Energy Community Investment Challenges: Fighting Climate Change

Results from Phase I of the Regional Strategic Energy Planning Project: Opportunities and Benefits Arising from Enhanced Energy Efficiency and Renewables in the Energy Community

Presented by Gary Goldstein on behalf of the National Planning Teams
INTERNATIONAL RESOURCES GROUP

Energy Community Secretariat
Vienna Austria
May 25, 2011

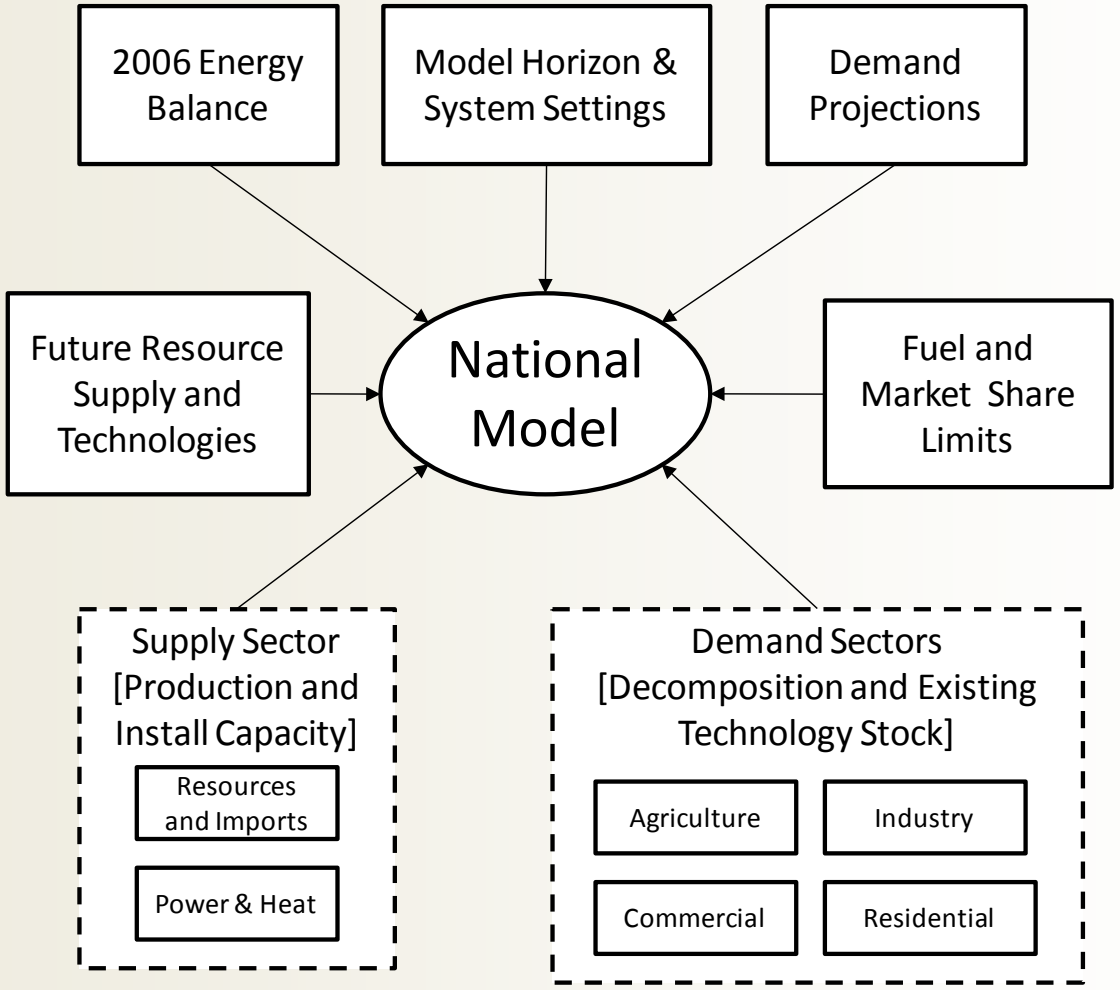
PRESENTATION OUTLINE

- Purpose, Methodology, and Organization
- 2006 Baseline
- Business-As-Usual Reference Case
- Energy Efficiency and Renewable Energy Scenarios
- Future Plans

Project Overview

- Purpose: Build capacity within the Energy Community to support strategic energy planning and inform the policy formulation process by establishing national Planning Teams.
- Implementation: In collaboration with CRES, assist countries in developing integrated energy system models using IEA-ETSAP MARKAL/TIMES, review data and assumptions, and perform policy-oriented analyses.
- Coordination: USAID/IRG in cooperation with the Ministries and Energy Community Secretariat.
- Anticipated Outcome: An analysis performed by the National Planning Teams of energy efficiency and renewables opportunities, as well as other key national priorities, and the institutional framework for sustaining this capability.

MARKAL/TIMES Building Blocks



MARKAL/TIMES models start with an initial energy balance along with the complete suite of existing power plants and an estimate of the current device stock. Future resource supply and technology options are assembled by the model to meet demand projections reflecting anticipated economic and demographic activity, within resource, technology, environmental and policy constraints. [Note that the current models do not include the transport/refining sectors, which are to be added in 2011.]

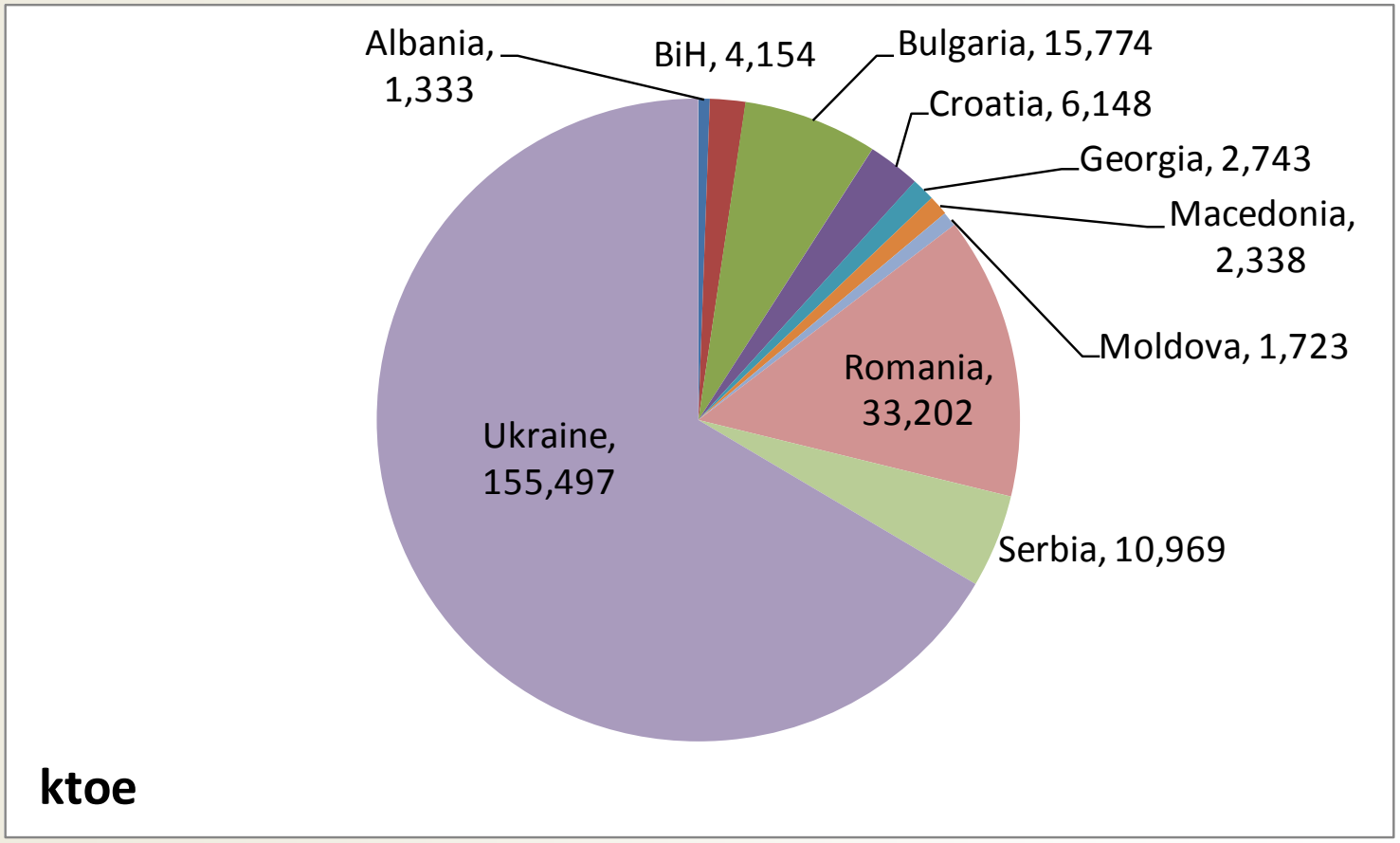
Regional Strategic Energy Planning Project Participants

Country	Lead Ministries	Planning Team Institutions
Albania*	Ministry of Economy, Trade and Energy	Albanian Agency of Natural Resources
Bosnia and Herzegovina*	Ministry of Foreign Trade and Economic Relations	Faculty of Electrical Engineering in Istocno East Sarajevo Faculty of Electrical Engineering in Sarajevo
Bulgaria (EU)	Ministry of Economy and Energy	Ministry of Economy and Energy
Croatia*	Ministry of Economy, Labour and Entrepreneurship	Ministry of Economy, Labour and Entrepreneurship Hrvatska Elektroprivreda (HEP) EKONERG
Georgia*	Ministry of Energy	World Experience for Georgia Tbilisi State University
Macedonia*	Ministry of Economy, Department of Energy	Ministry of Economy, Department of Energy Research Center for Energy, Informatics and Materials, Macedonian Academy of Sciences and Arts (ICEIM-MANU)
Moldova*	Ministry of Economy and Commerce	Academy of Sciences of Moldova / Institute of Power Engineering
Romania (EU)	Ministry of Economy and Commerce	Transelectrica
Serbia*	Ministry of Mining and Energy	Electric Power Industry of Serbia (EPS)
Ukraine	Ministry of Fuels and Energy Ministry of Housing and Community Services	National Academy of Science / Institute for Economic Forecasting

* Select Energy Community Countries (SECC), 2-EU and Ukraine presented as groups as latter two overshadow former

