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**MUNICIPAL ENERGY  
REFORM IN UKRAINE**

# LEDS/INDC Analysis Using TIMES-Ukraine

## Short Briefing from Inter-Ministerial Working Group Presentation



**DecisionWare Group LLC**  
Policy Analysis for  
Energy, Economy and Environment



**Ukraine National Academy of Sciences  
Institute for Economic Forecasting**

**July 1, 2015  
Kiev, Ukraine**



## Summary of INDC Submissions

INDC Submissions*			
Country	Nature of Baseline	Reduction Target	Planned use of international market mechanisms
Andorra	below BAU in 2030	37%	no
Canada	below 2005 level in 2030	30%	possible
Ethiopia	below BAU in 2030	64%	yes
Europe	below 1990 level in 2030	40%	trading within EU
Gabon	below BAU in 2025	50%	no
Liechtenstein	below 1990 level in 2030	40%	yes
Mexico	below BAU in 2030	25% / up to 40%	unconditional / with international cooperation
Morocco	below BAU in 2030	13% / 32%	unconditional / with international cooperation
Norway	below 1990 level in 2030	40%	possible
Russia	below 1990 level in 2030	70-75%	no
South Korea	below BAU in 2030	37%	yes
Switzerland	below 1990 level in 2030	50%	yes
United States	below 2005 level in 2025	26-28%	no

\*total of 13 as of June 30, 2015



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## Objectives of this LEDS / INDC Analysis

- Identify integrated strategies for economic and sustainable energy development that offer the most
  - Economic way of covering energy needs
  - Efficient use of domestic resources
  - Enhancement of energy security
  - Reduction of environmental impacts
- Present analysis results from the application of TIMES-Ukraine in support of LEDS / INDC policy formulation to
  - Ministry of Ecology and Natural Resources
  - Ministry of Economic Development and Trade
  - Ministry of Regional Development, Construction, and Communal Living
  - Ministry of Energy and Coal Industry
  - State Agency for Renewable Energy and Energy Efficiency
- Provide analysis results via the web-based VedaViz Portal
- Energy sector INDC reduction potential to be developed by end of July for government approval



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## TIMES-Ukraine Integrated Energy System Model

- Developed at the Institute of Economics and Forecasting, Ukrainian National Academy of Sciences (IEF UNAS) to perform studies on energy and environmental policy scenarios
- TIMES-Ukraine is a full sector energy system optimization model employing the TIMES modeling framework, developed under the auspices the International Energy Agency's Energy Technology Systems Analysis Program ([www.iea-etsap.org](http://www.iea-etsap.org))
- TIMES is a widely accepted methodology that meets international requirements for energy and environmental analysis, and has been applied by over 300 institutions in more than 70 countries
- TIMES models are used by nearly all EU countries and numerous others to support the development of national GHG policies and mitigation strategies



## Guiding Premises for the Analysis

- **Pick the “low hanging fruit” first:** Cost-effective efficiency and renewable energy options should be incentivized as the first priority
- **Continue current commitments:** Existing Energy Community directives and regional cooperation agreements should be extended into the future
- **Examine shale gas impacts:** Assess the economic and energy security implications of developing Ukraine’s shale gas resource
- **Investigate CO<sub>2</sub> price impacts:** Determine how technology choices and costs change if an international price is established for CO<sub>2</sub> emissions
- **Determine the implications:** In terms competitiveness and energy security when setting Ukraine’s INDC



## LEDS/INDC Scenario Definitions

Scenario	Descriptor	Definition
<b>DEMAND</b>	Low	GDP growth of 15% by 2030 compared to 2012
	Reference	GDP growth of 32% by 2030 compared to 2012
	High	GDP growth of 64% by 2030 compared to 2012
<b>EFFICIENCY</b>	No	Implementation of energy efficient devices restricted to historical levels
	Measures	Incentive Measures applied to facilitate cost effective energy efficiency uptake
	Target	National Targets of 9/18% for 2020/2030
<b>RENEWABLES</b>	No	Implementation of RE limited
	Measures	Incentive Measures applied to facilitate cost effective RE projects
	Target	Targets for Gross final energy consumption of 11/18% for 2020/2030
<b>SHALE GAS</b>	No	No development of Shale (unconventional) gas
	Shale	Unconventional and conventional gases will cover domestic demand in 2035
<b>CO<sub>2</sub> PRICE</b>	No	No international price on CO <sub>2</sub> emissions
	Low	CO <sub>2</sub> price of 5/6/10 EUR/ton in 2020/2030/2050
	Medium	CO <sub>2</sub> price of 10/15/25 EUR/ton in 2020/2030/2050
	High	CO <sub>2</sub> price of 25/30/50 EUR/ton in 2020/2030/2050

