homes



TOTAL PRIMARY ENERGY SUPPLY (2013)



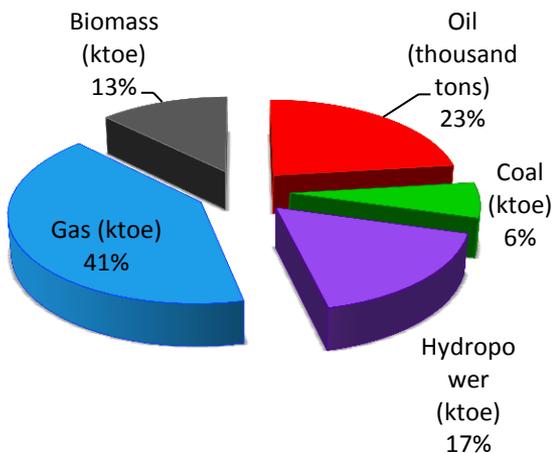


KEY CHALLENGES

De-forestation, illegal wood cutting

Polluting resource, lack of regulations

Growing dependence on single source, lacks a competitive market



Domestic resource mostly unused

Lack of competitive market to attract needed investment



LEGISLATIVE & REGULATORY REFORM

Harmonization with the EU Energy Directives and Regulations (EU Energy *Acquis*) in order to:

- Establish and develop competitive electricity and natural gas markets through amendments of primary and secondary legislation to attract private investment into the energy sector
- Create an effective regulatory framework to ensure competitive market operations including market monitoring
- Unbundling energy services in accordance with EU legislation



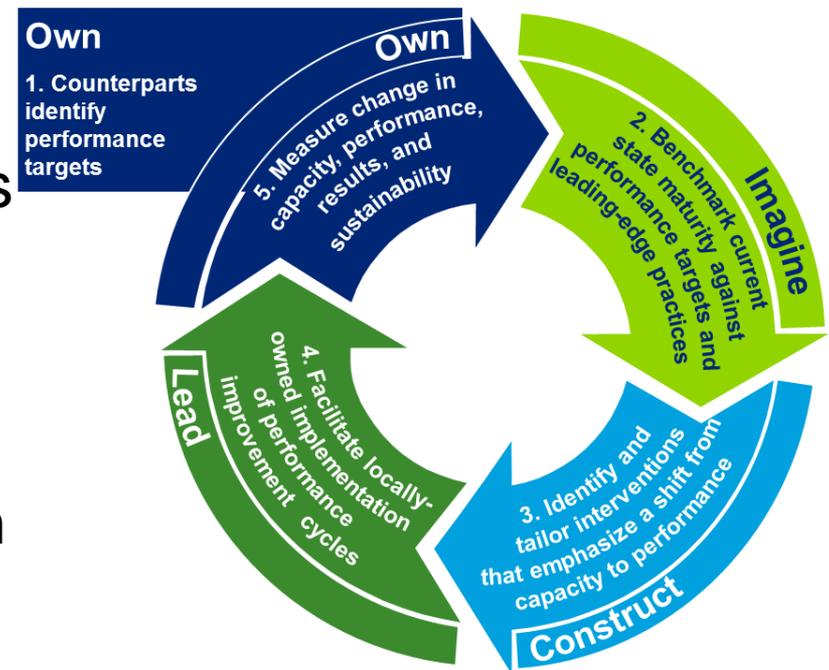
LEGISLATIVE & REGULATORY REFORM (cont'd)

Legislative and Regulatory strategies include:

- Strengthening regulatory independence
- Implement regulatory framework and trading mechanism for energy markets
- Develop and adopt laws and rules related to energy efficiency and renewable energy programs
- Develop and implement National Renewable Energy Action Plan (NREAP) and National Energy Efficiency Action Plan (NEEAP) in accordance with EU NREAP and NEEAP

COMMERCIALIZATION OF STATE-OWNED ENERGY ENTERPRISES

- Increasing institutional and human capacity
- Improve O&M practices of entities based on best practices
- Setting and monitoring key performance indicators
- Institutionalize project planning and project management within each entity





OPTIMIZE PRODUCTION & IMPROVE INFRASTRUCTURE

Optimize production capacity in the electricity, gas and oil sectors through strengthening current production and exploiting underutilized and potential sources. Strategies include:

- Improve infrastructure development in electricity production (HPPs), domestic energy networks and storage (gas and oil) through attracting investors and increasing competition
- Promote investment into increased energy transit capacity
- Attract private investment for exploration of potential conventional and unconventional domestic resources based on EU Directives
- Support research and development (R&D) of Renewable Energy Sources (RES) and Energy Efficiency (EE)