Primary Energy Supply by Country (2006)*

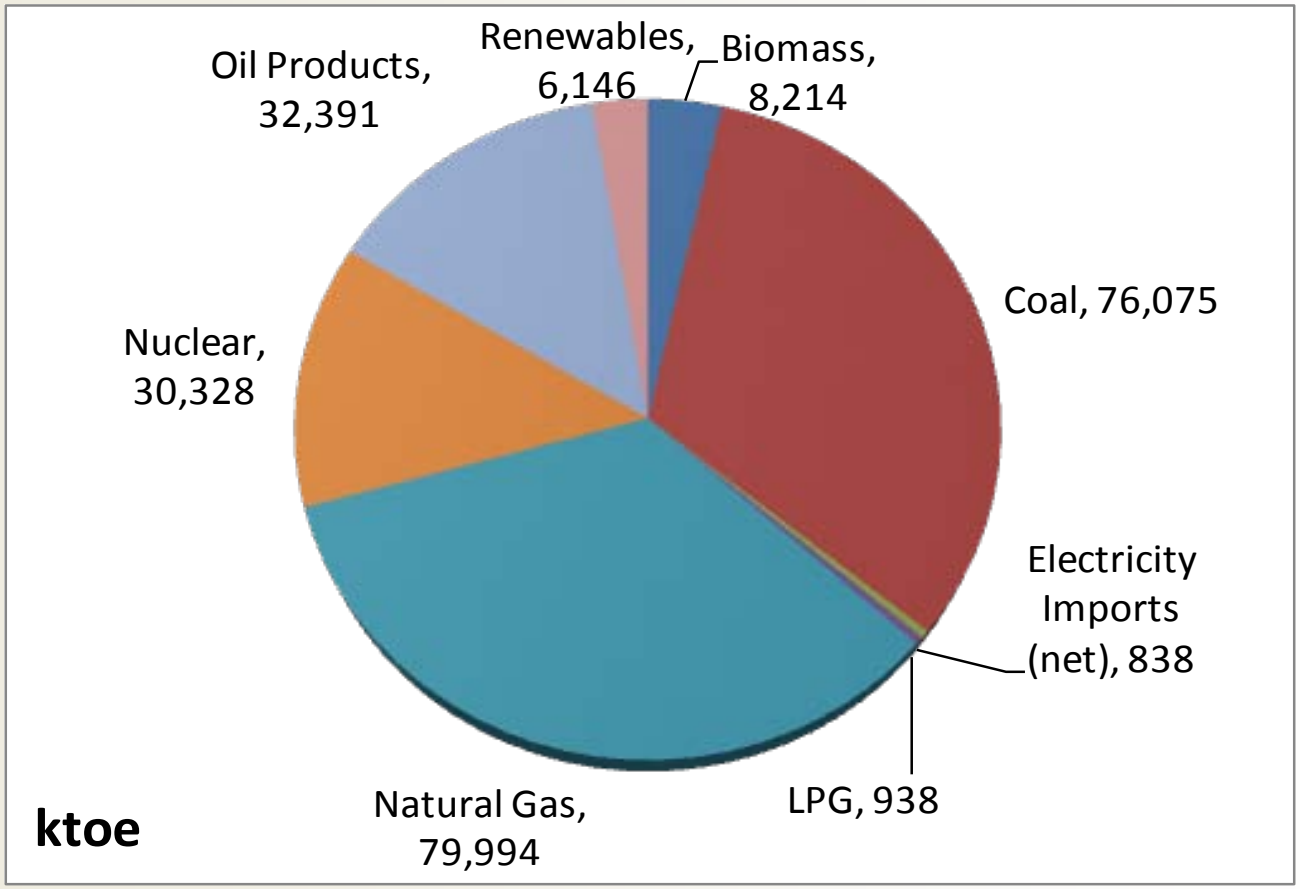
Ukraine and the 2-EU Countries clearly dominate the overall energy picture, but each of the countries have very distinct primary energy profiles meaning that national priorities and challenges differ significantly within the region



* Without transportation fuel requirements

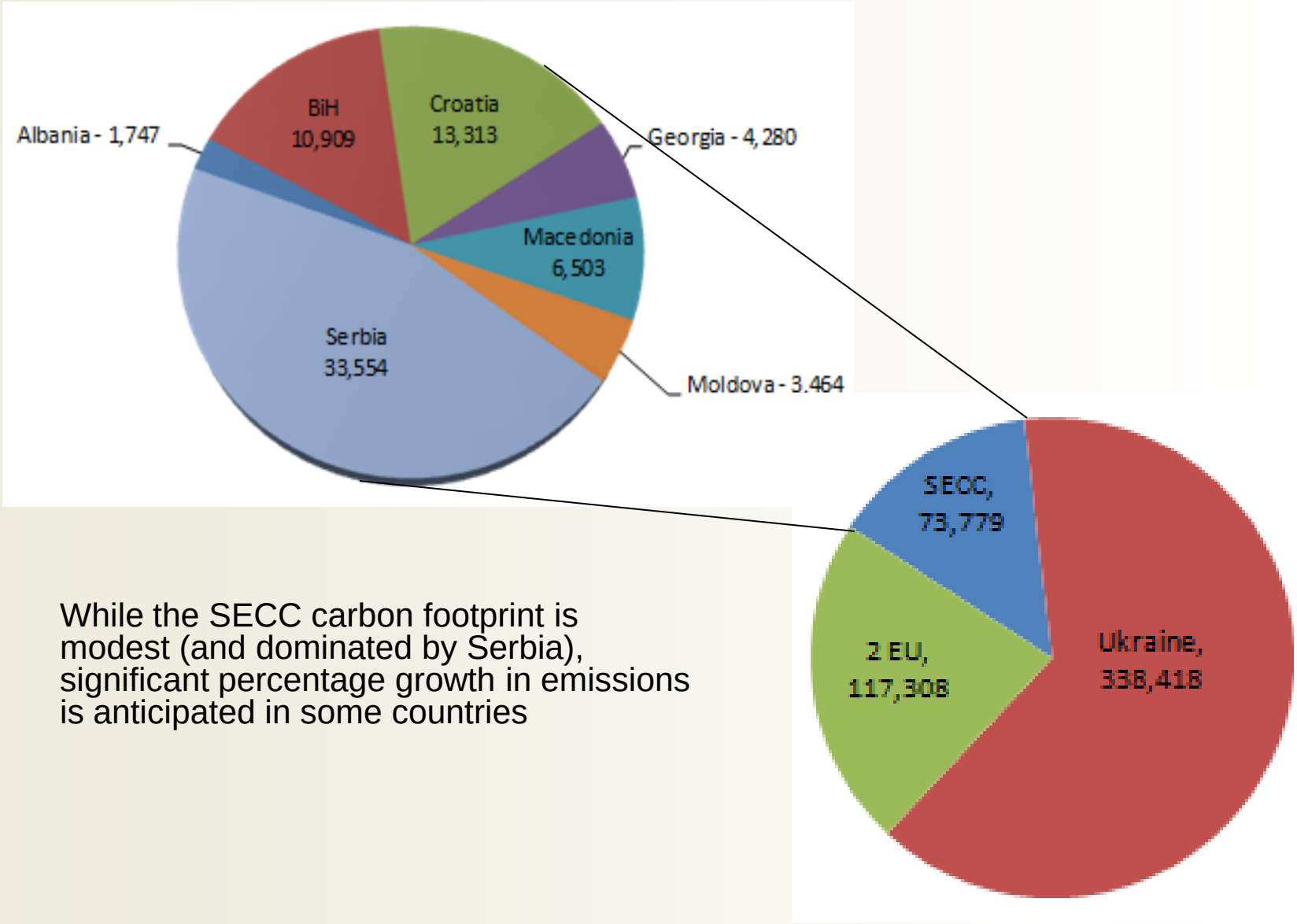
Primary Energy Supply by Type (2006)*

- Significant levels of gas imports into Ukraine and 2-EU countries, with high percentages of total primary in Croatia (39%) and Moldova (66%)
- Coal and nuclear are important for power generation in the region, with hydro significant for specific countries (most notably Albania and Georgia)



* Without transportation fuel requirements

CO_2 Emissions (2006, kt)



While the SECC carbon footprint is modest (and dominated by Serbia), significant percentage growth in emissions is anticipated in some countries

Trends Under BaU Conditions in SECC (and 2-EU/Ukraine)

- Expenditure on fuel will rise 135% between 2006 and 2030 with a level of 9B€ reached in 2030 (with Ukraine and two EU countries facing 42B€ a year by 2030)
- Primary energy requirements increase by 48%, with imports growing to 46% of supply, half of which is natural gas (while in two EU and Ukraine more like 22% increase in primary energy)
- An additional 16GW of new power plants need to be built (with another 15.6GW for the two EU countries and 14.3GW for Ukraine)
- CO2 emissions will grow by 60% between 2006 and 2030, reaching 118MT in 2030 (and 130Mt in the two EU countries and 437Mt in Ukraine)

Key Cumulative Indicators Under Energy Efficiency & Renewable Energy Scenarios

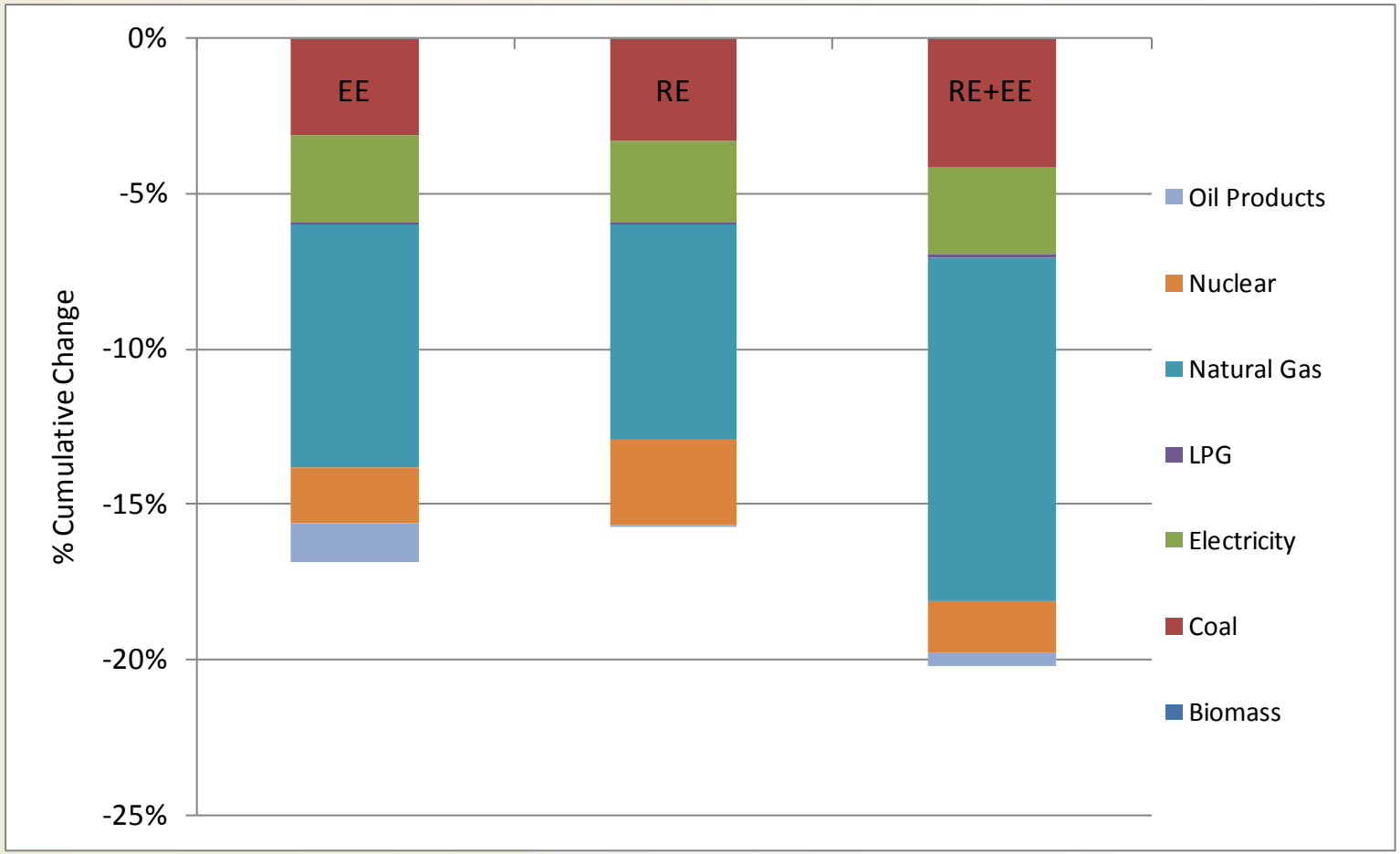
SECC	Total Energy System Costs (M€2006)	Primary Energy (ktoe)	Imports (ktoe)	Fuel Expenditure (M€2006)	Power Plant Builds (MW)	Final Energy (ktoe)	CO_2 Emissions (kt)
Reference	160,823	999,294	364,176	169,080	16,059	667,180	2,479,845
Energy Efficiency (EE)	-5,381	-47,435	-44,296	-14,082	-3,794	-45,691	-177,410
Renewable Target (RE)	1,748	-45,050	-38,782	-6,347	6,447	-3,648	-142,440
Combined (EE+RE)	-4,562	-85,245	-70,554	-19,458	221	-48,392	-279,068