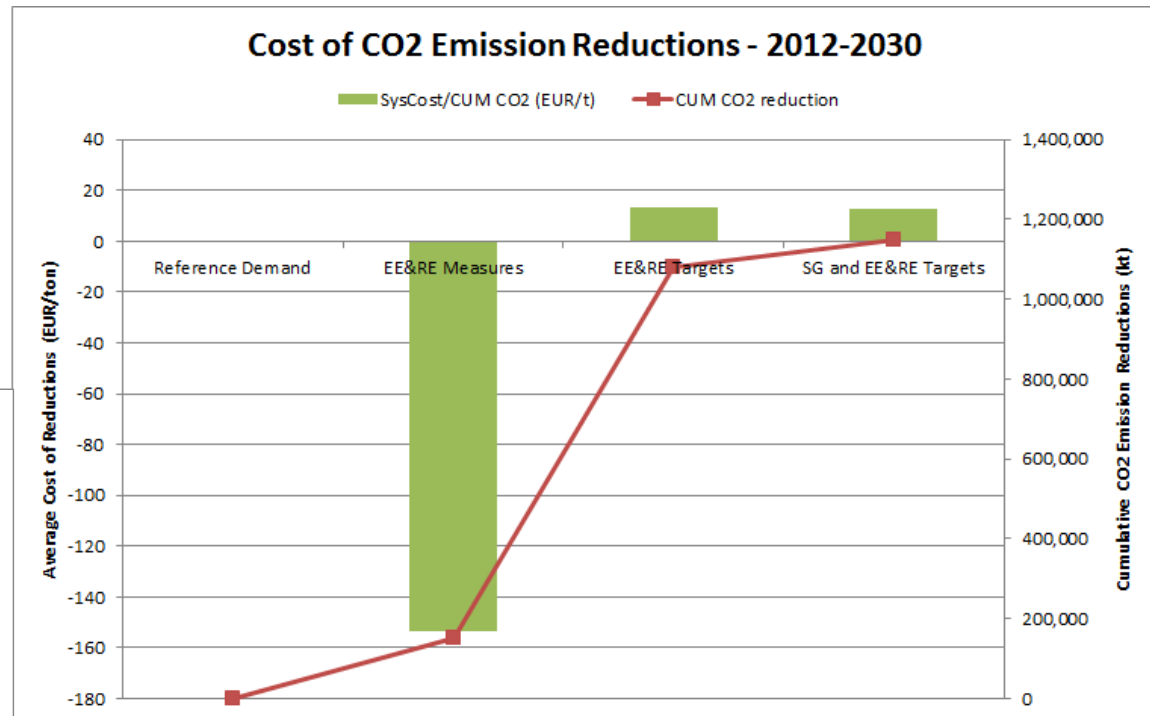
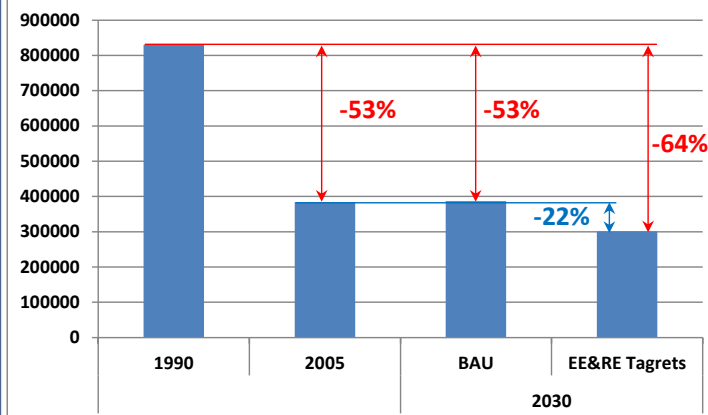
**BAU scenario consists of Reference Demand, No Efficiency, No Renewables, No Shale gas and No CO<sub>2</sub> Price**



EE&RE Targets appear to be the most cost-effective policies needed for significant CO<sub>2</sub> reductions with an average cost of under EUR 15 per ton. They are also consistent with EnC commitments and EU integration requirements. Shale gas has a marginal impact on INDC.

## 2030 INDC Reduction Levels (Unconditional)

- 22% below BAU
- 64% below 1990
- 22% below 2005





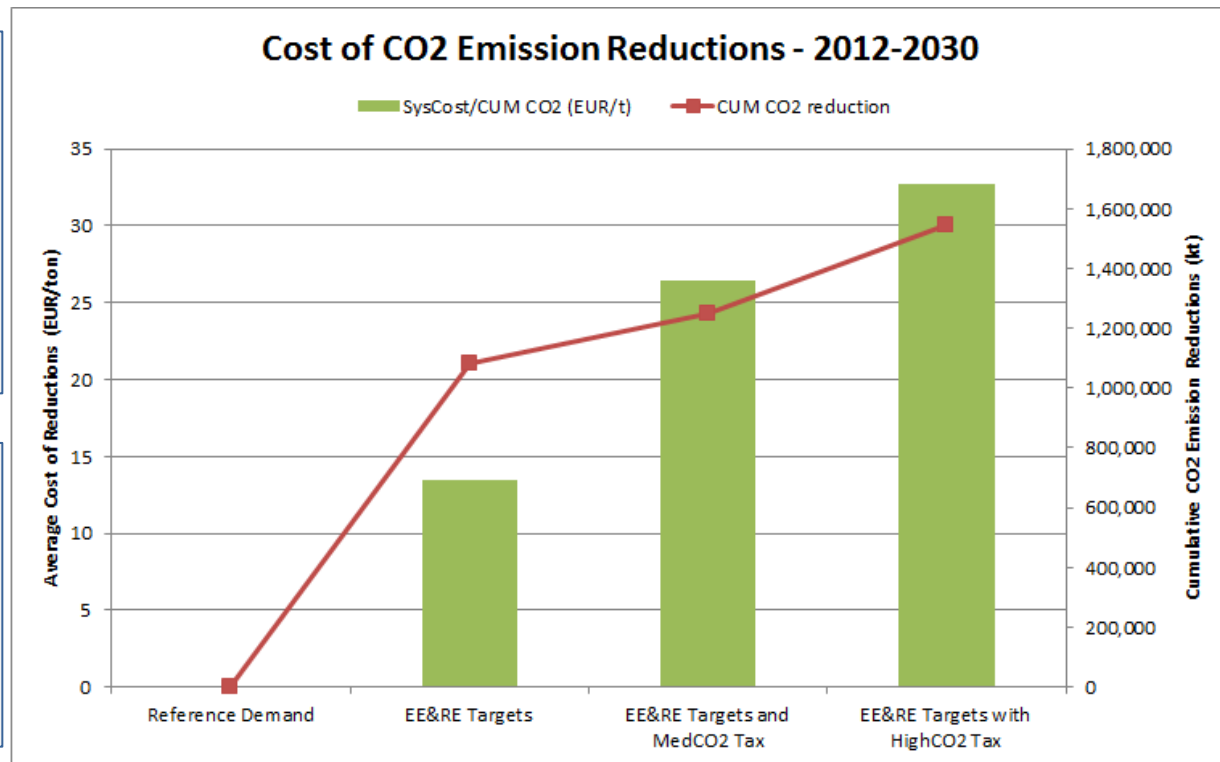
**EE&RE Targets in combination with a Medium or High CO<sub>2</sub> price will produce an additional 150 million to 400 million tons of GHG reductions, which could represent a range of additional investment that Ukraine could mobilize at these CO<sub>2</sub> emission prices with international cooperation.**

