USAID SEE Regional Energy Demand Planning Initiative

Regional Capacity Building and an Analysis of the Merits of Improved Energy Efficiency

SEE-REDP Steering Committee and
USAID/Hellenic Aid Cooperative Energy Program
Kick-off Meeting
Athens, Greece
May 19-20, 2008

[Presented by Gary Goldstein on behalf of the SEE-REDP Technical Working Group]

USAID
FROM THE AMERICAN PEOPLE

IRG

Overview of Presentation

- Project Objectives
- Overview of the Methodology
- Reference Scenario Results
- Results of the Initial Scenario Analyses
- Next Steps

Project Objectives

- Initiated September 2005 based upon a Memorandum executed by a Steering Committee (SC) designated by PHLG
- Goal is institutional capacity building, currently in 8 SEE countries
- The SC designated members of the Ministries and/or power companies to carry-out the actual work as the Technical Working Group (TWG)
- Bulk of the work is carried out by the TWG at 1-week workshops held every 3-4 months
- Employs a common approach for the representation and analysis of country energy systems
- Viewed as one component of a comprehensive planning process that involves GIS, Gasification Study, SECI Transmission, etc.

USAID
FROM THE AMERICAN PEOPLE

IRG

Methodology – System Design and Calibration

- Establish a consistent framework for the analysis of country energy systems for 2003-2027, SEE-MARKAL
- Establish Energy Balances for 2003
- Design a flexible standard Reference Energy System (RES) and series of Excel “smart” workbooks for assembling data
- Develop sector details by decomposing the energy balance and representing the current technology mix
- Calibrate the models for 2003, updated for 2006
- Challenges
  - Availability of Data (very data intensive)
  - Lack of TWG time (outside of the workshops), no junior staff or affiliate institutions, and changing participants
  - Steep learning curve to fully understanding how to use the model

USAID
FROM THE AMERICAN PEOPLE

IRG

Methodology - Establishment of a Reference Scenario 2003-2027

- Establish GDP and other demand drivers (e.g., population)
  - Relate economic and demographic drivers to the various individual sub-sector demands
- Expectation of future energy prices (based upon the EU-NEEDS evolution, similar to GIS)
- Repository of future technology options (adopted from IEA/ETSAP (power plants cross-checked with GIS))
- Known power plant builds/refurbishments/retirements
- Shape of the individual demand loads
- Decisions regarding the evolution of the energy system
  - Country policies (e.g., nuclear, RPS, emission limits)
  - Limits on potential (e.g., domestic resources)
  - Fuel switching limitations
  - Rate of adoption of new demand technologies

USAID
FROM THE AMERICAN PEOPLE

IRG

How does the model's analysis work?

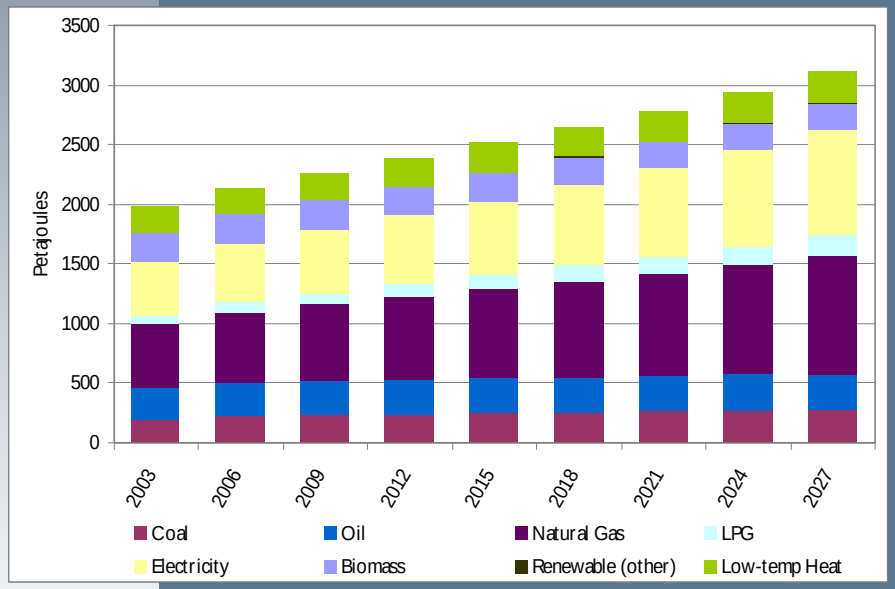
- Encompasses an *entire energy system* from resource extraction through to end-use demands as represented by a Reference Energy System (RES) network,
- Employs least-cost *optimization*
- Identifies the most *cost-effective* pattern of resource use and technology deployment over time,
- Provides a framework for "*what if*" 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