EU+Ukraine Countries	Total Energy System Costs (M€2006)	Primary Energy (ktoe)	Imports (ktoe)	Fuel Expenditure (M€2006)	Power Plant Builds (MW)	Final Energy (ktoe)	CO_2 Emissions (kt)
Reference	1,028,716	6,043,027	2,295,674	840,368	29,883	3,383,616	13,232,359
Energy Efficiency (EE)	-27,534	-187,489	-123,641	-5,473	-5,027	-156,988	-789,145
Renewable Target (RE)	10,441	-46,480	-22,442	-47,104	10,659	-13,694	-360,622
Combined (EE+RE)	-22,145	-212,878	-133,628	-52,156	-1,269	-155,339	-1,020,920

All figures that follow report cumulative changes against the Reference scenario over the 2006-2030 planning horizon

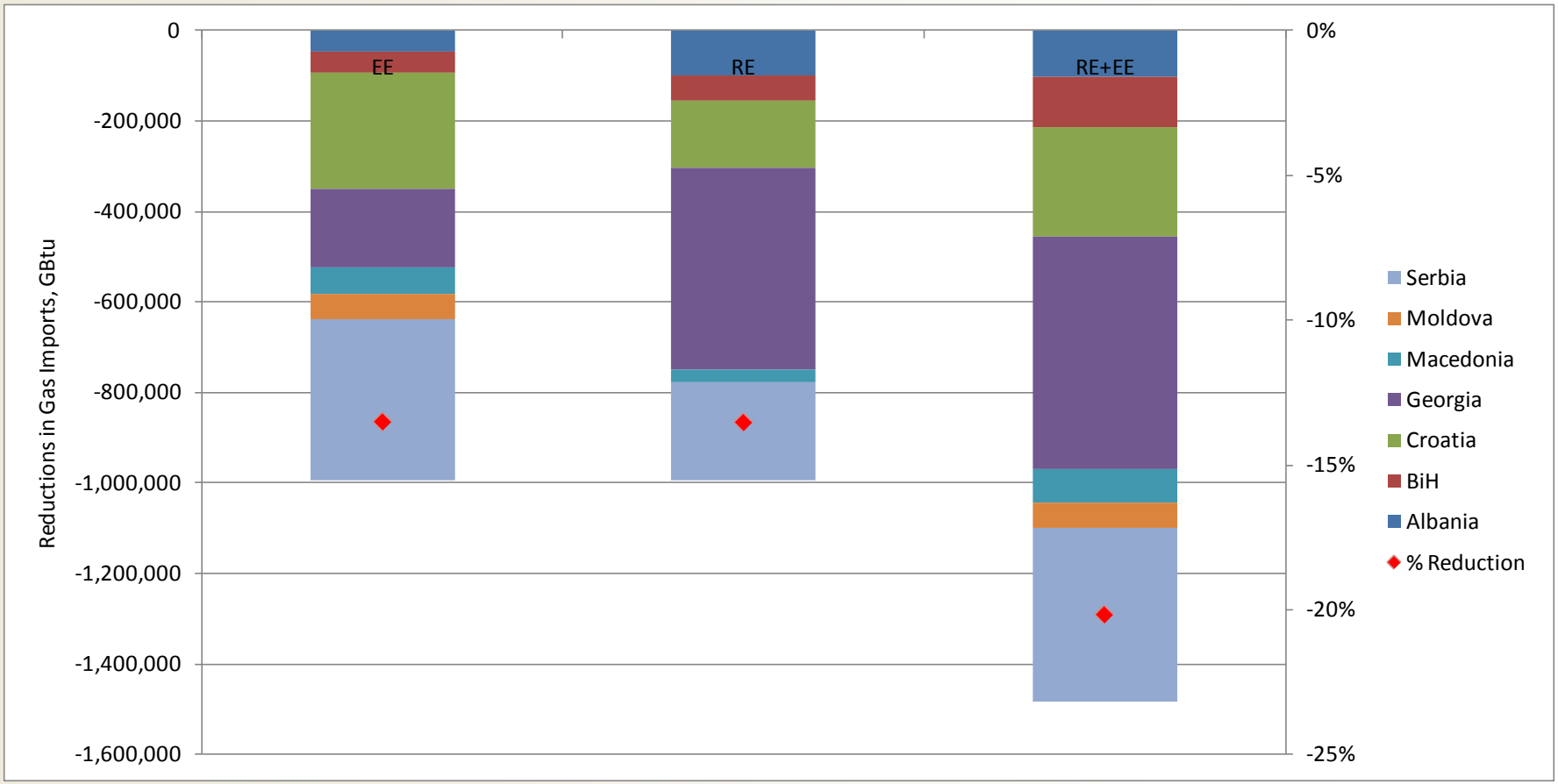
Energy Security Benefits Arising From EE&RE Policies

Strong reduction in imports, under both EE / RE cases, particularly with respect to natural gas



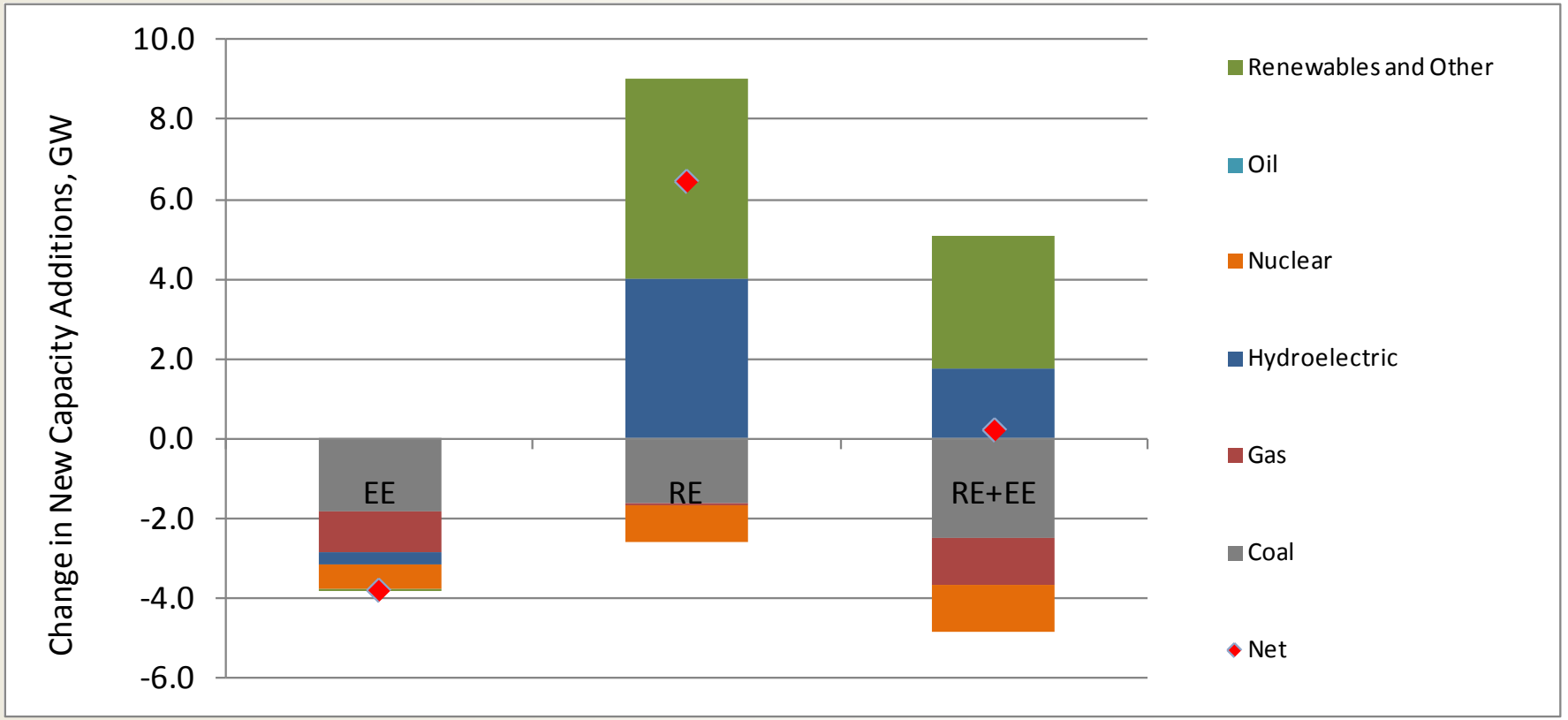
Reduction In Gas Imports Arising From EE&RE Policies

Total reduction of natural gas imports over the planning horizon reaches 20% in the EE+RE case, where the drop is most pronounced for Croatia, Georgia, and Serbia