## 2030 INDC Reduction Levels (Conditional)

- 27 to 35% below BAU
- 66 to 70% below 1990
- 26 to 34% below 2005

## Potential Foreign Investment

- Medium: 18 B€
- High: 36 B€







# Combined Energy Efficiency & Renewable Energy

## Key Observation

Policies that promote both EE and RE are the most cost-effective means of reducing GHG emission while at the same time supporting economic growth, promoting competitiveness, and enhancing energy security, while improving diversification, promoting local jobs and hedging against future energy price uncertainty.

## Main Policies & Measures

### Energy Efficiency

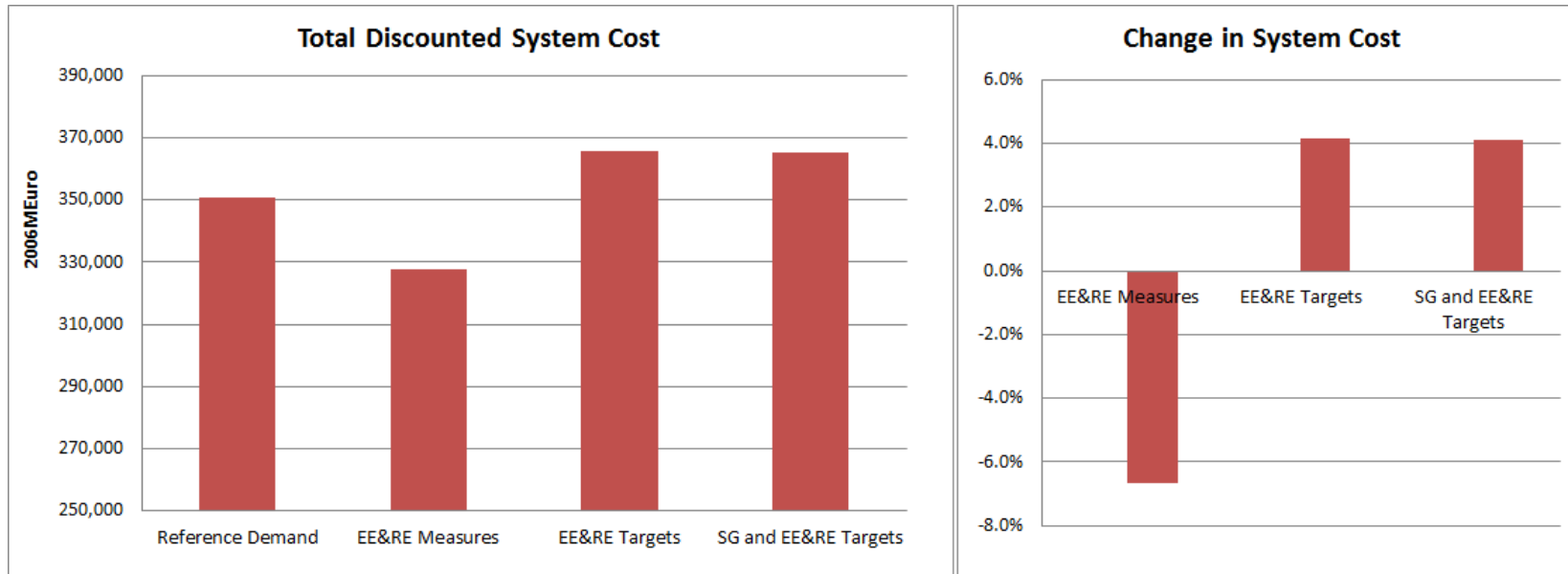
- Building Retrofits
- Building Standards
- Metering of energy consumption
- Energy audits and management
- Motor fuels standards
- Promotion of electric and LPG cars
- Reduction of coal and gas consumption in Industry
- Improvements in heating plant efficiency
- Substitution of gas-turbine engines to electric drive on the gas-compressor stations
- Reduction of losses from natural gas lines
- Implement improved building standards, technical regulations and methodologies

### Renewables

- Promote development of wind, solar and large hydro power plants
- Shift from gas to biomass in district heating
- Explore potential for biomass co-firing & dedicated CHPs
- Promote rooftop solar PV
- Promote heat pumps in Residential and Commercial sectors
- Use of alternative fuels (LPG, biodiesel, ethanol) in the transport sector