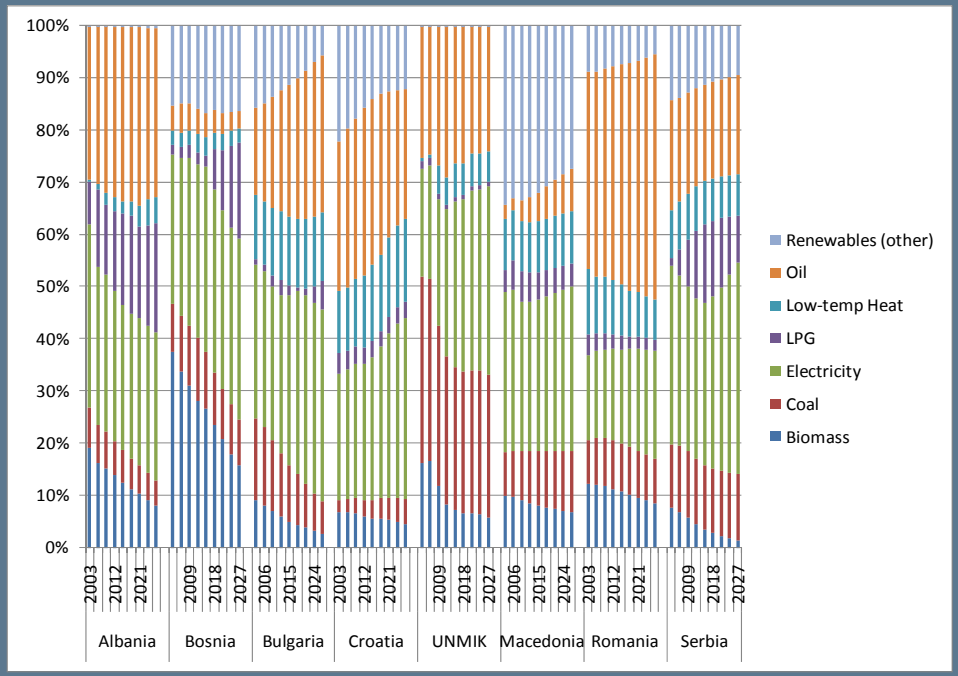
USAID
FROM THE AMERICAN PEOPLE

IRG

Reference Scenario Highlights – Final Energy Use Evolution

- Electricity and natural gas consumption grow from 51% to 60% of the total
- But the mix is quite different, as are the changes, in each of the countries