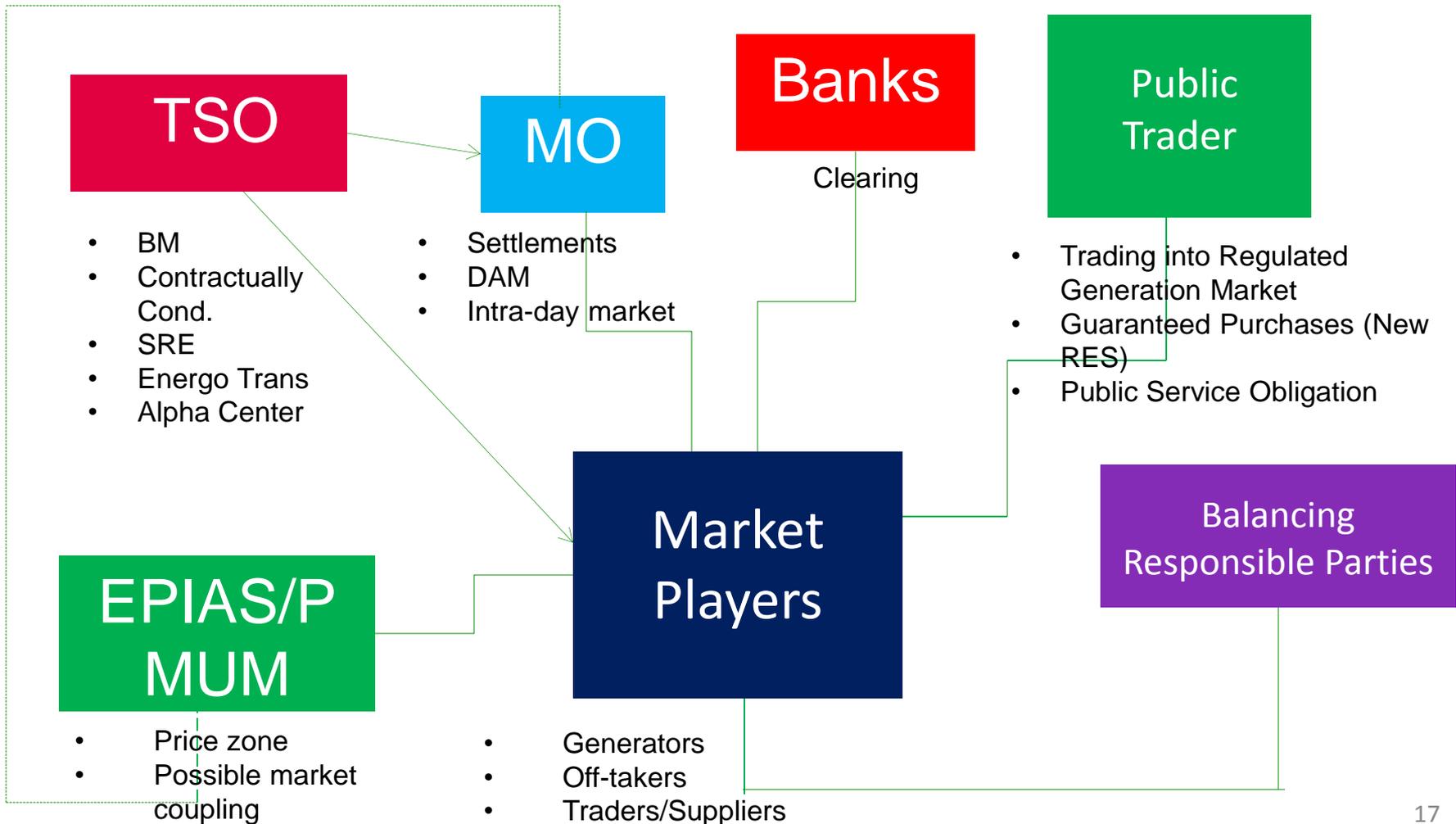


ELECTRICITY SECTOR STRATEGIES INCLUDE:

- Implement a competitive market with:
 - Third party access network
 - Take or pay bi-lateral contracts
 - Balancing market
 - Day ahead and intraday trading markets
- Develop rules and regulations according to ENTSO-E
- Unbundling of electricity generation, transmission, distribution and retail supply in accordance with EU regulation
- Remove cross-subsidies from electricity tariffs between sectors to give proper price signals and incentivize investors
- Evaluate off-grid solutions for isolated populations