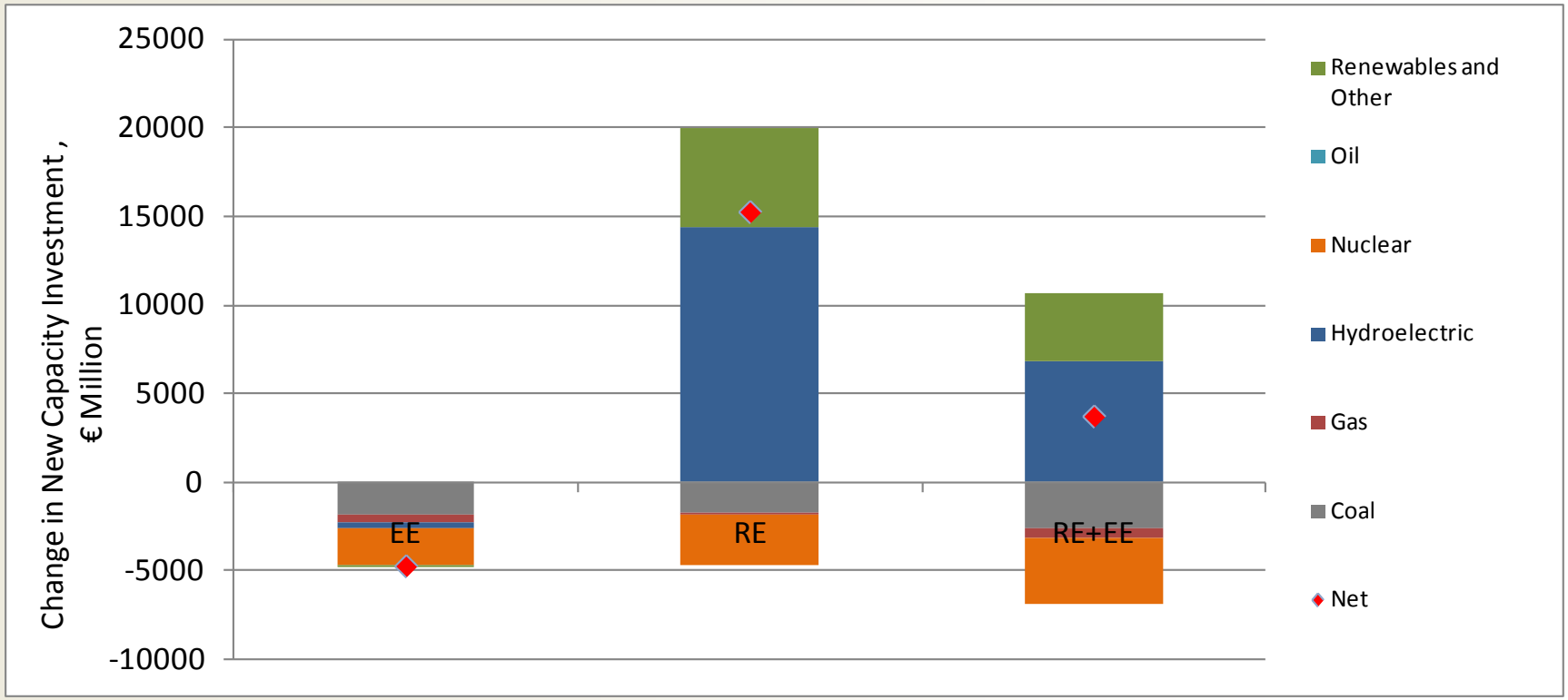
Change in New Power Plant Additions Arising From EE&RE Policies

Meeting the RE target by 2020 requires an additional 6.5GW of new renewable generation capacity, primarily hydro / wind, equivalent to a 40% increase, however with EE the net generating capacity additions are just 0.22GW



Changes In New Power Plant Investments Arising From EE&RE Policies

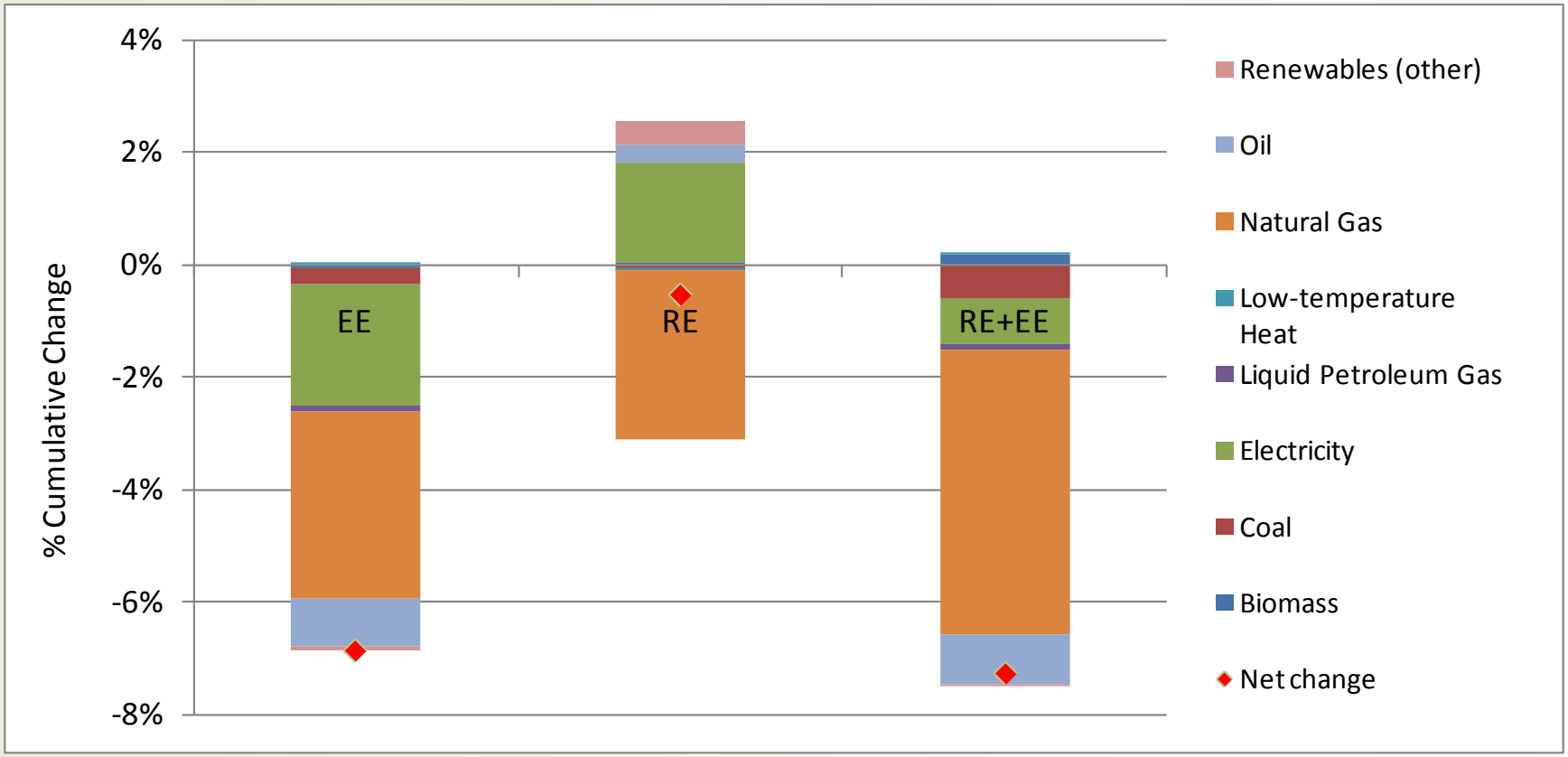
Total power sector investments increase by 15.3B€ to meet the RE target, but the net additional investment is reduced to just 3.7B€ when EE introduced



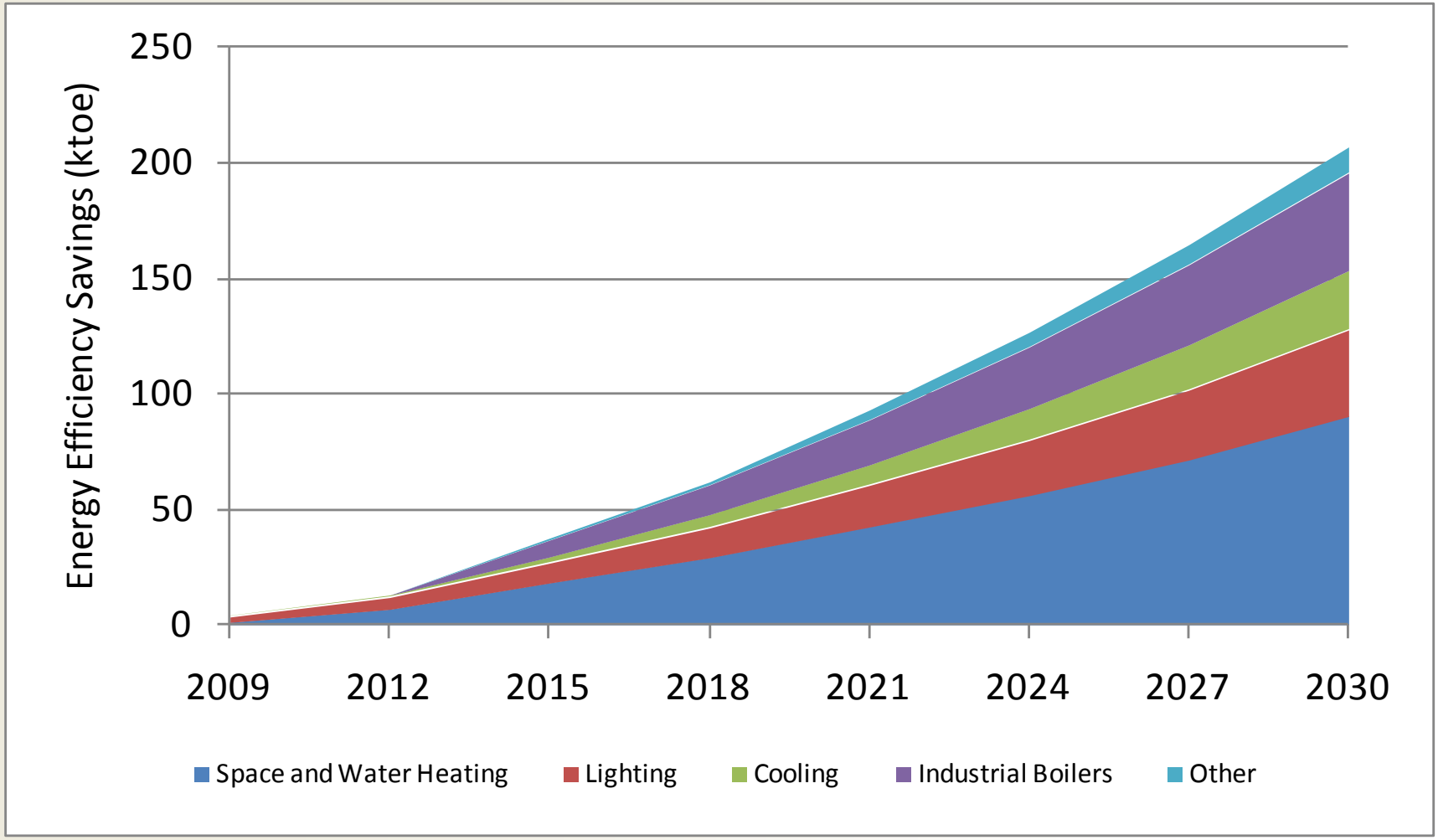
Changes In Final Energy Consumption Arising From EE&RE Policies

EE policies can result in reductions of around 7% for SECC. The net change from RE policies is a small reduction in final energy of 0.5%

The RE initiatives lead to a shift from gas to electricity. Energy efficiency policies also reduce gas consumption significantly. Electricity is also reduced but to a lesser extent under the combined scenario.