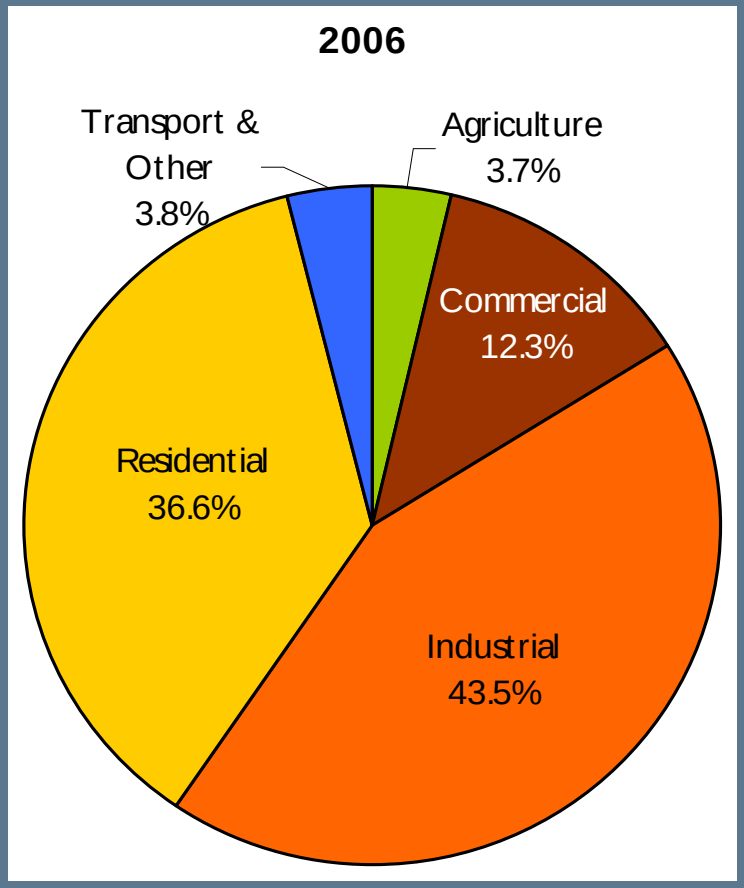


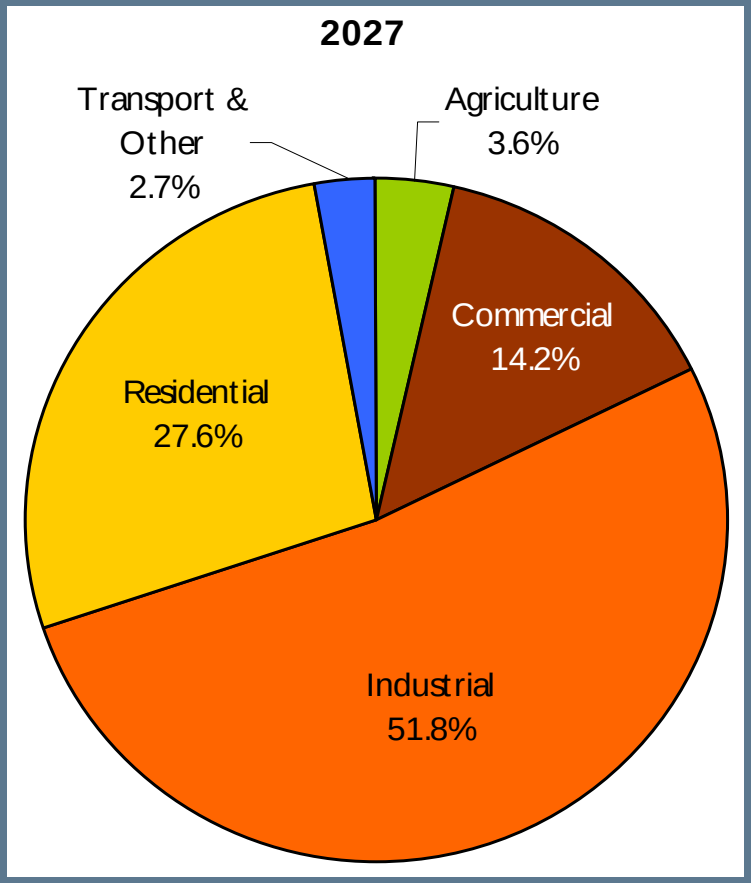
USAID
FROM THE AMERICAN PEOPLE

IRG

Reference Scenario Highlights – Energy Consumption by Sector

- End-use energy consumption grows fastest in the industrial (lead by Romania) and commercial sectors, with the residential sector shrinking in percentage terms