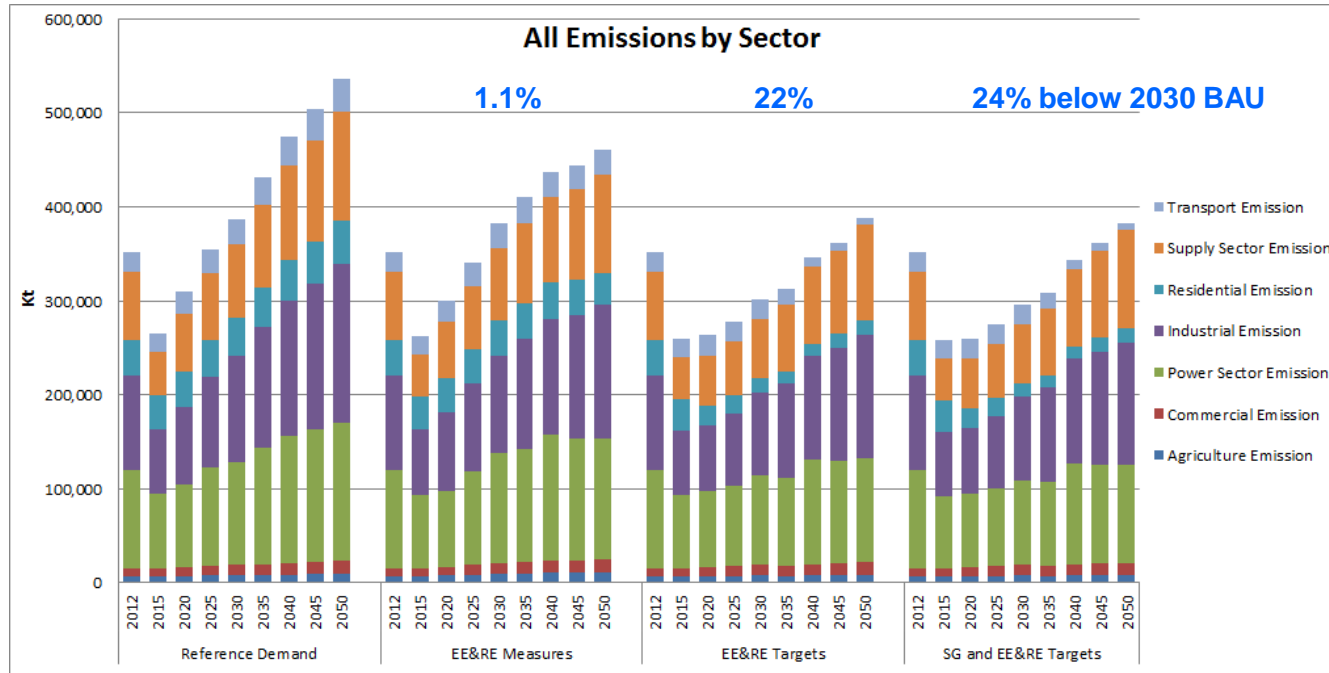
## EE & RE – System Cost



- Combined EE&RE Measures reduce System Cost by 6.6%, with the EE&RE Targets increasing system cost by 4.2% compared to Reference.
- Shale gas with EE&RE Target has minimal impact on the cost of the INDC scenario, as it primarily substitutes domestic gas for imports.



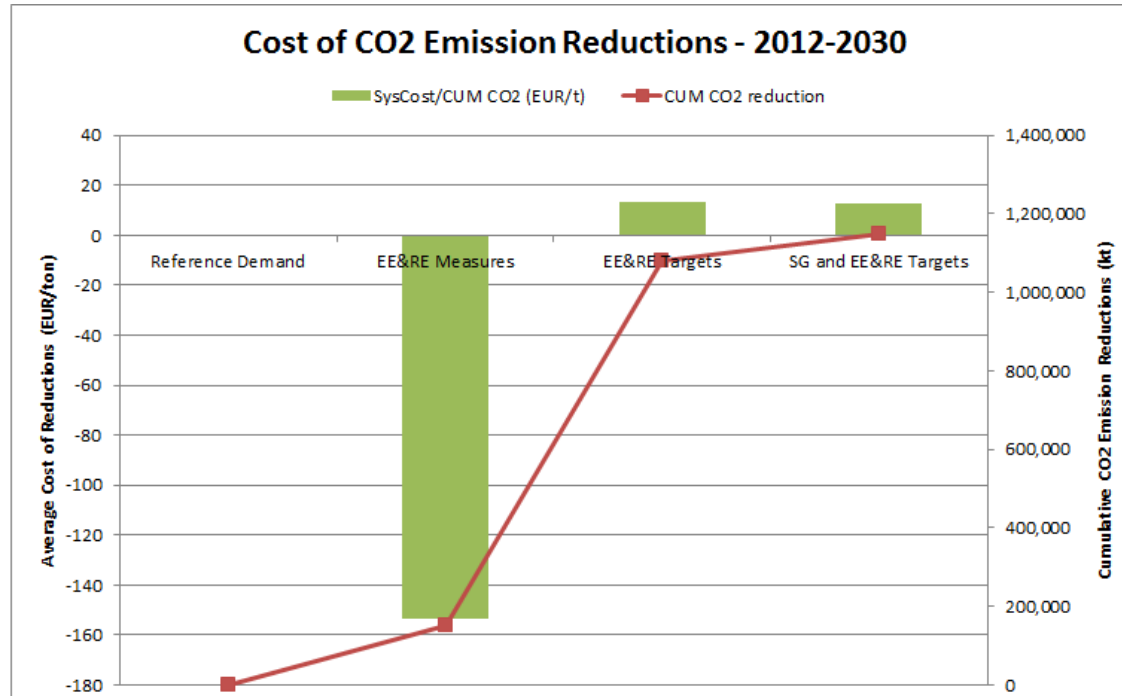
## EE & RE – CO<sub>2</sub> Emissions



- Combined EE&RE Measures reduces CO<sub>2</sub> emissions by 150 million tons between 2012 and 2030.
- EE&RE Target reduces CO<sub>2</sub> emission by 1080 million tons.
- Shale gas with EE&RE Target only slightly increases CO<sub>2</sub> emission reductions to 1150 million tons.



