Moldova Energy Policy Analysis:

The Role and Impact of Energy Efficiency and Renewable Energy Going Forward

USAID Regional Strategic Energy Planning Project

Gary Goldstein
International Resources Group

LeoGrand Hotel
Chisinau, Moldova

March 2, 2012
Why use the MARKAL/TIMES Energy System Model?

MARKAL/TIMES Building Blocks: What goes into the System?

What are the key components for the Reference Energy System?

Where are we now in the program and Next Steps?
• Provides an integrated energy systems modeling framework to guide policy formulation and investment priorities

• Widely used, proven and continually evolving

• Used to assess a wide range of energy, economic and environmental planning and policy issues

• Flexible, verifiable and adaptable methodology

ETSAP Partner Countries
MARKAL/TIMES Users
MARKAL/TIMES

Key Characteristics

- Developed and maintained under by the International Energy Agency – Energy Technology Systems Analysis Programme (IEA-ETSAP)
- Encompasses an entire energy system from resource extraction through to end-use demands as represented by a Reference Energy System (RES) network
- Employs least-cost optimization
- Identifies the most cost-effective pattern of resource use and technology deployment over time
- Provides a framework for the evaluation of mid-to-long-term policies and programs that can impact the evolution of the energy system
- Quantifies the costs and technology choices that result from imposition of the policies and programs
- Identifies the benefits arising for various policies and programs (e.g., increase energy security and economic competitiveness, reduced emissions)
MARKAL/TIMES
Building Blocks

2005 Energy Balance
Planning Horizon & System Settings
Energy Service Demand Projections
Future Resource Supply and Technologies
Fuel and Market Share Limits

Supply Sector
[Production and Installed Capacity]
- Resources and Imports
- Power & Heat

Demand Sectors
[Decomposition and Existing Technology Stock]
- Agriculture
- Industry
- Commercial
- Residential
- Transport*
• Energy Balance (2006/9)
• Analysis of the annual electricity load curve to establish sector consumption patterns
• End-use fuel consumption decomposition procedure
• Calibration throughout the energy system (resources, refining, power & heat, final energy by sector)
• Establishing drivers (e.g., GDP, population, saturation) and demand projections for each end-use
• Identify future resource supply, power sector and demand options
• Guiding the evolution of Reference scenario (BAU) energy system
  – Determine the “hurdle rates” for improved demand device (impediments to adoption of energy efficient options)
  – Decide upon fuel switching ranges in each sector
  – Reflect the cost of (electricity and gas) infrastructure expansion
  – Smoothing and taming model choices to reflect country situation
Simplified Reference Energy System

- Oil
- Natural Gas
- Uranium
- Coal
- Refining
- Electricity Generation
- Renewables
- Industry
- Commercial
- Residential
- Automobiles
### Reference Energy System Components

#### PRIMARY ENERGY SUPPLY
- **Mining**, e.g.
  - Crude oil
  - Natural gas
  - Coal
- **Imports**, e.g.
  - Crude oil
  - Oil products
- **Exports**, e.g.
  - Oil products
  - Coal
- **Renewables**, e.g.
  - Biomass
  - Hydro
  - Solar
  - Wind

#### CONVERSION TECHNOLOGIES
- **Fuel Processing Plants**, e.g.
  - Oil refineries
  - Hydrogen
  - Ethanol
- **Power Plants**, e.g.
  - Conventional
  - IGCC
  - Solar
  - Wind
  - Nuclear
  - CCGT
  - Fuel cells
  - CHP

#### END-USE TECHNOLOGIES
- **Industry**, e.g.
  - Steam boilers
  - Machinery
- **Commercial**, e.g.
  - Air conditioners
  - Light bulbs
- **Households**, e.g.
  - Space heaters
  - Refrigerators
- **Agriculture**, e.g.
  - Pumps
  - Tractors
- **Transport**, e.g.
  - Gasoline car
  - Fuel cell bus

#### DEMAND FOR ENERGY SERVICE
- **Industry**, e.g.
  - Process steam
  - Motive power
- **Commercial**, e.g.
  - Cooling
  - Lighting
- **Households**, e.g.
  - Space heat
  - Refrigeration
- **Agriculture**, e.g.
  - Water supply
- **Transport**, e.g.
  - Person-km

#### Resource Supply-Cost Curves
#### Technology Cost and Performance
#### Device Cost and Performance
#### Demand Projections

Level of technology detail is a function of available data and nature of the questions and policies to be explored.
Where we are now?

- **Substantial progress** has been made by participating countries in developing a useful tool for national strategic energy planning and the skills to work with it.
- National models are positioned to play a **significant role in policy formulation** and energy strategy deliberations.
- Current analyses look to **quantify the benefits and costs** of different Energy Efficiency (EE) and Renewable Energy (RE) targets, and other national priorities.
- Today’s Academy of Sciences of Moldova / Institute of Power Engineering (ASM/IPE) presentation makes a strong case that Energy Efficiency and Renewable Energy investments can contribute to **improved energy security, promoting economic growth, and reduce greenhouse gas emissions** for Moldova.
• Many assumptions have to be made and there is clearly room to refinement as part of a **consensus building process**, for which this workshop is meant to serve as a solid starting point in Ukraine.

• Similar **National Energy Policy workshop briefings** have been held in two other Energy Community countries, and planned for 2012 in two others.

• Here in Moldova, besides the progress to date, **analyses are also planned to**
  – Complete the Energy Community Regional Energy Strategy Data Call
  – Contribute to the preparation of the update to the Energy Strategy 2030
  – Provide support for the Moldova's Task Force Group on Gas-to-Power Initiative of the Energy Community
  – Provide support for Moldova's Renewables Action Plan (NREAP) for Energy Community
  – Perform updated Energy Efficiency analysis in support of Moldova’s Energy Efficiency Action Plan (NEEAP)
Major Europe MARKAL/TIMES Analyses

• IEA Energy Technology Perspectives - Scenarios and Strategies to 2050 [16 region global model]
  http://www.iea.org/techno/etp/index.asp

• UK Climate Change Policy “White Paper”
  http://www.ukerc.ac.uk/ResearchProgrammes/EnergySystemsandModelling/ESM.aspx

• New Energy Externalities Developments for Sustainability (NEEDS)
  http://www.isis-it.net/needs/

• The Pan-European TIMES model (PET)

• RES2020 examining the EU renewables directive
  http://www.cres.gr/res2020/

• REALISEGRID optimal development of European transmission infrastructure
  http://realisegrid.rse-web.it/

• Risk of Energy Availability: Common Corridors for Europe Supply Security (REACCESS)
  http://reaccess.epu.ntua.gr/TheProject/ProjectObjectives.aspx
Thank You!

Gary Goldstein
International Resource Group / DecisionWare, Inc.

E-mail: gary.a.goldstein@gmail.com