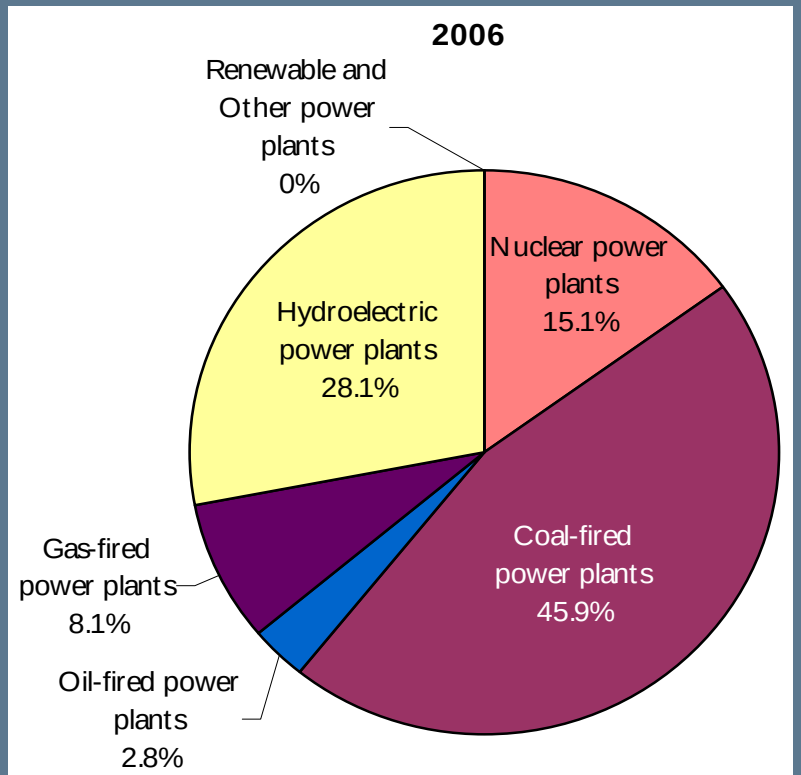


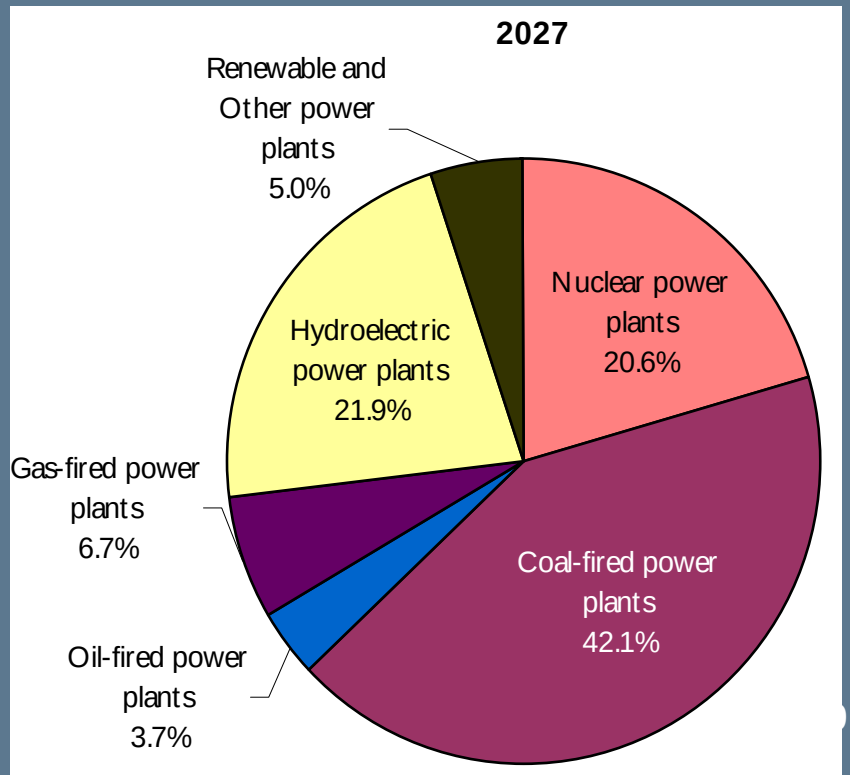
USAID FROM THE AMERICAN PEOPLE

IRG

Reference Scenario Highlights – Electricity Generation

- Electric generation is ~3% higher than the new WB Generation Investment Study in 2020
- Coal/lignite remains the dominant fuel
- Nuclear has the biggest increase
- Hydro and gas-fired plants decrease in percentage terms
- Renewables grow to 5%