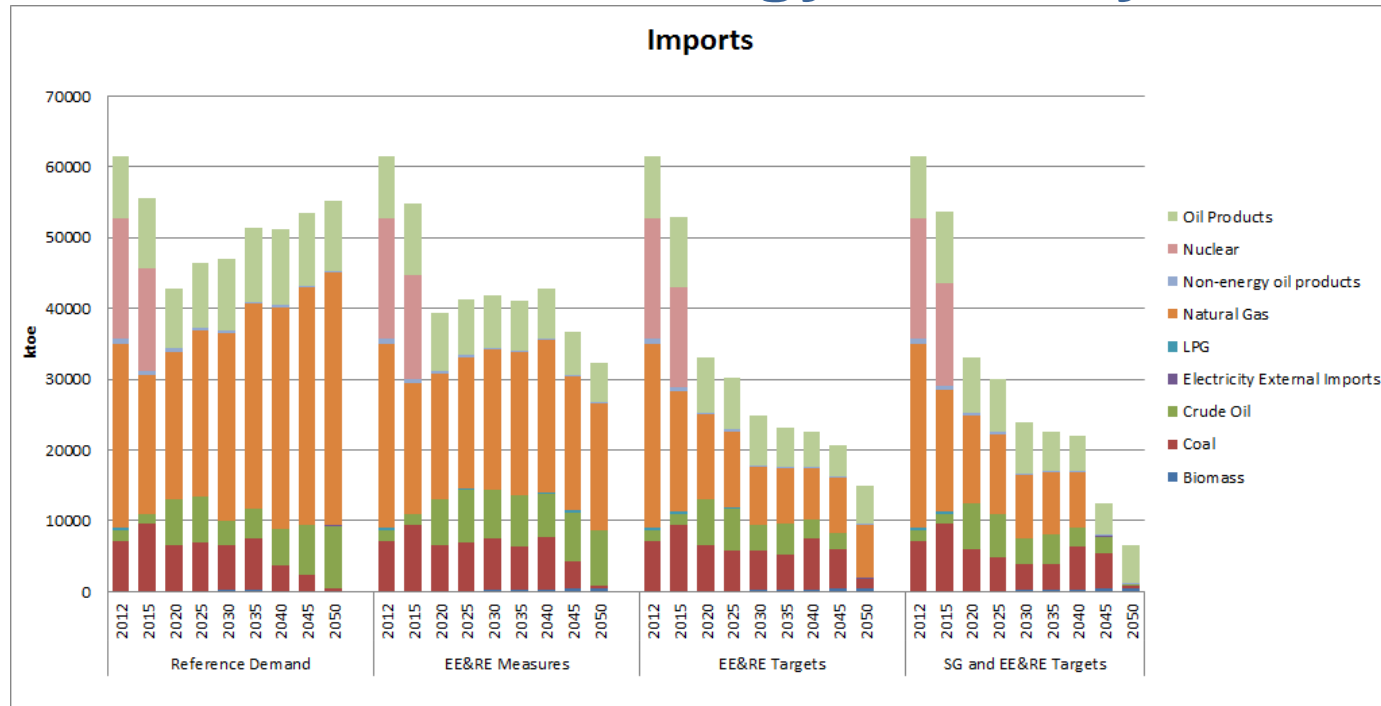
## EE & RE – Environmental Benefits



- Emission reductions under EE&RE Measures are quite cost-effective.
- Implementing the EE&RE Targets increases the emission reduction cost to about 13.5 EUR per ton.
- Shale gas with EE&RE Target reduces the average cost of emissions reductions to about 12.5 EUR per ton.