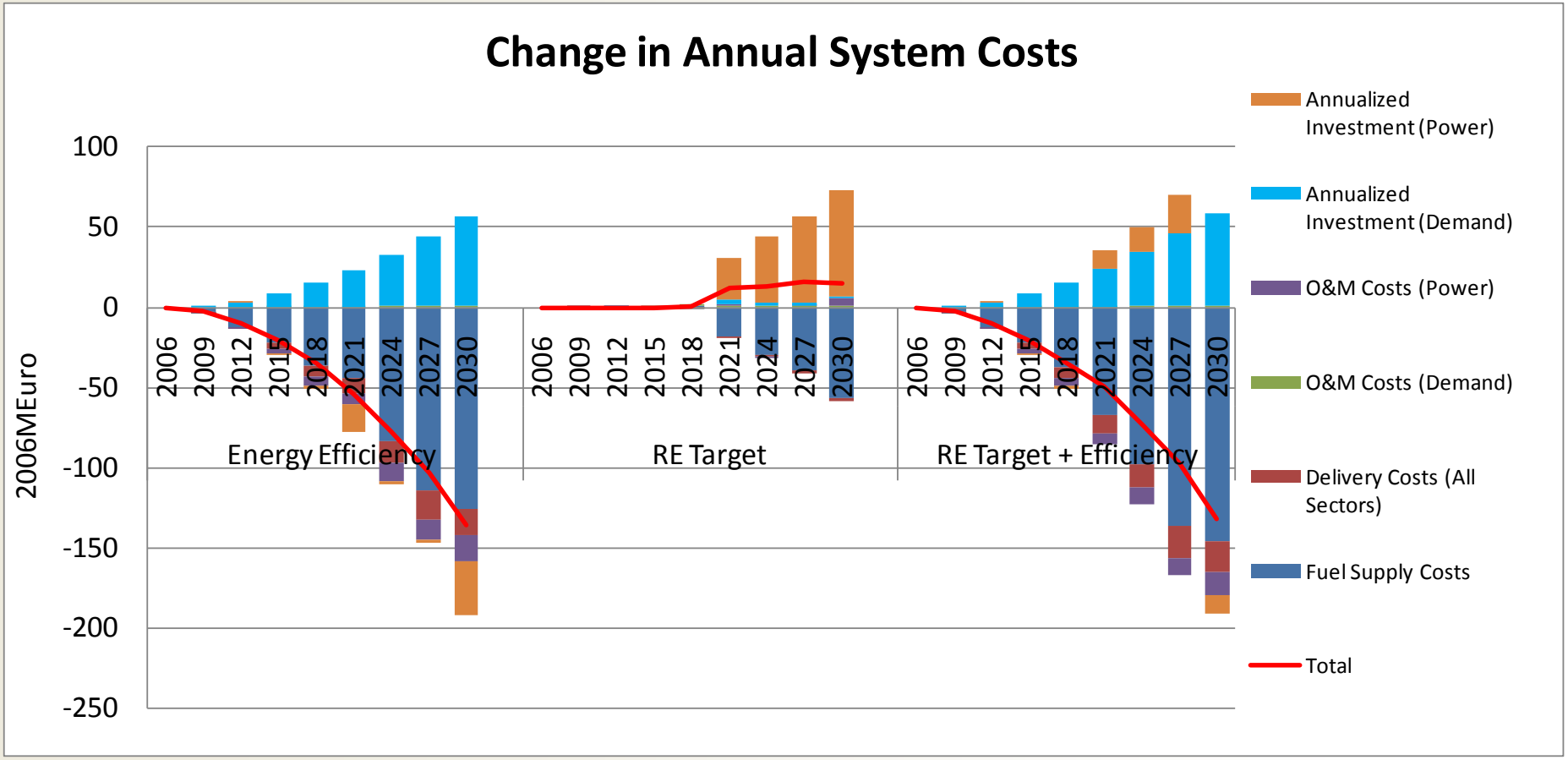


Final Energy Savings Due to Efficiency
A Country Example



Opportunities for energy savings arise from improvements in lighting and space conditioning, along with industrial boilers

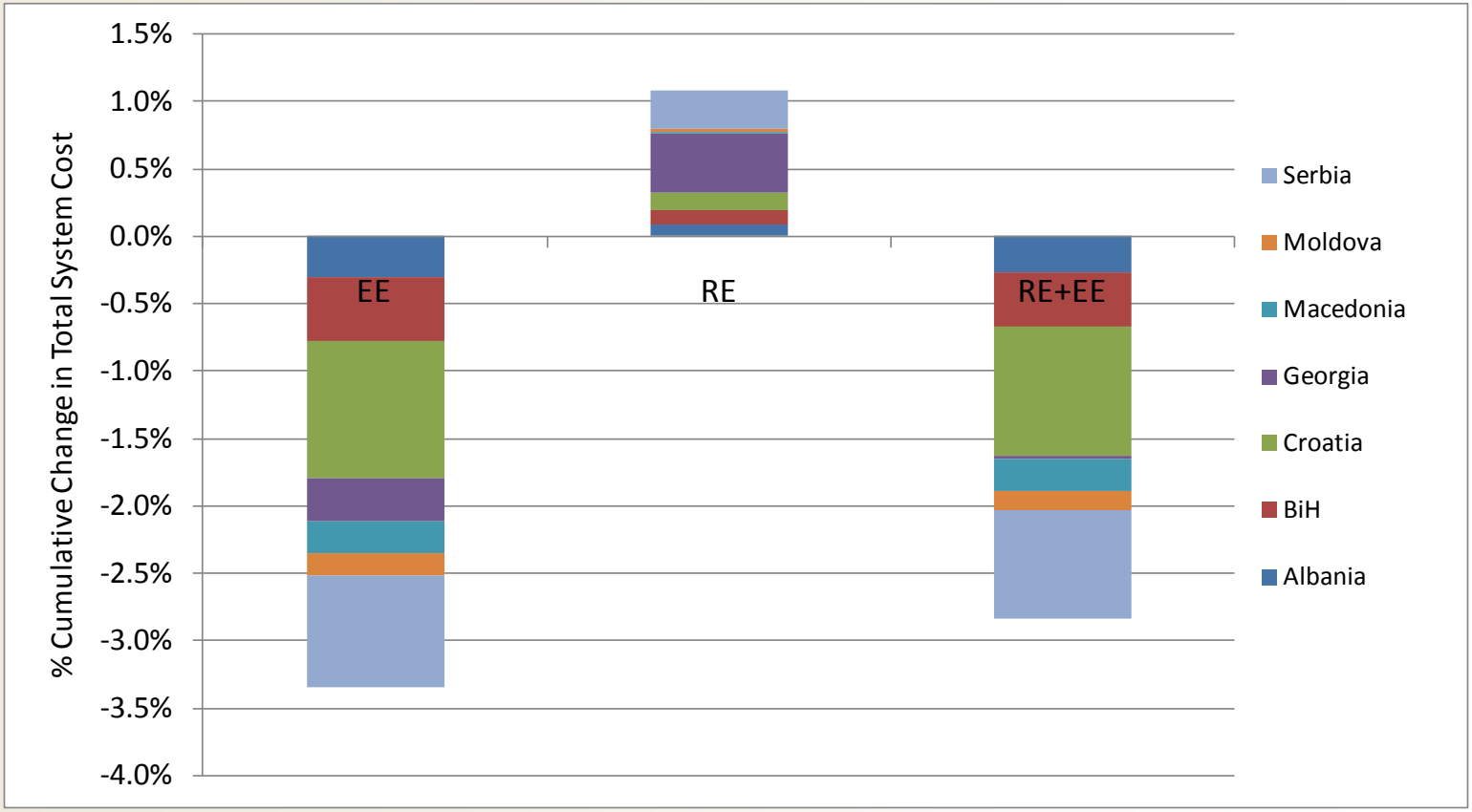
Investment Tradeoffs and Fuel Savings
A Country Example



In the Combined EE+RE scenario, the 53.8M€/year added cost of purchasing improved devices translates into an overall annual savings of nearly 200M€/year due to reduction in fuel expenditures, imports, and new power plants

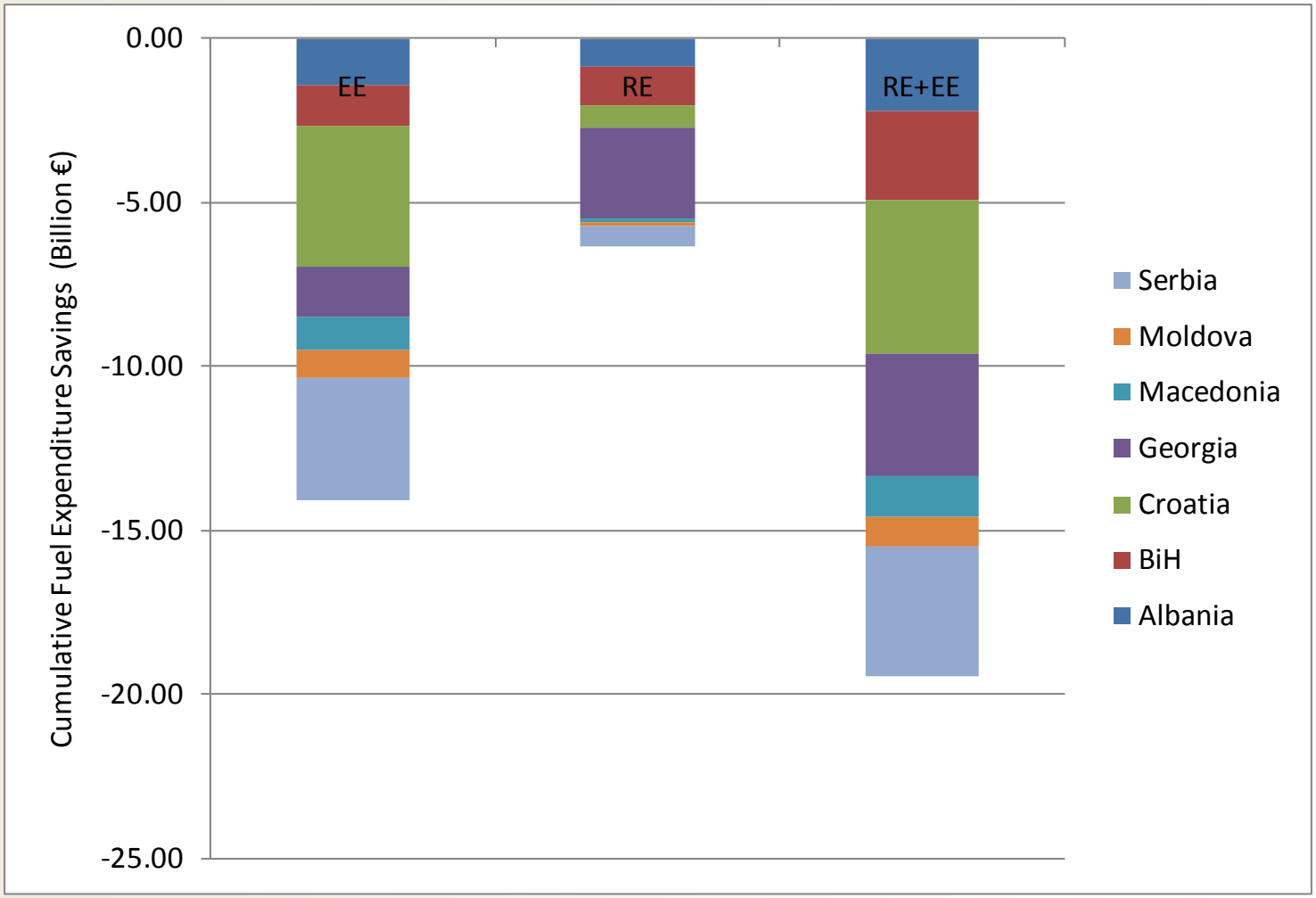
Economic Implications Arising From EE&RE Policies – Overall System Cost

