Objectives of Study

- To illustrate the MARKAL-MACRO Model as a viable tool to assist strategic planning in R&D programs
- To evaluate the costs and benefits of EERE R&D portfolio under alternative scenarios
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Description of Scenarios

- Reference: AEO2001 baseline assumptions
- EERE : EERE at reference price (2030: $3.46/Mcf for Gas, $23.5/bbl for oil)
- EERE High Oil & Gas Price (2030: $4.5/Mcf for Gas, $35/bbl for oil)
Factors Affecting the Contribution of EERE Portfolio

- Reduced capital cost
- Improved performance
- Lower hurdle rate
- Earlier date of introduction
- Financial incentives

Residential Service Demand Growth Index

- High growth rates for air conditioning and miscellaneous appliances.
- Low growth rates for space heat and refrigeration
Commercial Service Demand Growth Index

- High growth rates for Office product and misc. appliances.
- Low growth rates for air conditioning and lighting

Industry Service Demand Growth Index

- High growth rates process heat and machine drive.
- Low growth rates for feedstock and basic metals
Transportation Service Demand Growth Index

- High growth rates for air travel and freight trucks.
- Low growth rates for LDV and shipping

Economic Benefits of EERE Portfolio

- Energy bills to decline by $3 billion in 2005, $7 billion in 2010, $30 billion in 2020, and $50 billion in 2030
- GDP to increase by $3 billion in 2005, $5 billion in 2010, $10 billion in 2020, and $100 billion in 2030
Costs and Benefits of EERE Portfolio

- Incremental investment is greater than savings in energy bills in earlier years, but represents only a small fraction of the savings in the long run.
- Savings in energy bills are due to reduced consumption and lower prices.

Non-Renewable Primary Energy Savings by Sector

- Non-renewable energy savings are due to energy efficiency improvements and increase use of renewable resources in electricity generation
- Non-renewable energy savings total 4 quads in 2010, 11 quads in 2020, and 18 quads in 2030.
Energy Intensity by Sector
Reference vs. EERE

- Residential
- Commercial
- Industrial
- Passenger Vehicle

NOx Reduction - EERE Portfolio

- Reduction in NOx emissions amounts to more than 1 million MT in 2020, and 2 million MT in 2030.
Carbon Reduction – EERE Portfolio

- Reduction in carbon emissions amounts to 70 million MMT in 2010, and 190 million MT in 2020 and 300 million MT in 2030.

Marginal Cost of Carbon Reduction
Reference vs EERE

- With EERE Portfolio, the marginal cost of carbon reduction is $132 per ton in 2010 – more than $50 per ton lower than the cost in the reference case.
- The marginal cost increases rapidly to $520 per ton in 2030 under the EERE scenario, but $500 below that of the reference case.
Security Benefits of EERE Portfolio

- EERE Technologies reduce oil intensity from 2.9 to 2.7 thousand Btu/$ GDP in 2020 and from 2.7 to 2.4 in 2030.
- Total oil imports are reduced by 380 thousand bbl per day in 2010 and by 2.4 million bbl per day in 2030.

Security on Infrastructure –Distributed Energy Resources

- DER technologies improve overall generation efficiency
- DER technologies reduce concentration of power generation and system reliabilities
- DER technologies reduce reliance on transmission lines and power supply disruptions
Economic Benefits of EERE Portfolio, High Oil & Gas Price

- Savings in energy bills are higher than under reference prices, declining by $40 billion in 2020, and by $80 billion in 2030
- GDP to increase by $40 billion in 2020 and by $160 billion in 2030

Carbon Reduction – EERE High Price

- Reductions in carbon emissions due to EERE are greater under high prices, amounting to 255 million MMT in 2020, and 350 million MT in 2030.
**NOx Reduction – EERE High Price**

- Reductions in NOx emissions due to EERE are greater under high prices, amounting to 1.7 million MT in 2020, and 2.6 million MT in 2030.

**GDP Losses under Carbon Emission Reduction**

- Under the Reference Scenario, GDP is projected to decrease by 1.7% in 2020 and 4.3% in 2030.
- With EERE Portfolio, GDP loss is reduced to only 0.9% in 2020 and 1.8% in 2030.
Primary Energy Consumption, EERE vs. EERE with Carbon Reduction

- Under increasing carbon emission limit pressure, biomass will play a much greater role in resource supply.
- Coal to hydrogen conversion with carbon sequestration will be a cost-effective alternative in the long run.