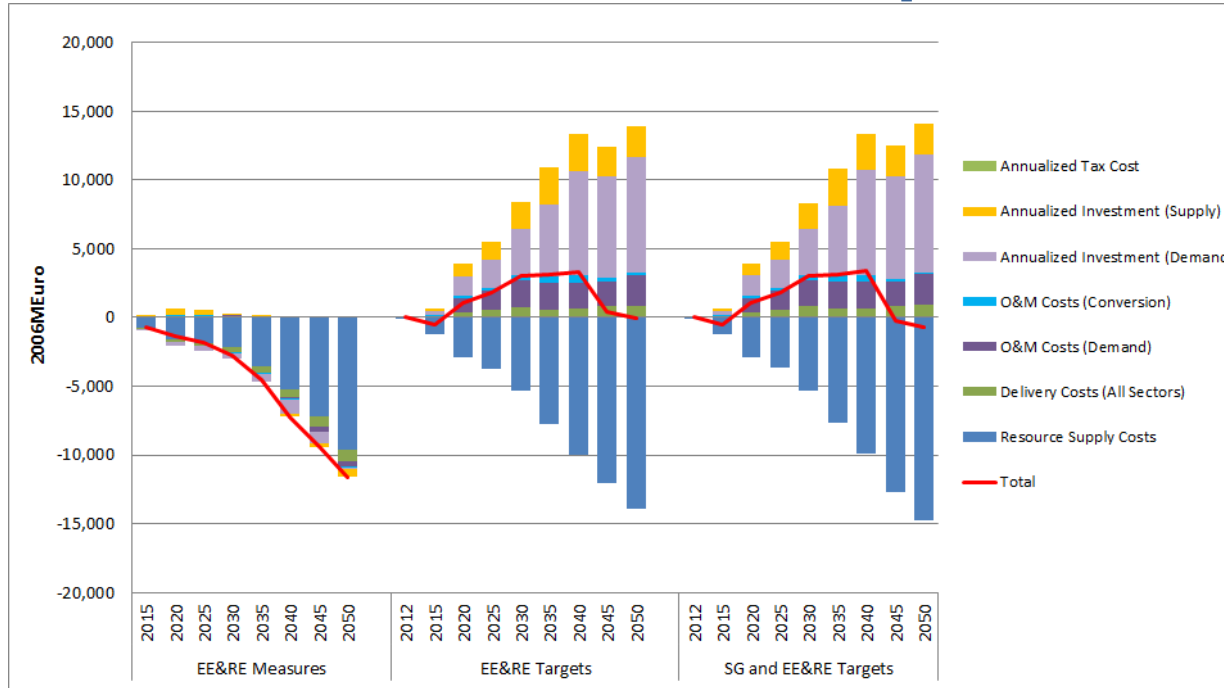
## EE & RE – Energy Security



- Combined EE&RE Measures reduce overall energy imports by 11% in 2030.
- EE&RE Target reduces imports by 47% relative to Reference.
- Shale gas with EE&RE Target reduces imports by 49% relative to Reference.



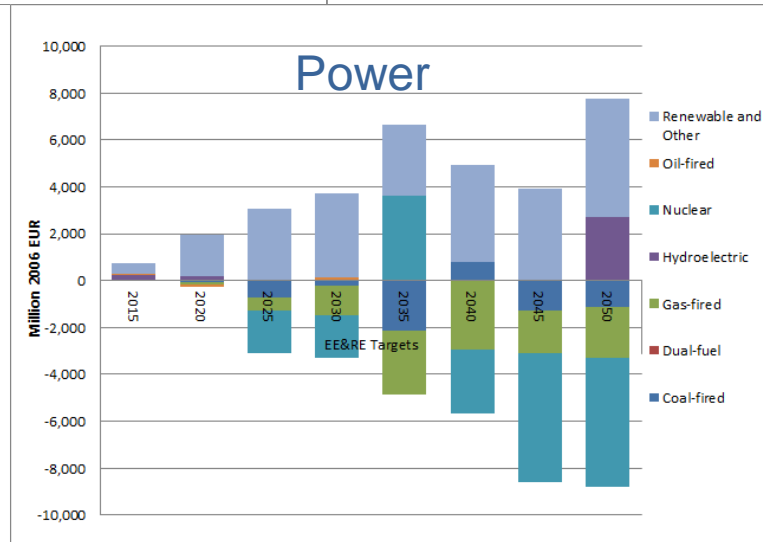
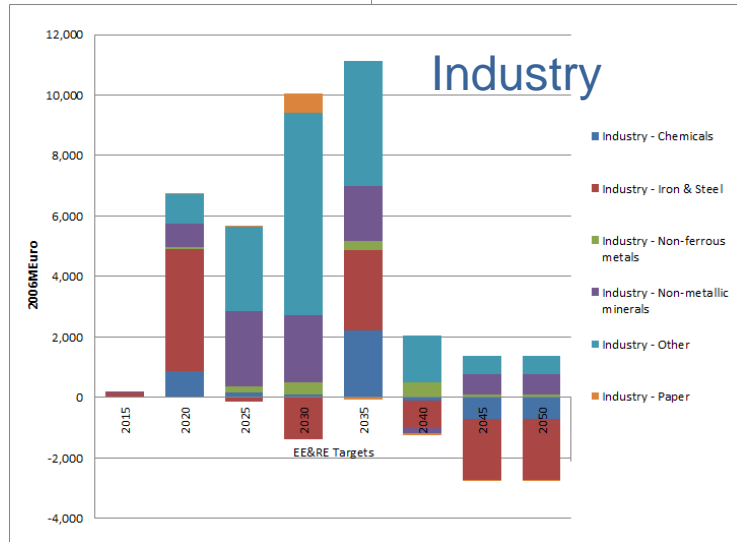
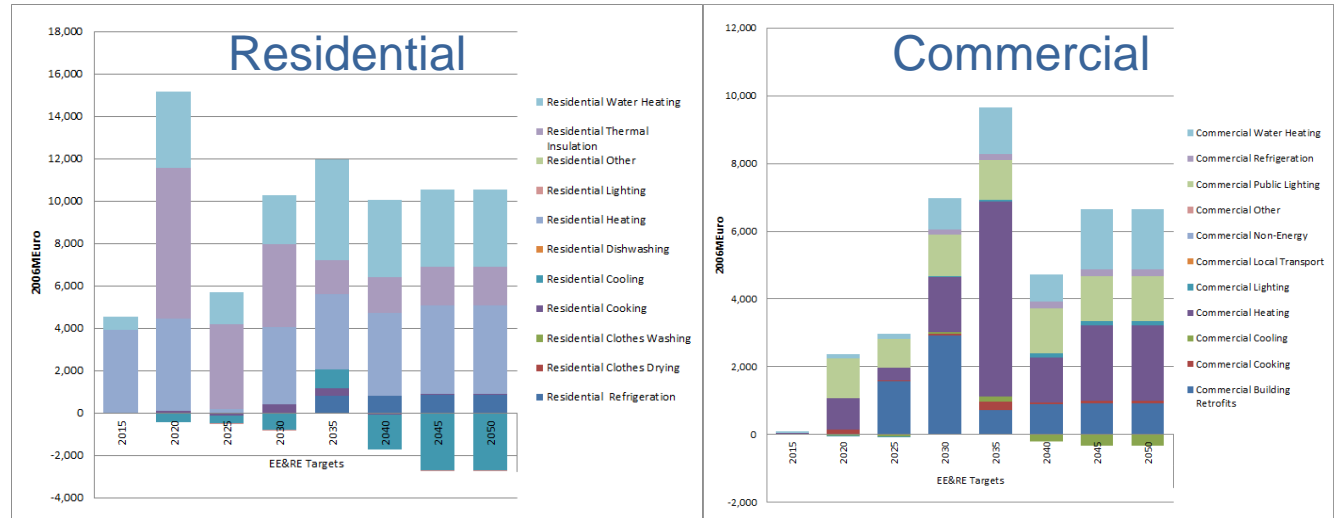
## EE & RE – Investment Implications



- Combined EE&RE Measures produce significant fuel savings.
- EE&RE Target increases investment in both supply and demand devices, which fully offsets the fuel savings.
- Shale gas with E&RE Targets does not change the investment pattern.