PROPOSED POWER MARKET STRUCTURE



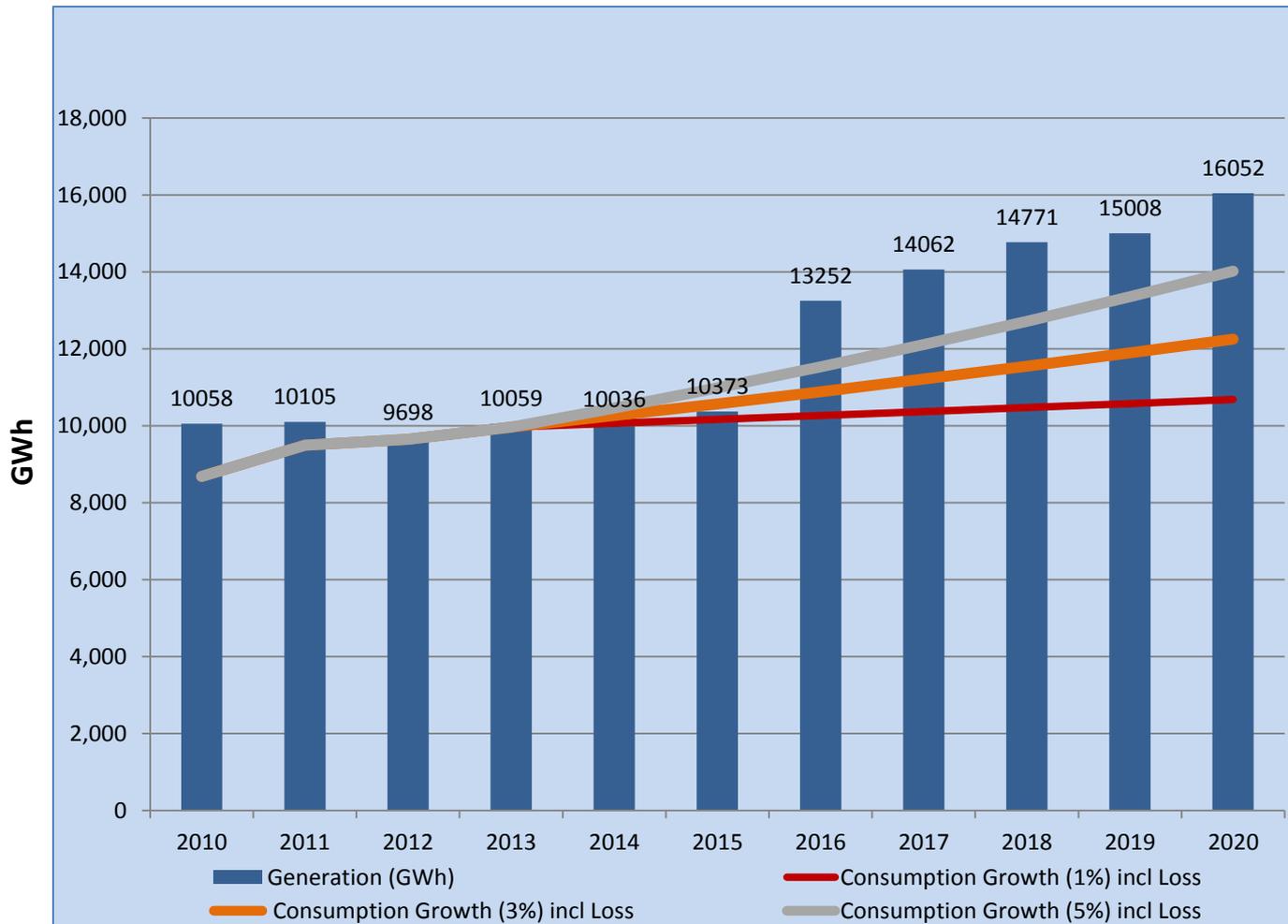


CREATE A MARKET OPERATOR

- Establishment of Market Operator in Georgia
- Establishment of Day-ahead Scheduling
- Finalize Automatic Metering Reading (AMR) System
- Establishment of Day-ahead Planning
- Implementation of balancing and settlement rules
- Introduction of Hourly/Daily Settlement
- Establishment of Balancing Market
- Introduction of licensed traders