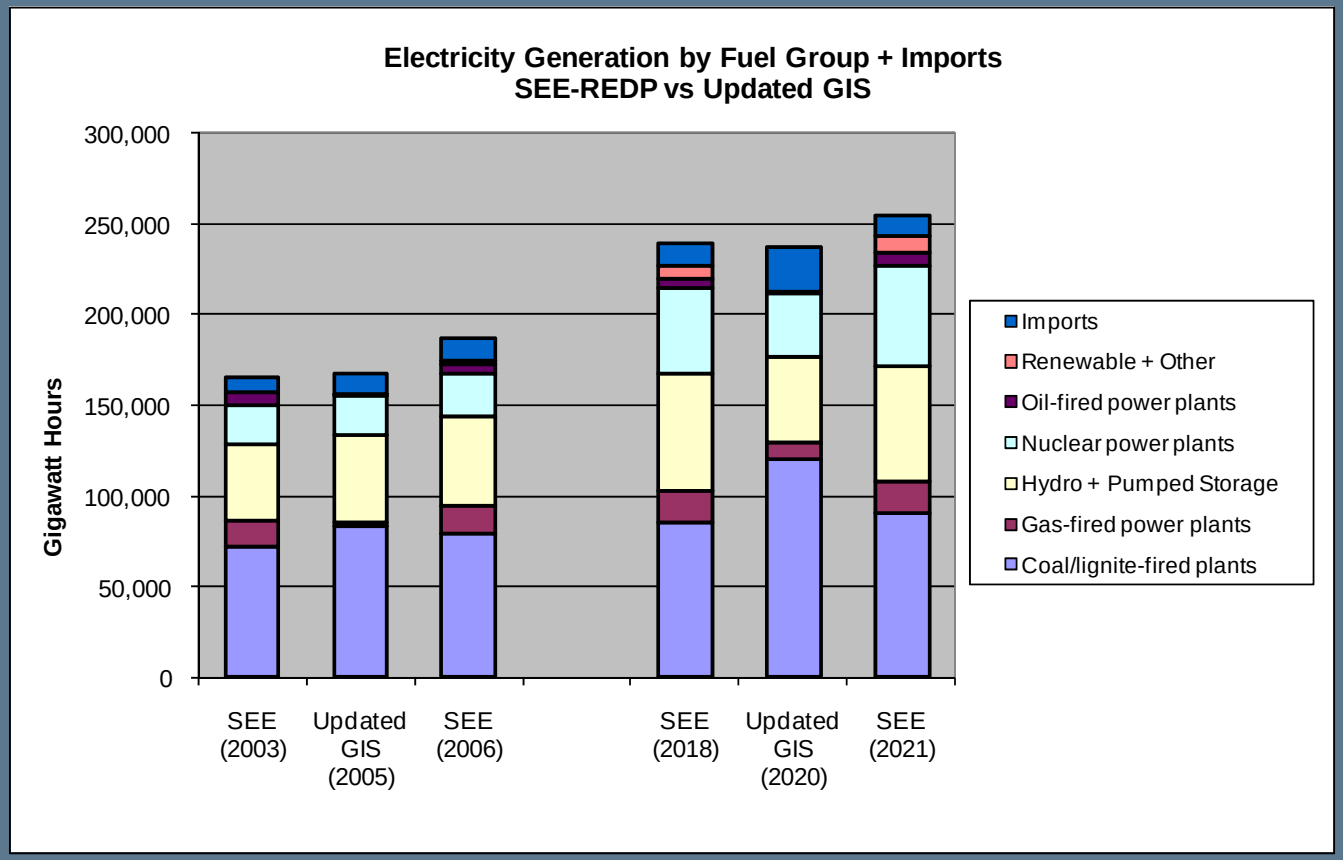


USAID FROM THE AMERICAN PEOPLE

IRG

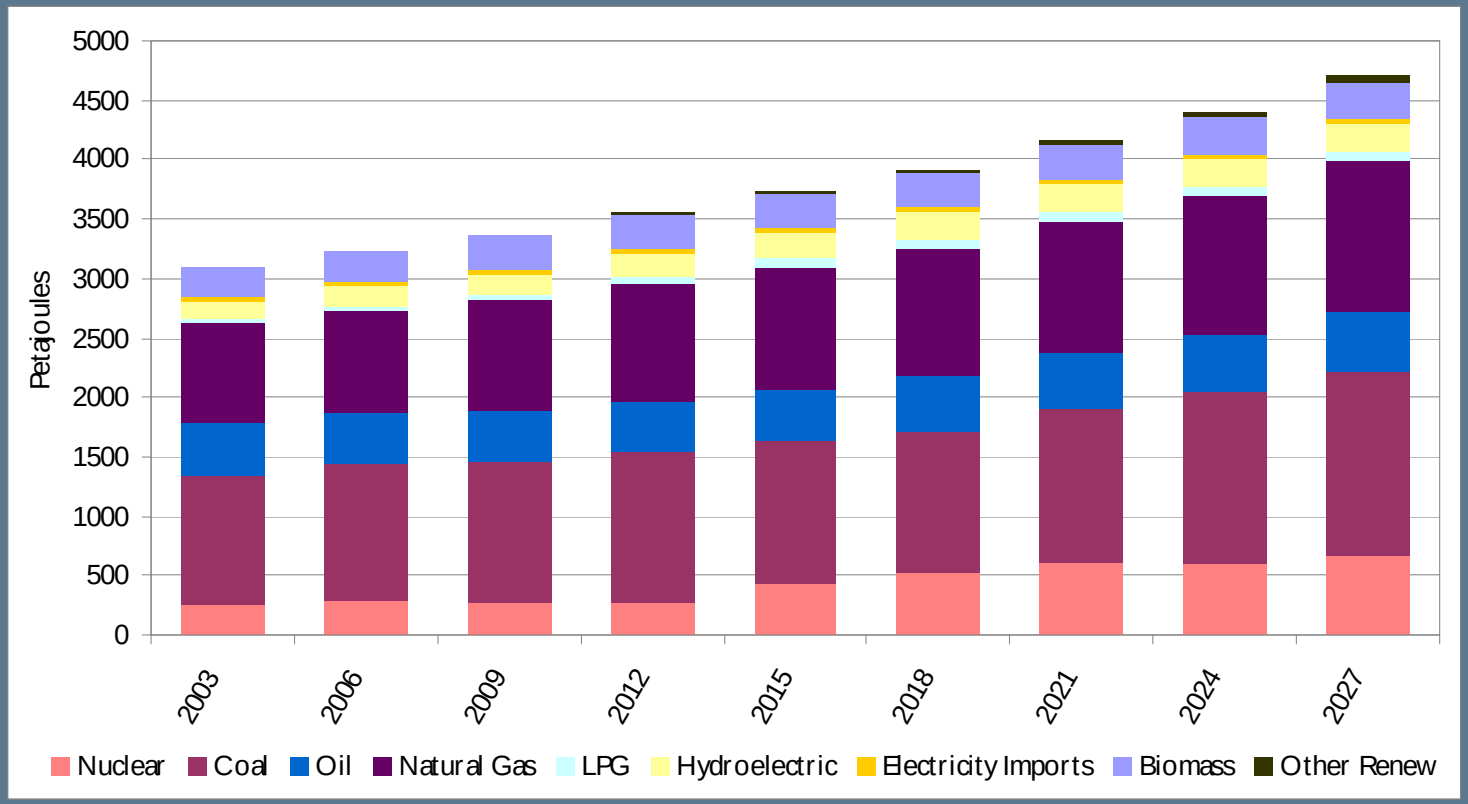
Reference Scenario Highlights – Relationship to WB-GIS