- EE policies can save 5.4B€ (with 32.9B€ of savings possible including Ukraine and the EU countries)
- RE targets can be achieved at relatively modest additional costs (1%, or 1.75B€), both at the regional level and in most countries
- In parallel with energy efficiency initiatives RE targets can be achieved while still realizing overall savings

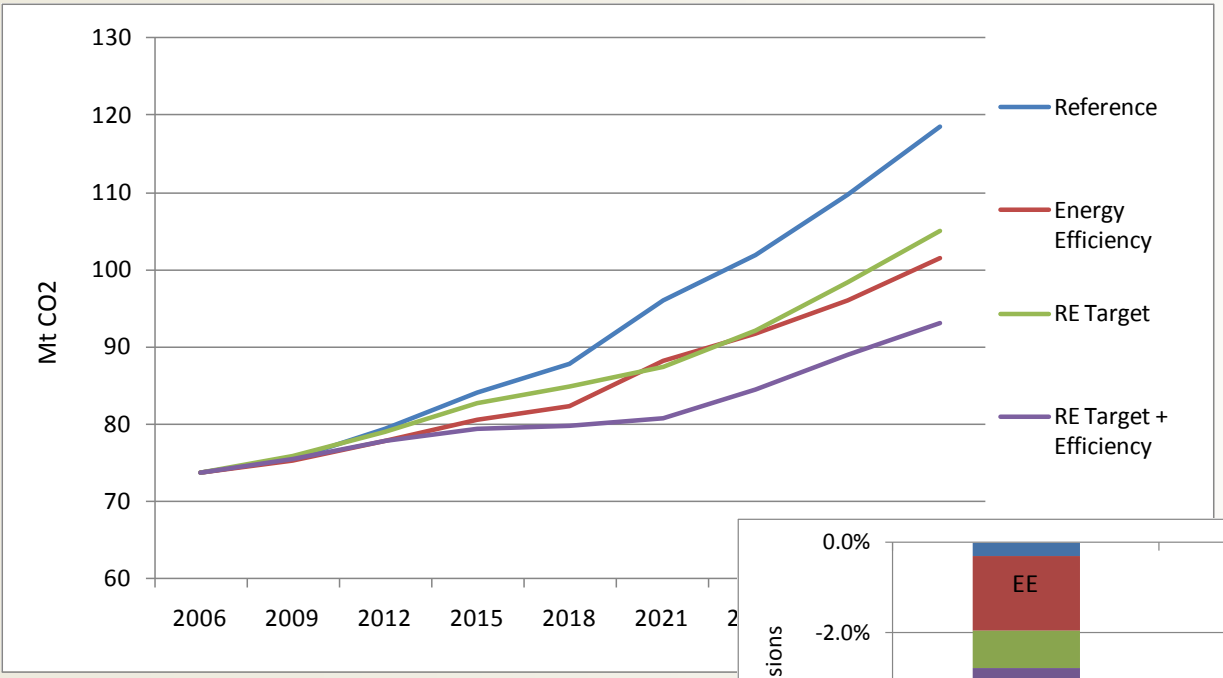


Economic Implications Arising From EE&RE Policies – Saving from Fuel Payment

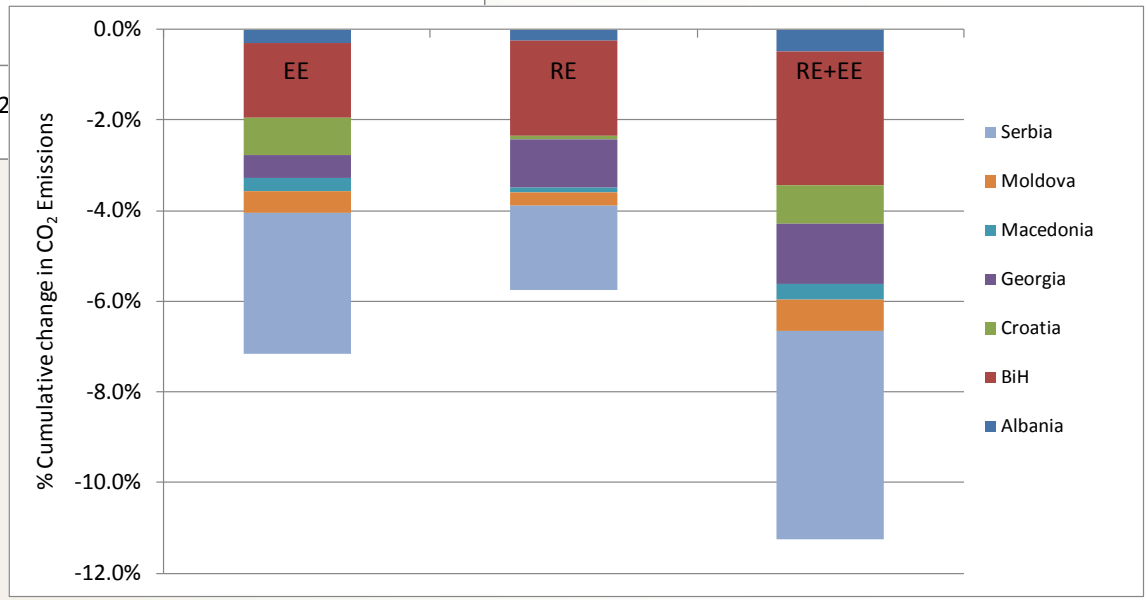
The biggest savings come from reductions in payments for fuel, due to the drop in consumption in the EE cases and reduced imports in the RE case, where combined these achieve reductions of 19.5B€ or 11.5%



Climate Change Implications Arising From EE&RE Policies



CO_2 emissions in 2030 increase by 61% in the SECC, 11% in 2-EU and 29% in Ukraine under BaU



Substantive reductions in CO_2 emissions of as much as 279Mt can be observed, highlighting the synergies between EE&RE and low carbon development

Cumulative Benefits Arising from Strong EE & RE Policies (SECC)

- Promoting EE programs can realize savings of 5.4B€, or 3.4% of the total cost of the energy systems, through reduced expenditures on fuels (mainly for imports) and fewer power plant additions
- Meeting illustrative RE targets (in line with those suggested under the EU's RE Directive for 2020 (IPA 2010)) requires 15.3B€ additional investment in the power sector, however the overall increase in total energy system cost is only 1.7B€ (owing primarily to drops in payment for fuel)
- Combining EE+RE policies enables RE targets to be met while
  - Reducing additional power sector investment by 11.5B€, to 3.8B€
  - Realizing an overall energy system savings of 4.6B€
  - Cutting imports (mostly natural gas) by over 20%
  - Lowering CO_2 emissions by 279Mt or 11.25%

Future Plans

- Hold a series of National and Regional strategic planning workshops with participating Ministries
- Add transportation and refining sectors for comprehensive coverage of the entire energy system
- Consider ways of improving the knowledge of current consumption patterns and devices
- Detailed economic analysis of key growth sectors and their implications for demand assumptions
- Refining future energy prices and technology characterizations to reflect best available data
- Conduct coordinated analyses of Climate Change mitigation and EU compliance strategies, along with other national priorities
- Institutionalize National Planning Teams and integrate their capacity into the ongoing planning process
- Possible integration of the national models into a regional framework to examine regional least-cost and trading scenarios

Thank You!

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Supporting Slides

Regional Energy Picture (2006)

Country	Primary Energy (ktoe)	Imports (ktoe)	Installed Power Plants (MW)	Electric Generation (GWh)	Final Energy (ktoe)	CO_2 Emissions (kt)
Albania	1,333	599	1,475	5,721	1,105	1,747
Bosnia and Herzegovina	4,816	199	3,504	10,821	2,979	10,909
Croatia	6,129	1,813	4,387	17,319	4,579	13,313
Georgia	2,743	1,837	3,295	8,278	2,226	4,291
Macedonia	2,338	815	1,470	8,357	1,438	6,503
Moldova	1,723	1,626	361	4,131	1,324	3,464
Serbia	10,969	2,401	7,158	31,004	6,393	33,554
SECC Toal	**30,051**	**10,952**	**21,650**	**178,278**	**20,044**	**73,779**
Bulgaria	16,454	6,444	17,564	34,797	7,351	37,124
Romania	33,202	9,850	16,234	57,849	22,647	80,042
Ukraine	155,338	77,440	65,958	197,769	81,412	265,800
Grand Total	**235,049**	**103,024**	**121,404**	**376,046**	**131,453**	**456,887**