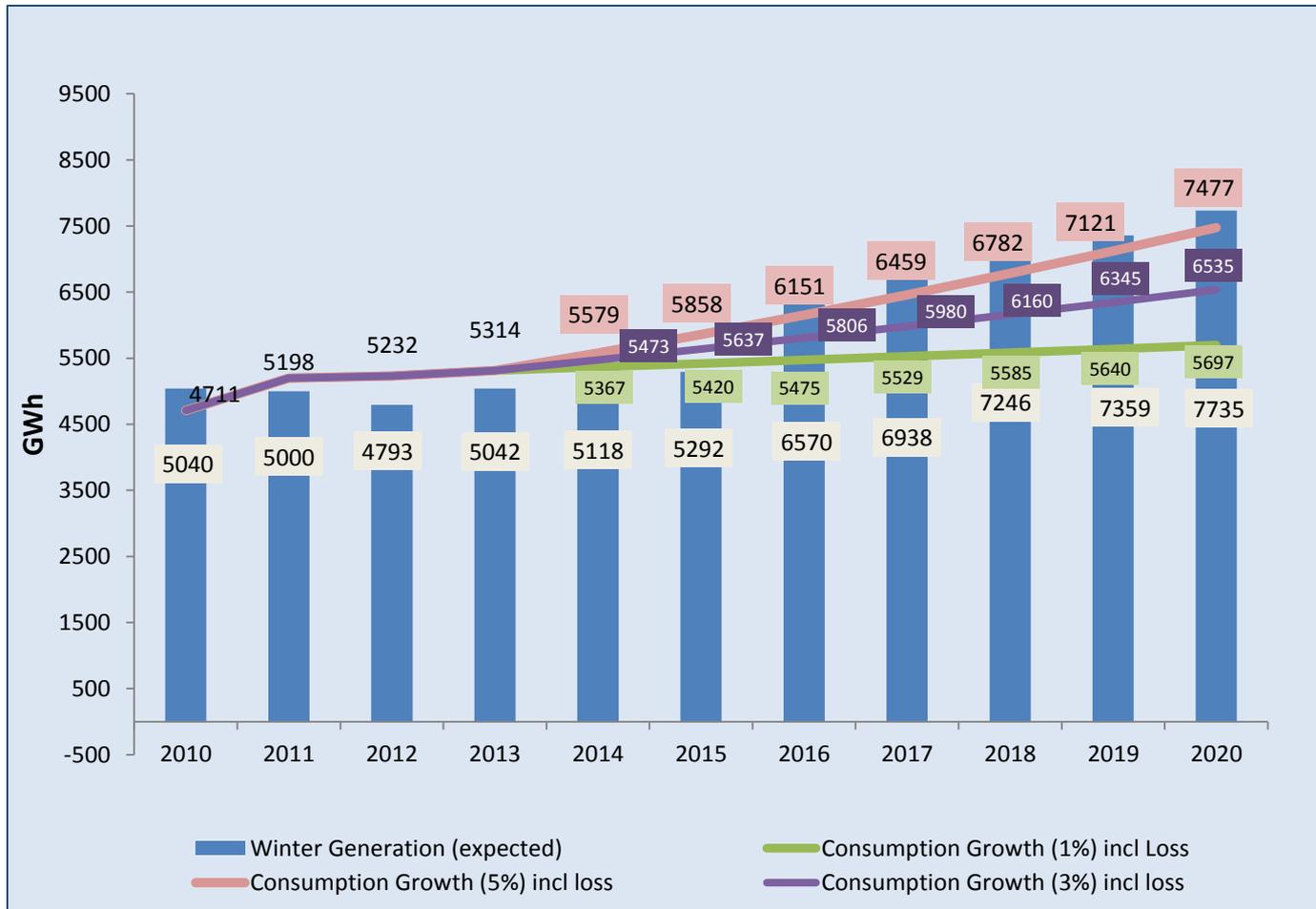


ELECTRICITY GENERATION PRODUCTION VS. CONSUMPTION¹



1. HPEP pessimistic, realistic and optimistic growth assumptions

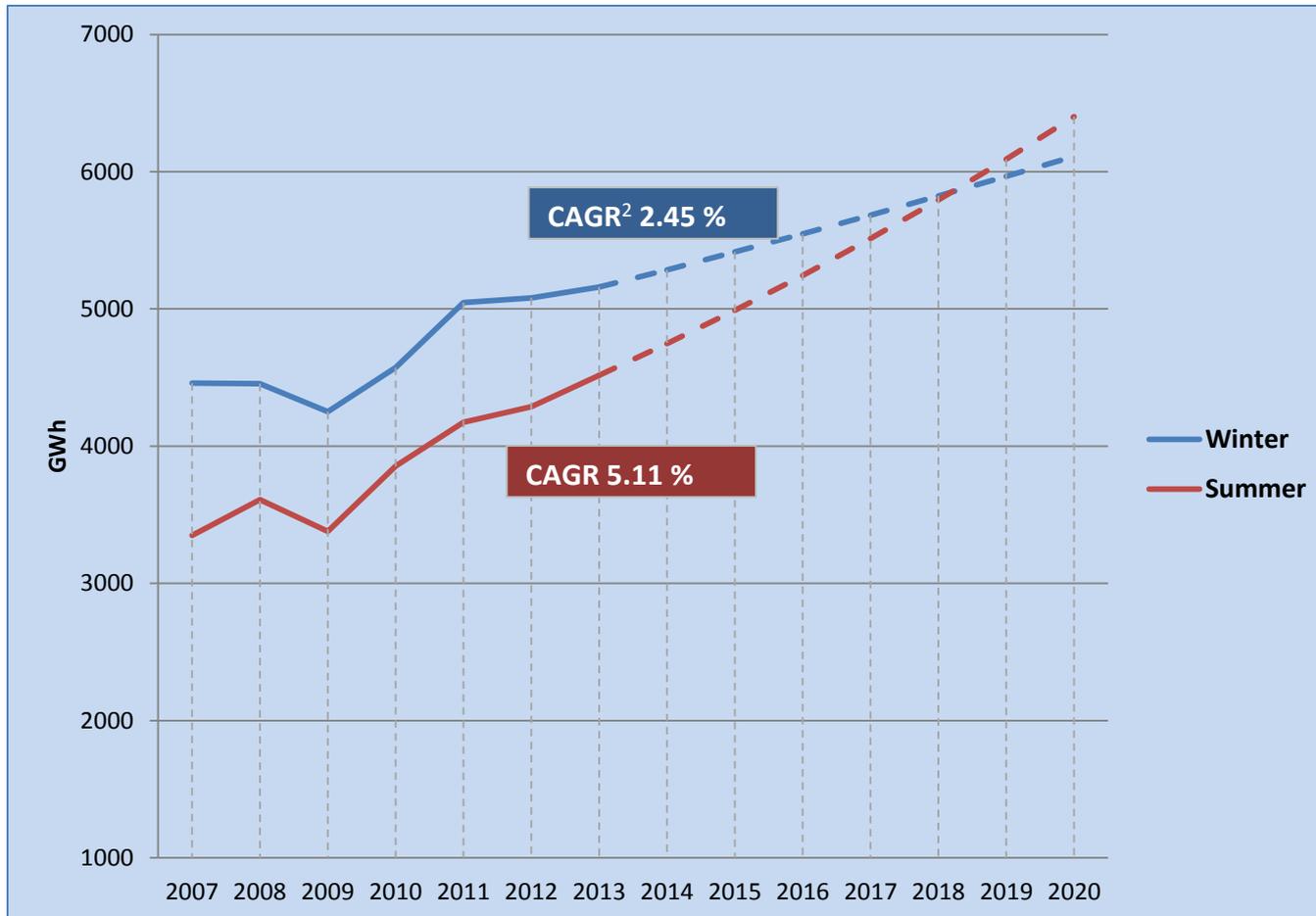
ELECTRICITY GENERATION VS. CONSUMPTION¹



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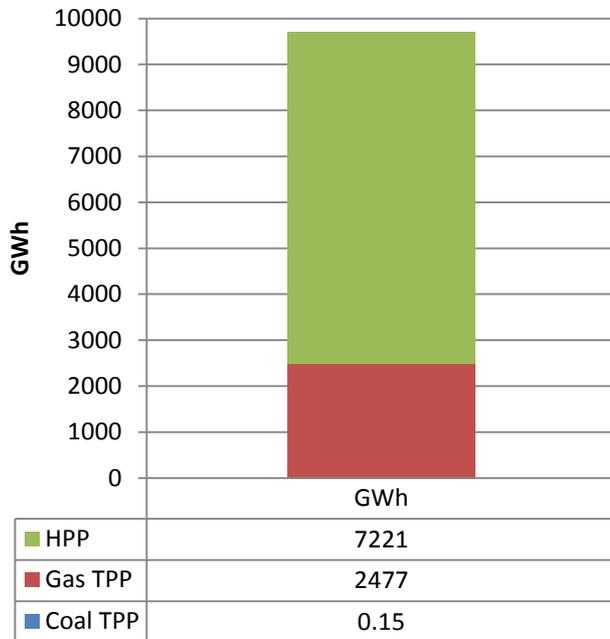


GROWTH OF CONSUMPTION OF ELECTRICITY DURING WINTER & SUMMER PERIODS¹