- Comparable assumptions on fuel prices and technology characterizations
- TWG review of hydroelectric and retrofit/refurbish options
- Comparable preliminary electricity demand projections
- New GIS regional only, so can't directly compare model choices (by country)



Reference Scenario Highlights – Primary Energy Supply

- Primary energy use in the region increases by over 50 percent by 2027
- Almost two-thirds of this increase is supplied by coal, with increasing contributions from natural gas and oil
- Gas consumption, while 2nd to coal, is lower than the new WB Regional Gas Study in 2020 (owing to cheaper fuels being available)

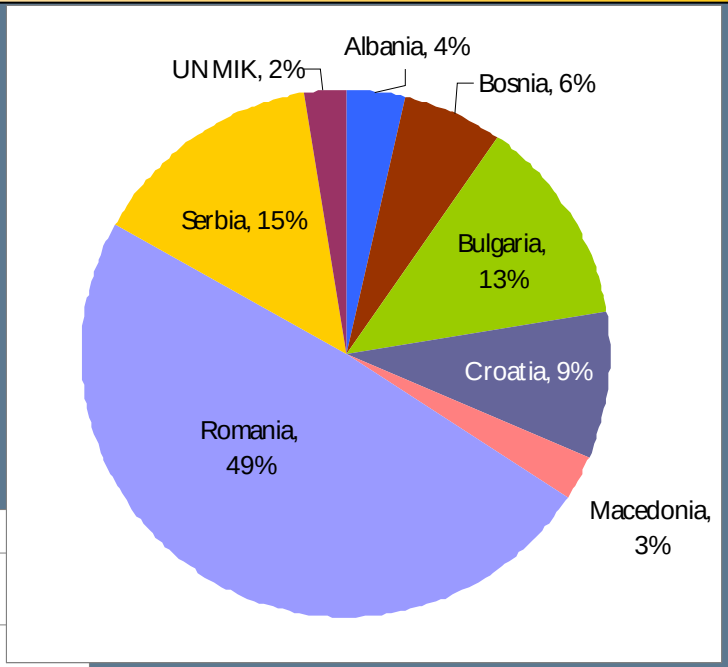


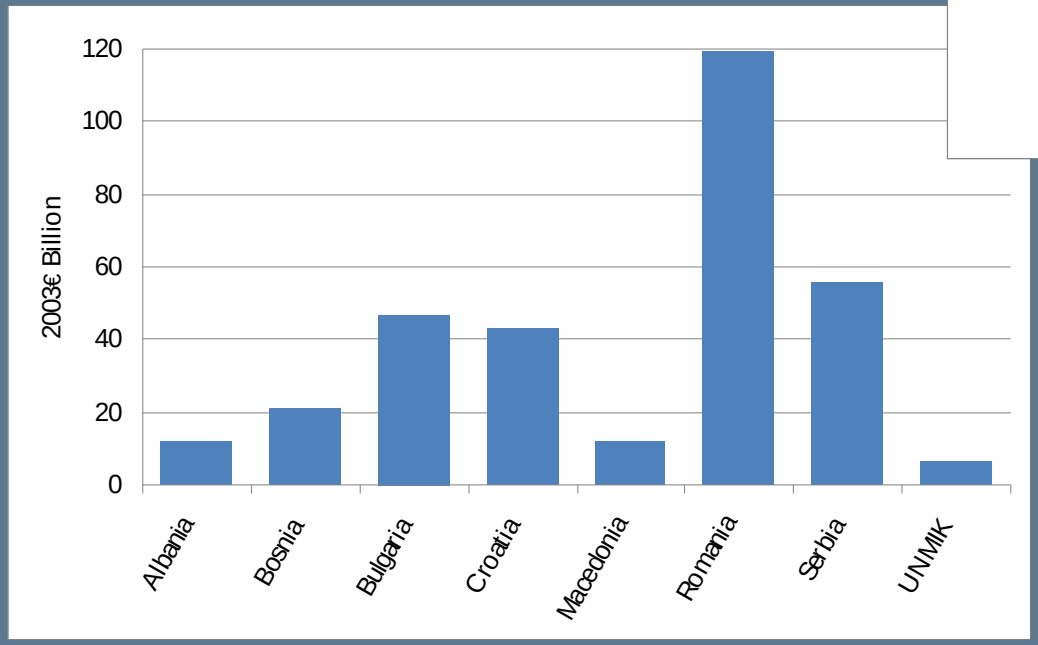
USAID FROM THE AMERICAN PEOPLE

IRG

Reference Scenario Highlights – Energy Share & Total System Cost by Country

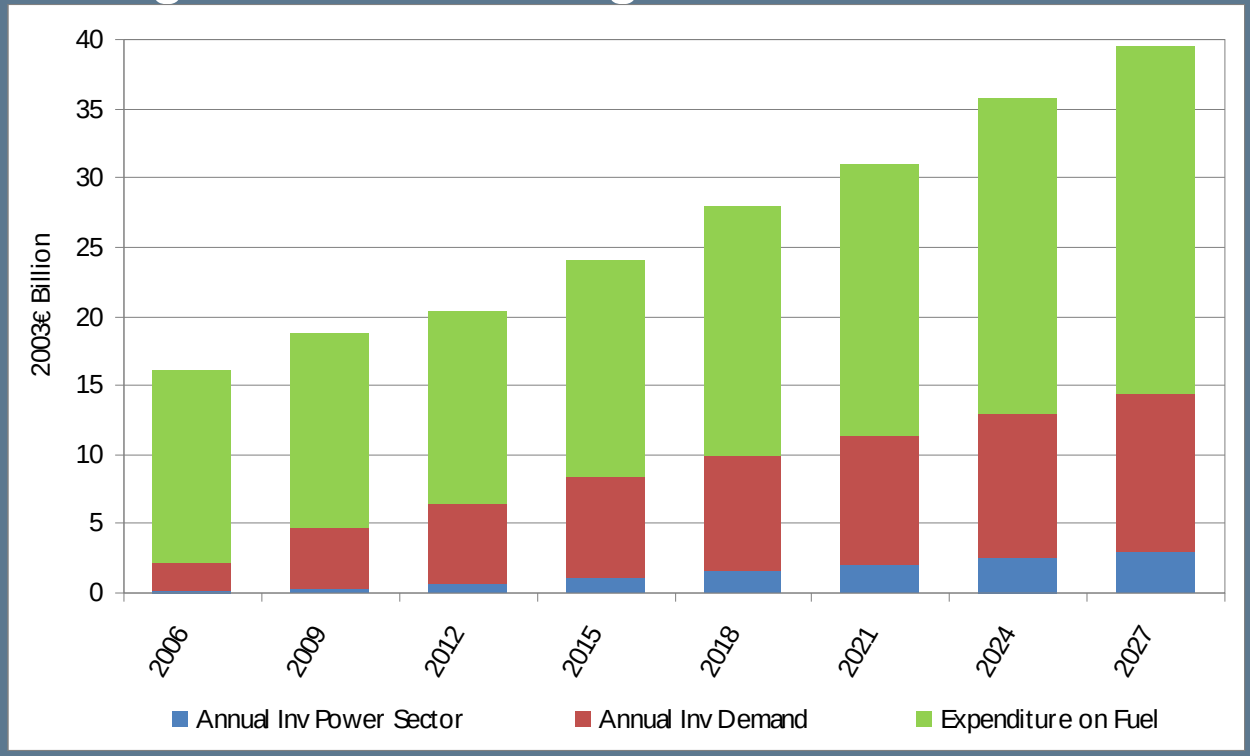
- Romania, Serbia, Bulgaria and Croatia have the highest energy use and thereby largest energy system costs





Reference Scenario Highlights – Energy System Cost Components

- Annualized investments in power plants and demand devices reach €12Billion Euros in 2020, with demand devices needing 5 times more investment than power plants
- Fuel expenditures increase to €35Billion per year by 2027, nearly doubling and dominating the cost of the energy system



USAID
FROM THE AMERICAN PEOPLE

IRG

Scenario Analyses – Promoting Energy Efficiency

- Reference scenario assumes that individuals will not make the higher initial outlay in lieu of subsequent substantive savings, despite the cost-effectiveness of energy efficiency
- Initial scenario analyses examined the implications of the following three energy efficiency related policies
- Results are presented as differences from the Reference Scenario