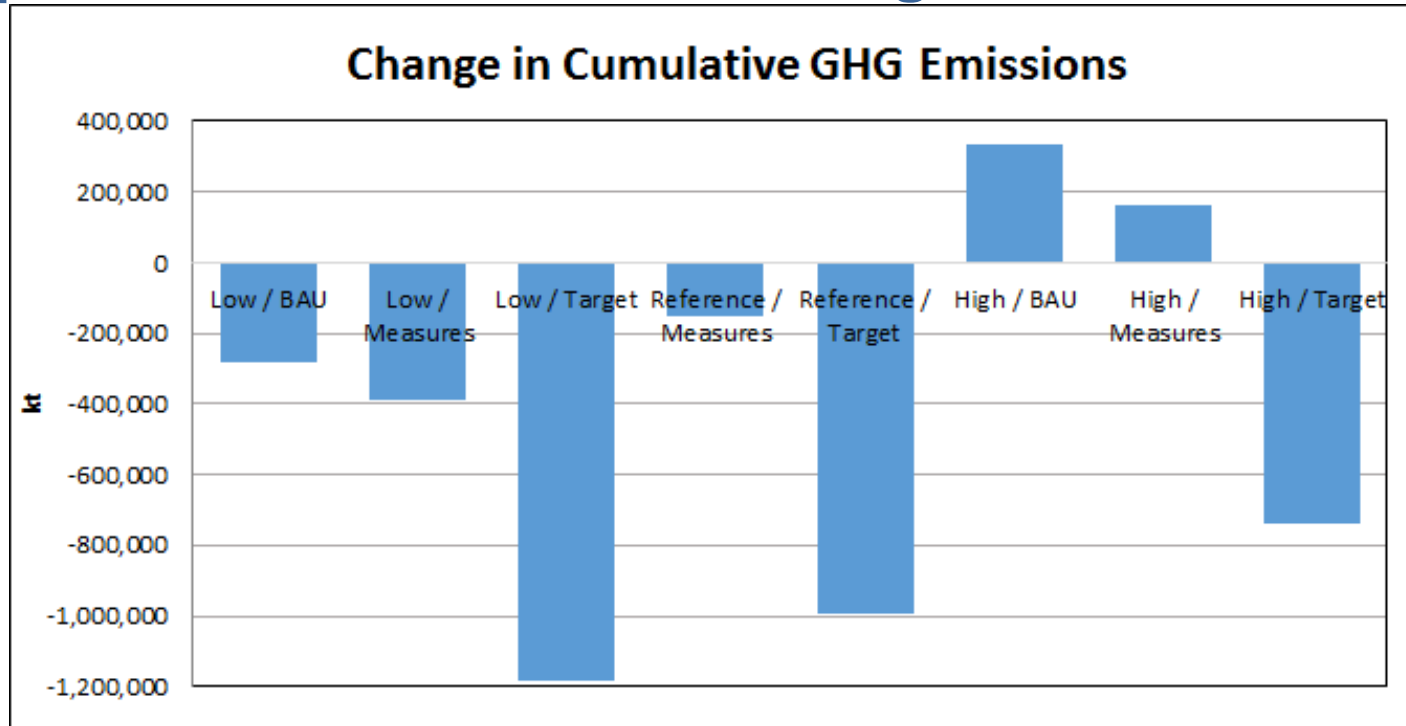


## Incremental Investments to Achieve EE&RE Targets





## Impact on GHG Emissions of High and Low Demand

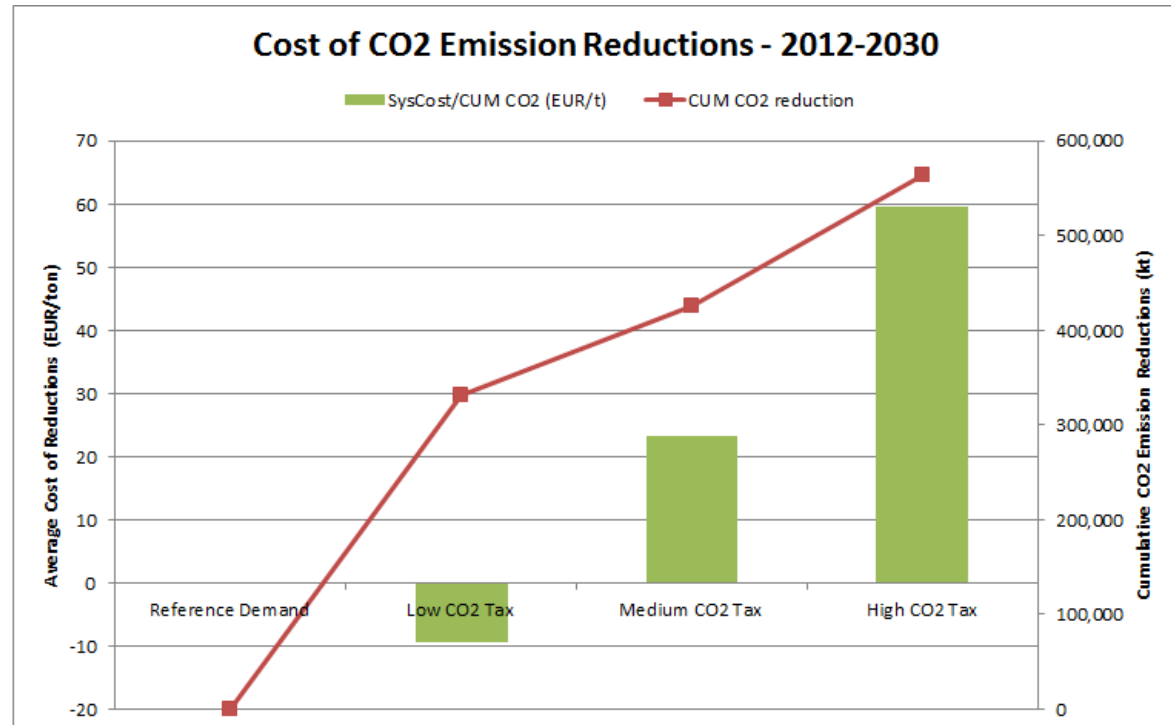


- Low demand reduces GHG emissions relative to BAU by 280 million tons.
- High demand increases GHG emissions relative to BAU by 335 million tons.
- EE&RE Measures and Targets reduce GHG emissions similarly to the Reference demand scenarios.





## CO<sub>2</sub> Price Cases



- A Low CO<sub>2</sub> price stimulates emission reductions (about 330 million tons) that reduce fuel consumption with a higher cost savings than the CO<sub>2</sub> price.
- A Medium CO<sub>2</sub> price results in an average cost of 23 EUR per ton and reductions of 425 million tons.
- A High price results in about 564 million tons of reductions and an average cost of 60 EUR per ton.