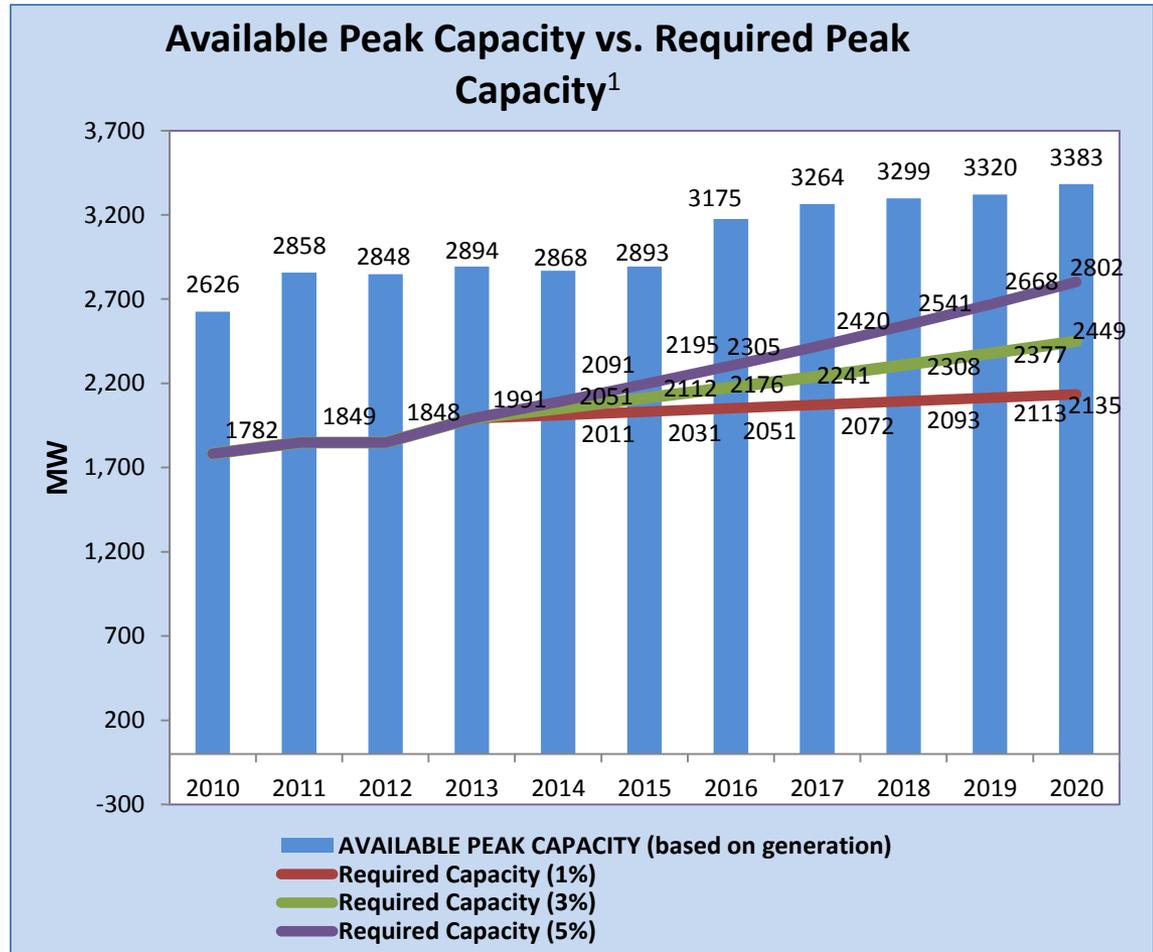


1. HPEP growth assumption
2. Compound Average Growth Rate (CAGR)

ELECTRICITY SECTOR (cont'd)



Electricity generation by source of energy (2012)



1. HPEP pessimistic, realistic and optimistic growth assumptions



NATURAL GAS SECTOR

Natural Gas is the largest single energy source for Georgia and it is forecasted to grow. Natural Gas Sector strategies include:

- Technical and contractual limits from gas pipelines restrict the ability to deliver gas to the TPPs during the peak times in the winter
- Natural gas storage is the highest priority for security of supply; Gas storage facility will greatly relieve the above issue during peak hours

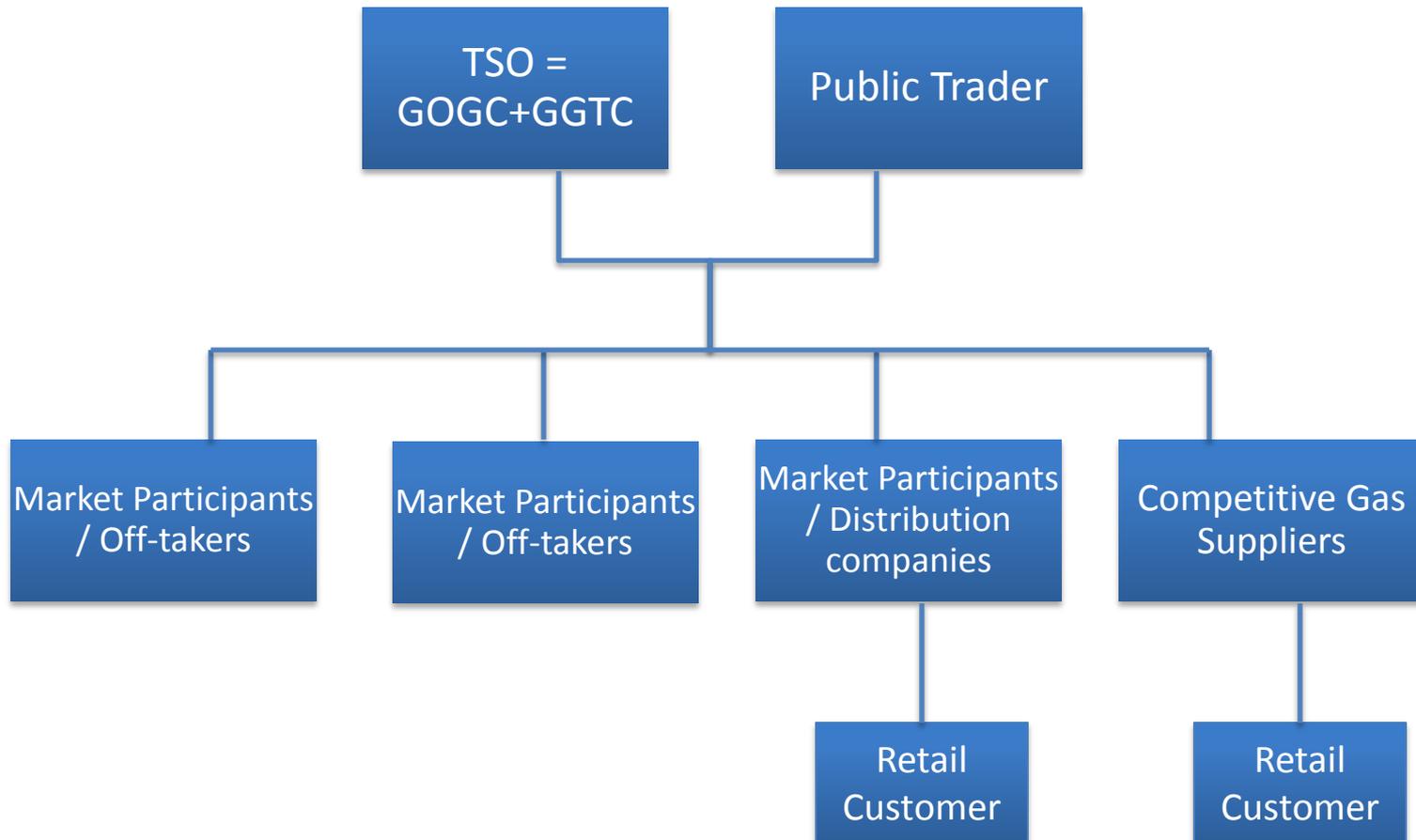


NATURAL GAS SECTOR (cont'd)

Natural gas sector strategies also include:

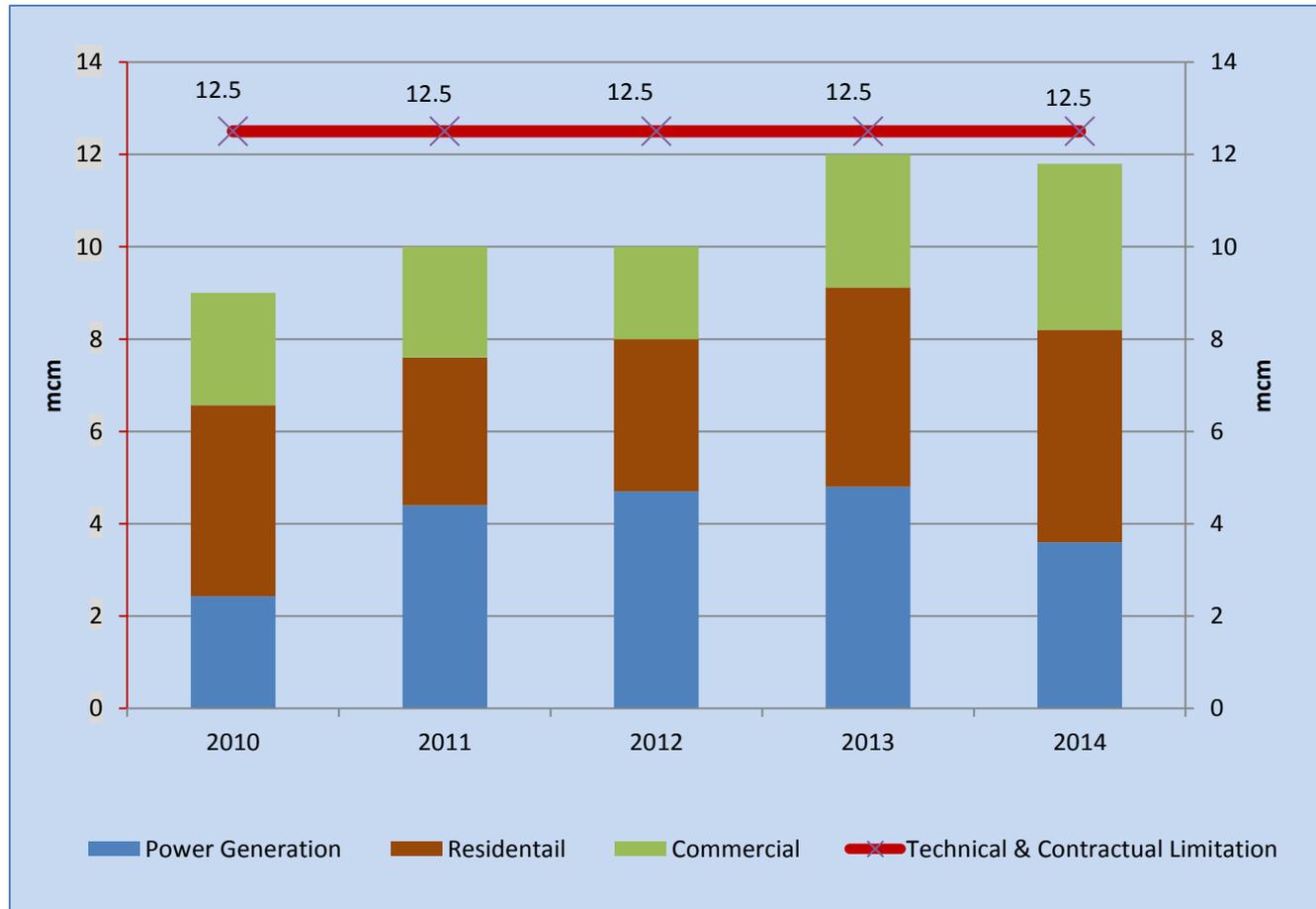
- Joining ENTSO-G
- Unbundling transmission and trading in accordance with EC/73/2009
 - Separate independent public trader must be created
 - GOGC (which owns transmission) and GGTC (the dispatcher) will be merged to create one Gas TSO
- Explore possible reserves of conventional and unconventional gas
 - Regulatory reform to attract investors to explore for shale gas reserves
 - Production sharing agreements so Georgia benefits

PROPOSED GAS MARKET STRUCTURE





DAILY PEAK GAS CONSUMPTION¹ VS. TECHNICAL & CONTRACTUAL LIMITATIONS²



1. Gas consumption depends on hydropower generation in winter
2. 2014 data is an estimate by Georgian Oil and Gas Corporation (GOGC)



OIL & OIL-BYPRODUCTS

Oil & oil-byproducts strategies include:

- Establish an independent oil sector regulator for upstream activities and authorize GNERC to regulate downstream
- Enhance research and development, particularly in upstream oil activities
- Reform current legislation to facilitate local oil refinery potential in a competitive market
- Improving downstream regulation including protection of consumers and environment
- Develop an emergency oil stock plan in accordance with EU energy *Acquis*



COAL SECTOR

- Georgia has significant coal reserves which should be exploited efficiently through the use of clean coal technologies under competitive energy markets
- Coal use should be considered for use for different economic activities:
 - Electricity generation
 - Industry use
 - Commercial and household heating
- Using of low grade coal and developing the full cycle of utilization, including the Coal Bed Methane (CBM) and Coal Mine Methane (CMM)
- Developing legislation on licenses for harvesting CBM/CMM



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TRANSPORTATION

- The trend of fuel-switching from oil to natural gas has been increasing resulting in need for regulation and monitoring of the market
- Introduce emission control practices for vehicles to reduce emissions
- Adoption of electric vehicles as the technology becomes affordable





RENEWABLE ENERGY SOURCES

- Renewable energy sources (RES) - biomass, hydro, geothermal, biofuels, solar and wind have technical and economic potential that are currently underutilized
 - Support research and development of RES
 - Devise incentives and measures encouraging purchase of renewable energy. i.e. provision of tax credit, privilege, and subsidies
- Establish Georgia as a regional green electricity trading platform
- Utilize biofuel potential
- Incentivize sustainable biomass production for biofuels and take advantage of Georgia's strong agricultural sector: for example, canola for biodiesel, eucalyptus trees for efficient biomass