Summary snapshot of key energy system metrics in 2006

Underlying Modeling Assumptions

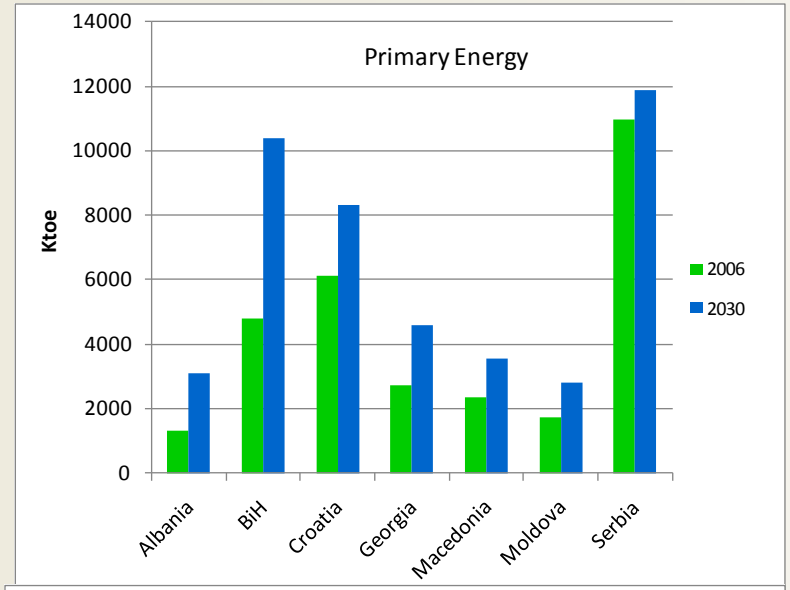
- Average GDP ranging from 3% to 6% over the 2006-2030 planning horizon
- Good depiction of current resources supply levels/costs and the power sector for each country
- Acceptable representation of current demand-side consumption patterns (fuel choice and timing for electricity), and technology mix and characterization – though industry weaker in most countries
- Reasonable relationships established between GDP, demographic, other drivers and future energy service demand projections
- Future energy prices adapted from EU-NEEDS/PET (oil $86/bbl in 2030)
- Future energy technology characterizations adapted from EU-NEEDS/PET

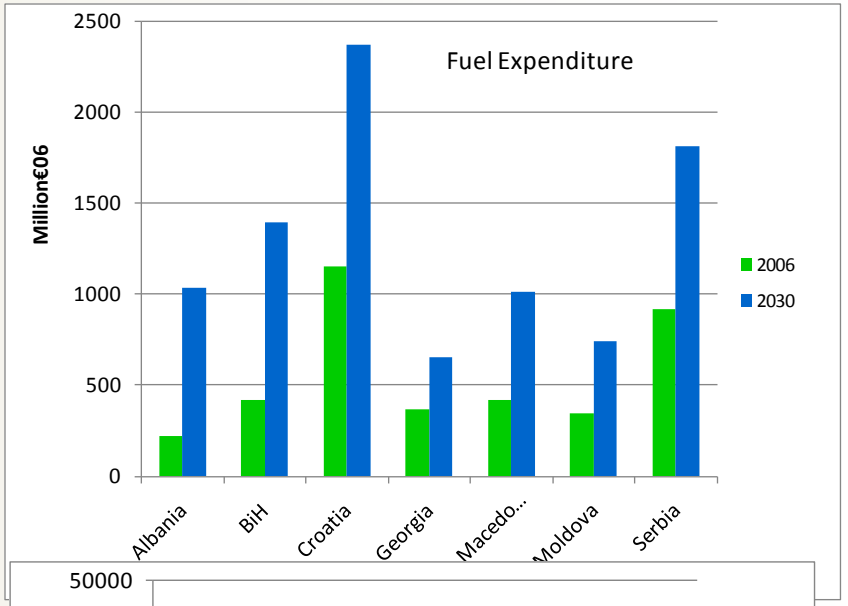
Cumulative Indicators Under BaU Conditions*

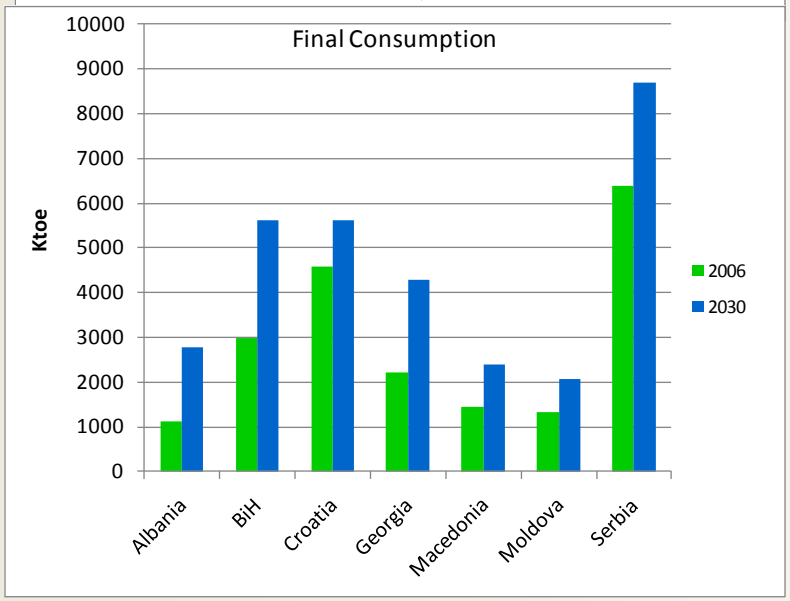
Country	Total Energy System Costs (M€2006)	Primary Energy (ktoe)	Imports (ktoe)	Fuel Expenditures (M€2006)	Power Plant Builds (MW)	Final Energy (ktoe)	CO_2 Emissions (kt)
Albania	13,179	53,302	29,374	17,754	1,596	48,309	79,123
Bosnia and Herzegovina	23,492	192,594	24,025	25,097	5,484	115,421	539,502
Croatia	44,387	190,063	58,625	48,084	1,916	133,996	326,780
Georgia	15,574	91,467	56,304	11,459	1,850	82,853	144,383
Macedonia	14,928	78,953	29,955	19,268	2,356	49,770	220,695
Moldova	9,187	59,322	55,943	14,440	1,029	45,175	145,788
Serbia	40,076	324,492	84,062	32,977	1,829	191,655	1,023,574
SECC Total	**160,823**	**990,195**	**338,288**	**169,080**	**16,059**	**667,180**	**2,479,845**
Bulgaria	40,883	429,397	266,090	33,000	2,271	205,823	971,005
Romania	126,180	962,723	73,055	164,344	13,316	625,916	2,131,479
Ukraine	861,654	4,650,907	1,956,528	643,024	14,296	2,551,877	10,129,875
Grand Total	**1,189,540**	**7,033,222**	**2,633,961**	**1,009,448**	**45,942**	**4,050,795**	**15,712,205**

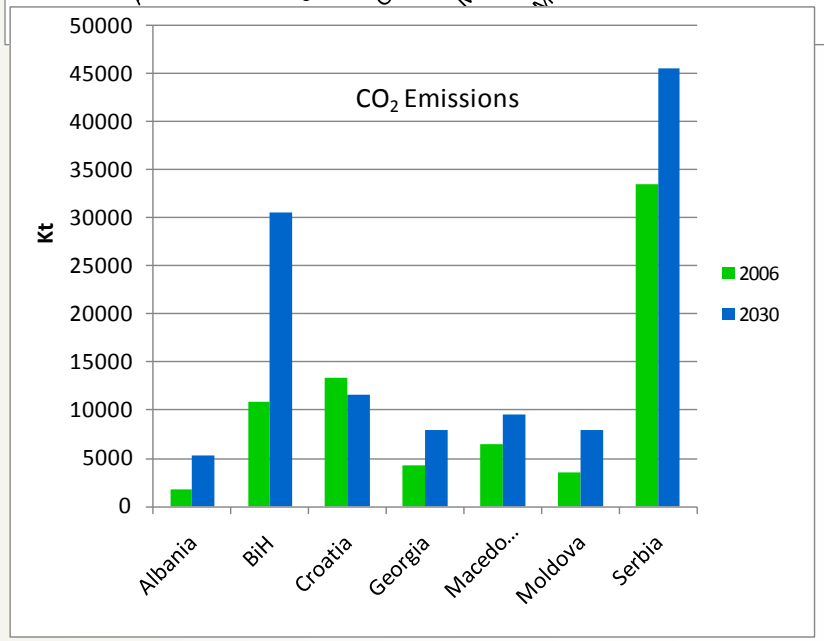
* All figures are cumulative amounts over the entire 2006-2030 planning horizon