## Energy Sector INDC Reduction Potential

Unconditional*			
Demand	Low	Reference	High
BAU	29%	22%	14%
1990	67%	64%	60%
2005	29%	22%	13%

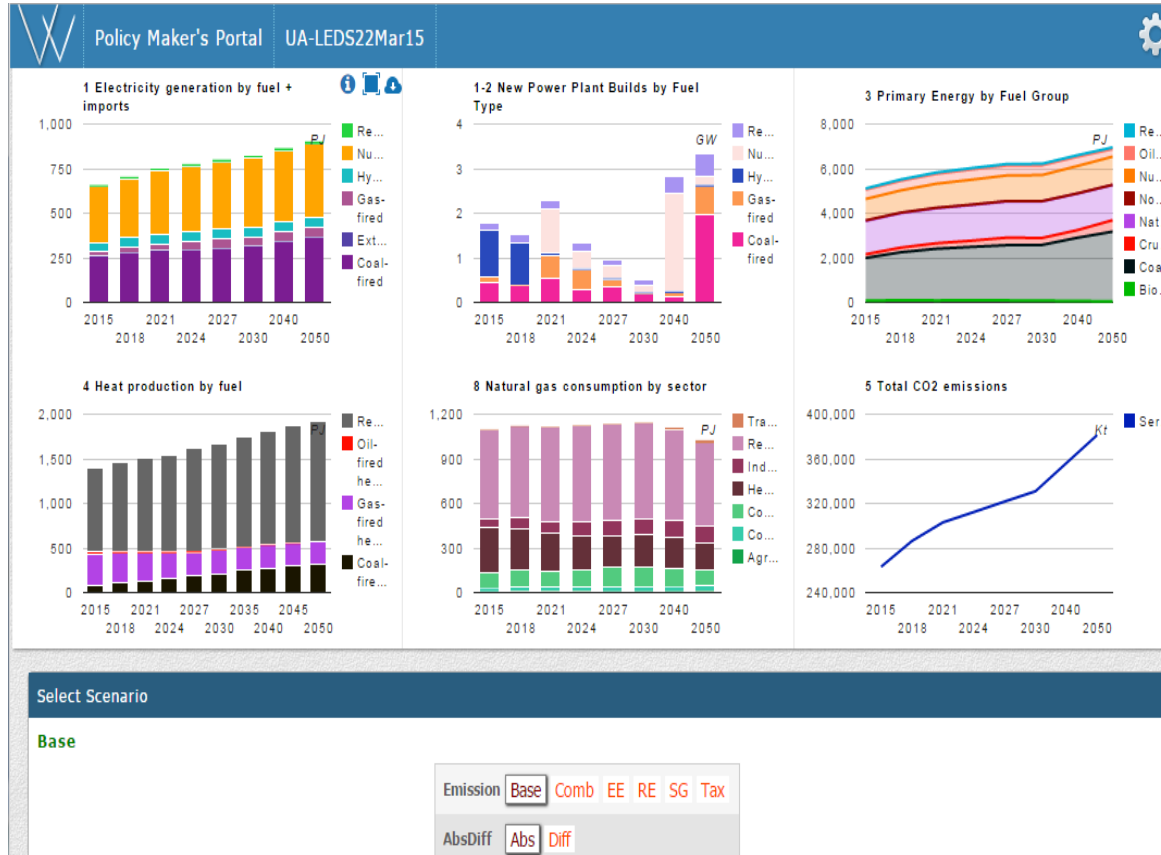
\* assumes extension of current EE&RE EnC targets (18% FE below BAU, 18% RE share) in 2030

Conditional*			
Demand	Low	Reference	High
BAU	32-43%	28-35%	19-26%
1990	69-73%	66-70%	62-65%
2005	32-42%	27-35%	18-25%
Revenue	18-36B€	18-36B€	18-36B€

\* assumes international CO<sub>2</sub> price of 15 to 30€ per ton in 2030



## Policy Advisor Scenario Review Web Portal



- Enables policy advisors to be involved in the analysis process via a highly interactive web-based portal to examine many combinations of scenarios by simply switching between scenario variant values
- Encourages the exchange of ideas & observations via a user forum