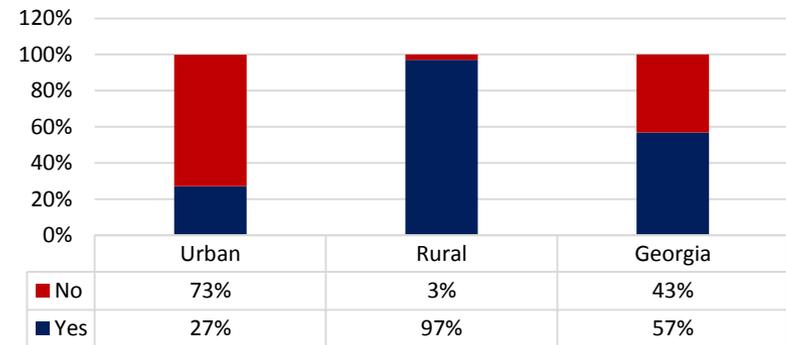
HOUSEHOLD ENERGY END-USE SURVEY

- Wood is a significant energy source for space-heating, water-heating and cooking; results show that wood consumption is five times more than estimated by National Statistics Office of Georgia
- Such heavy use of wood is a contributor to deforestation¹

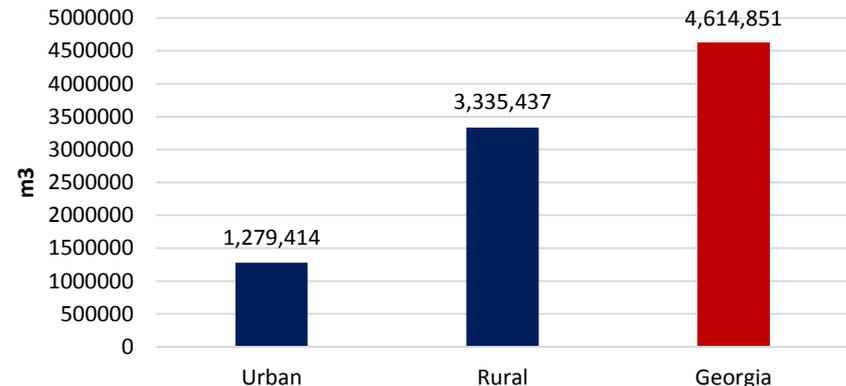
1. Caucasus Environmental NGO Network (CENN)

Use of firewood in Georgia

Did you use firewood during last 12 months?



Total wood used by Households during last 12 months (m³)





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MAIN ISSUES WITH WOOD CONSUMPTION

- Deforestation
- Illegal wood cutting
- Lack of proper pricing system for wood
- Efficient stoves are too expensive
- Natural gas cannot replace wood use as it is relatively expensive





PROPOSED SOLUTIONS

- Developing tree plantations and stricter monitoring
- Encourage banks to give energy credit for purchase of efficient stoves
- Decrease wood consumption through the following measures:
 - Improve wood burning practices
 - Switch from green to dry wood use
 - Use waste wood, hazelnut shells and sawdust
- Improve overall wood stoves/furnaces efficiency levels through equipment replacement¹



**Advanced efficiency
wood stove**



WOOD STOVE EFFICIENCIES & RESPECTIVE COSTS

	HEAT TYPE	INSTALLED COST	EFFICIENCY	FUEL UNIT	FUEL COST (PER UNIT)	HEAT PER UNIT (MM BTU)	FUEL COST (PER MM BTU)
WOOD STOVE	Svanetian wood stove	300-500 GEL	50%	CUBIC METER	80 GEL	2.85	28.07 GEL
	Simple wood stove	20-70 GEL	15-35%		80 GEL	1.42	56.14 GEL
	Sawdust stove	40-70 GEL	40%		30 GEL	1.99	15.04 GEL
ADVANCED STOVE	Pellet stove*	1850-13200 GEL	80-85%	TON	265 GEL	4.7025	56.35 GEL
	Efficient stove (Bioenergia)	250-300 GEL	80%	CUBIC METER	80 GEL	4.56	17.54 GEL

* For pellet stoves Bulgarian prices were used as a proxy for Georgia



STRATEGY: DEMAND-SIDE MANAGEMENT

Demand-side management (DSM) strategies include:

- Modification of consumer demand for energy through various customer response programs
- Large Consumers can partake in providing ancillary services in the electricity and gas markets
- Promotion of energy efficiency through research, development and demonstration (RD&D)
- Promotion of energy efficiency through EC-LEDS
- Legislation to safeguard the drivers of innovation



SOCIAL PROTECTION & AFFORDABLE ENERGY

Social protection strategies include:

- Provide proper price signals to consumers so they make informed decisions for energy consumption and energy equipment purchases
- Shift government subsidies of natural gas from the energy producers to vulnerable consumers
- Encourage competitive retail markets to deliver outcomes that are in the long-term interests of consumers
- Identify vulnerable consumers and protection in accordance with EU Energy *Acquis*



ENVIRONMENTAL & SOCIAL PROTECTION

Environmental Protection strategies include:

- Develop and utilize renewable energy sources in order to decrease CO₂ emissions
- Discontinue the practice of venting gas; either flare the gas released as a byproduct of coal harvesting or ideally capture it for local consumption
- Evaluate environmental, CBA and social impact costs and safety of watershed basin development using CBA methodology
- Reduce deforestation by improving infrastructure and access to electricity and employing efficient energy technology





NEXT IMMEDIATE STEPS

- Establish Energy Strategy working group led by the Ministry of Energy
- The working group will consist of experts from various energy sectors such as electricity, gas, coal, oil, Civil Society Organizations (CSOs) and government entities
- The government of Georgia will implement the agreed conclusions



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