Comparative 2006/2030 Indicators Under BaU Conditions

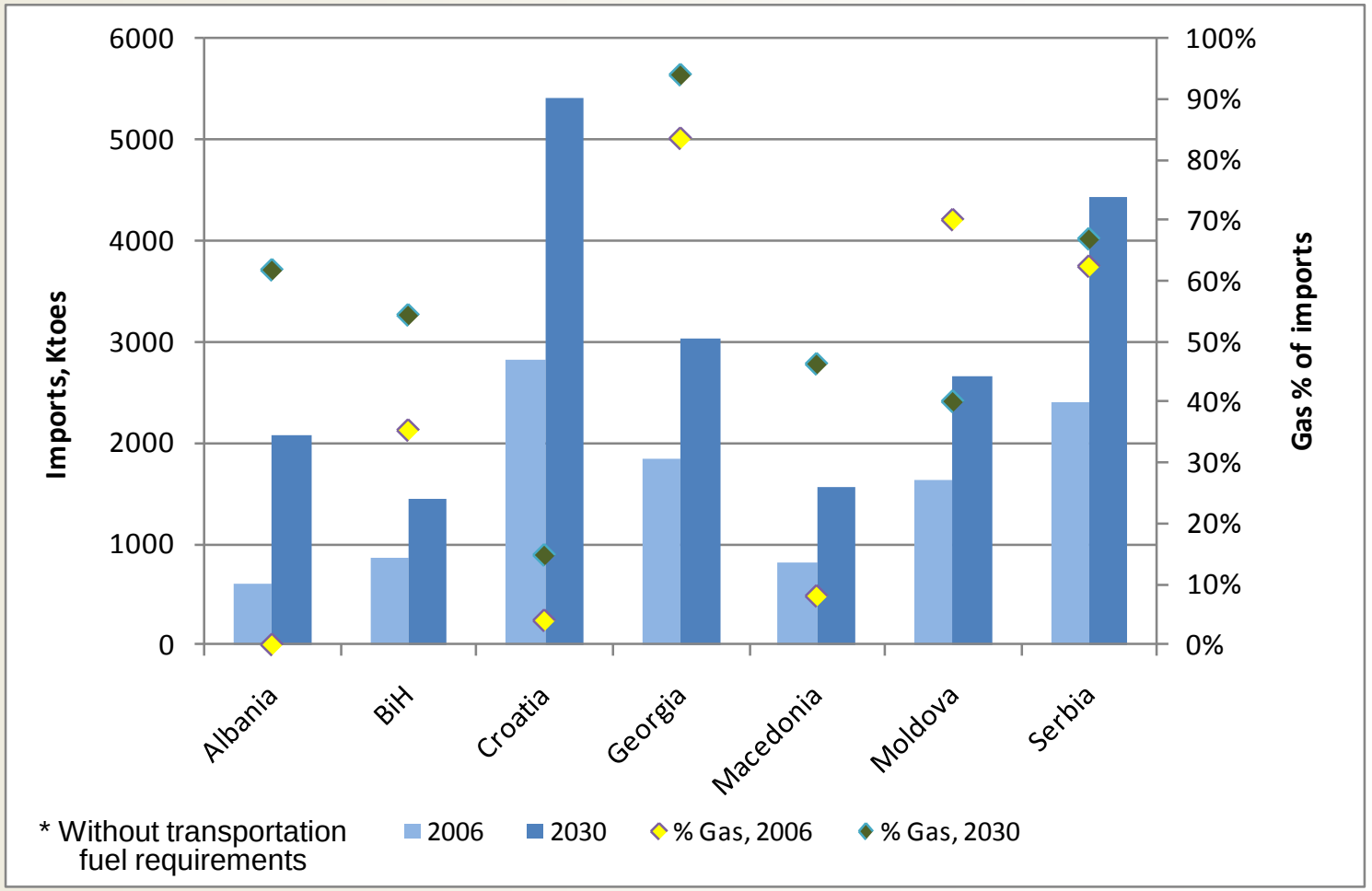






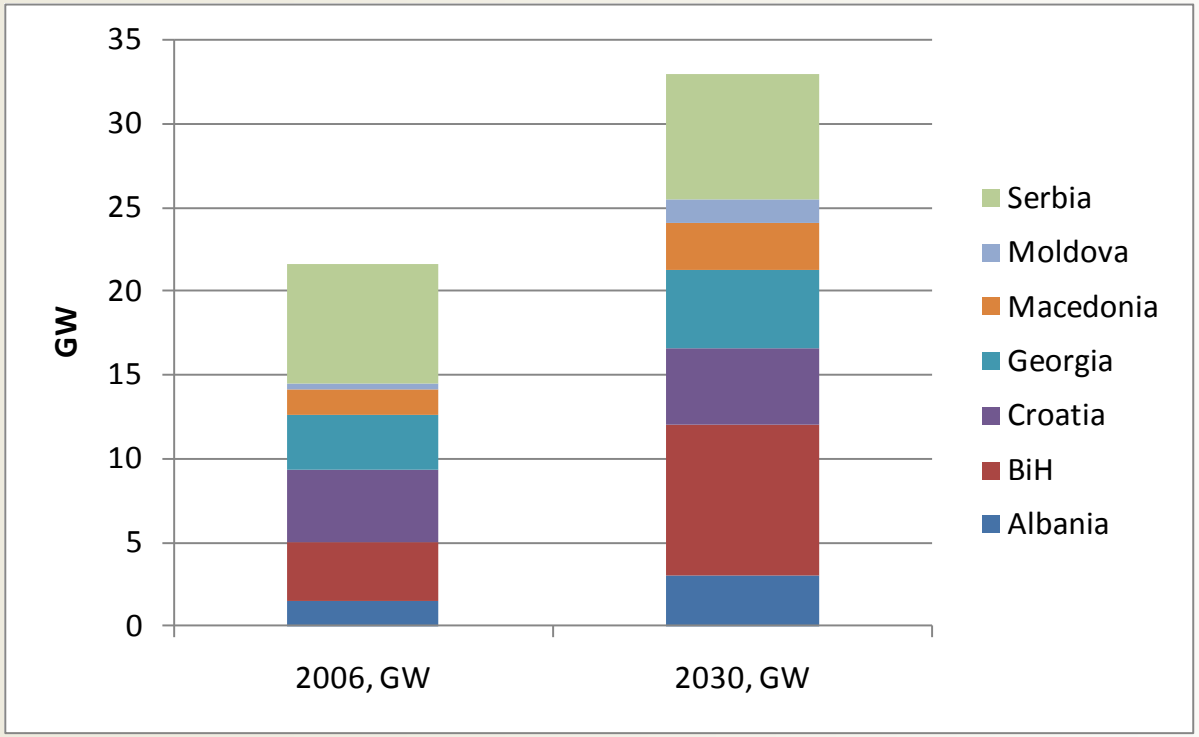


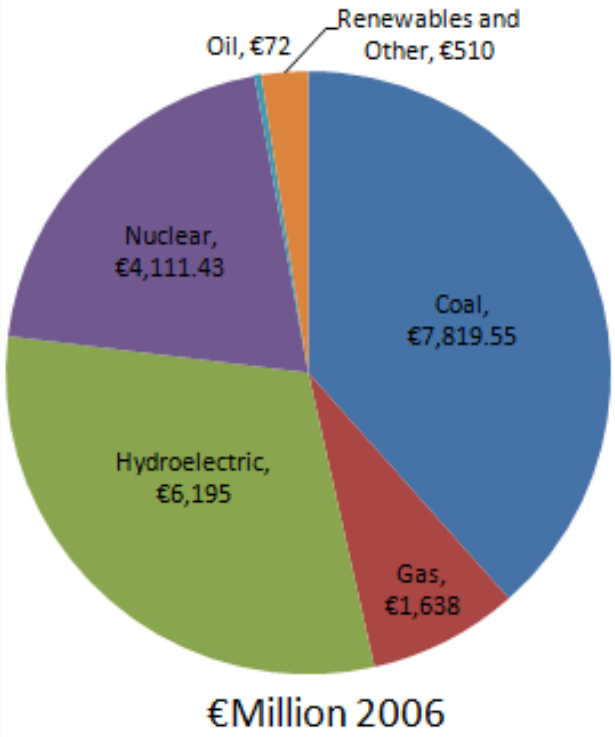
IMPORTS AND GAS SHARE (SECC)*



- As energy demand increases over time, the level of imports grows significantly, as a percent of total primary energy going from 36% in 2006 to 46% in 2030.
- Gas imports becomes increasingly important across the majority of the countries in the region – particularly in Albania, BiH, and Macedonia.

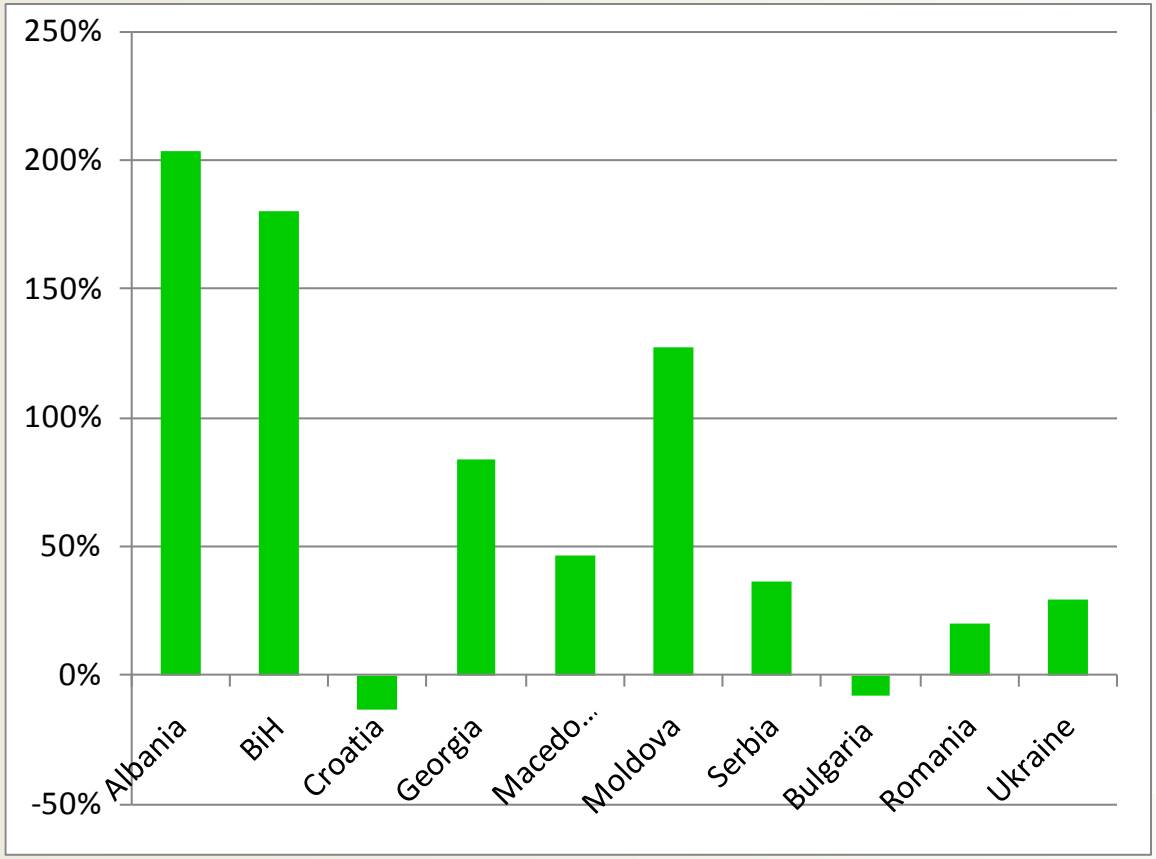
Growth in Electric Generation Capacity and Investment Required by Type (SECC)

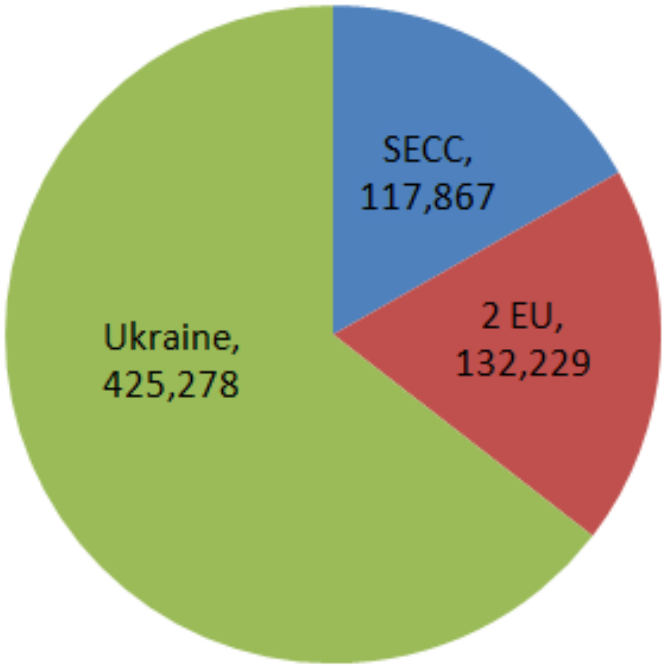




A 65% increase in generating capacity will require that 20.3€ Billion be invested over the next 20 years

CO_2 Situation in 2030 (Percent Increase and Total)





CO_2 emissions increase primarily due to the growth in energy service demands. For specific countries the increased use of more fossil fuels results significant percentage increases in emissions over the planning horizon

MARKAL/TIMES Use in the EU

- IEA-ETSAP Partner Countries (www.etsap.org, UK Energy White Paper *www.ukerc.ac.**uk**/support/tiki-download_file.php?fileId=205*)
- IEA global Energy Technology Prospectus (ETP) model http://www.iea.org/techno/etp/index.asp
- A relevant suite of studies was recently conducted by the European Union that employ a Pan-European TIMES model (PET))
  - http://www.res2020.eu/files/fs_inferior01_h_files/pdf/deliver/The_PET_model_For_RES2020-110209.pdf
  - http://www.isis-it.net/needs/
  - http://www.res2020.eu
  - http://realisegrid.rse-web.it/
  - http://reaccess.epu.ntua.gr/TheProject/ProjectObjectives.aspx