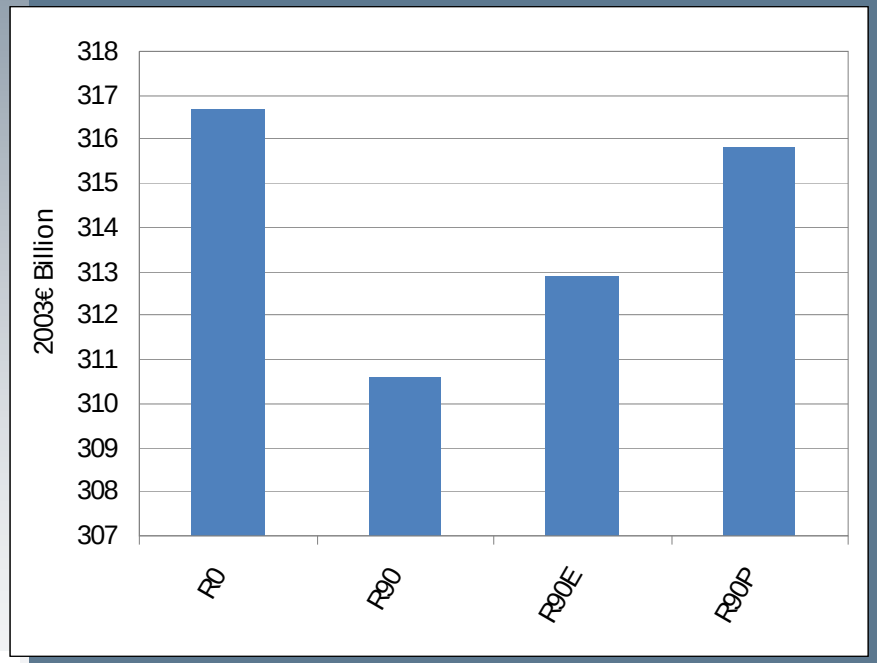
Scenario	Description
R0: Reference (BAU) Scenario	The presumed evolution of the energy system, where the current dynamics continue.
R90: Promoting Energy Efficiency	Increase access to energy efficient demand technologies.
R90E: Reducing Electricity Consumption	Impose a requirement of a 10% reduction -- from the Reference case – in electricity consumption.
R90P: Reducing Energy Intensity	Reduce overall energy intensity by forcing reductions in total energy consumption to the lowest level possible at the same energy system cost as the Reference case.

USAID
FROM THE AMERICAN PEOPLE

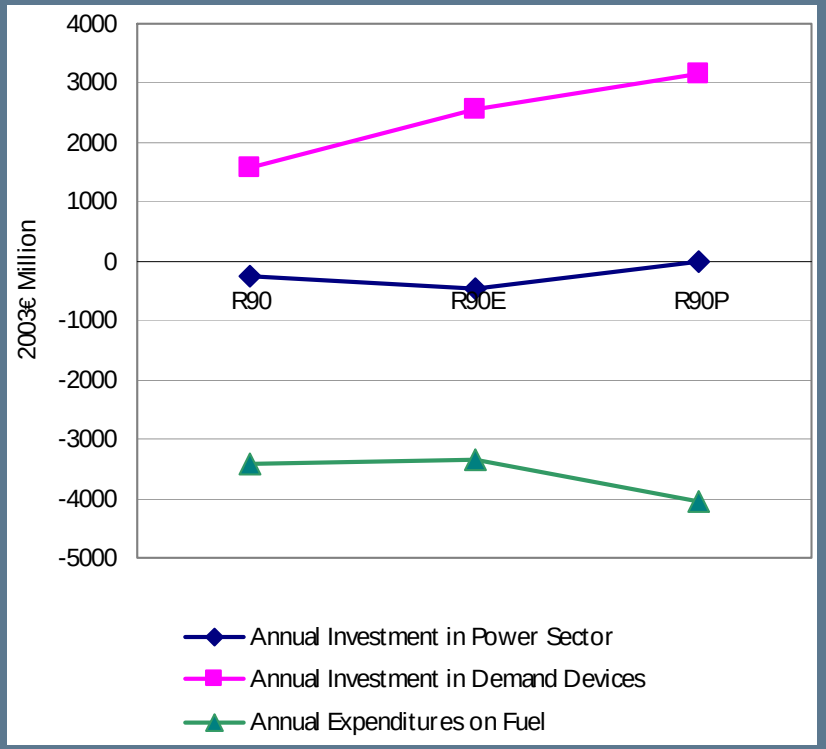
IRG

Improving Regional Competitiveness

Total discounted energy system costs drop €3.78 - €6.06 billion



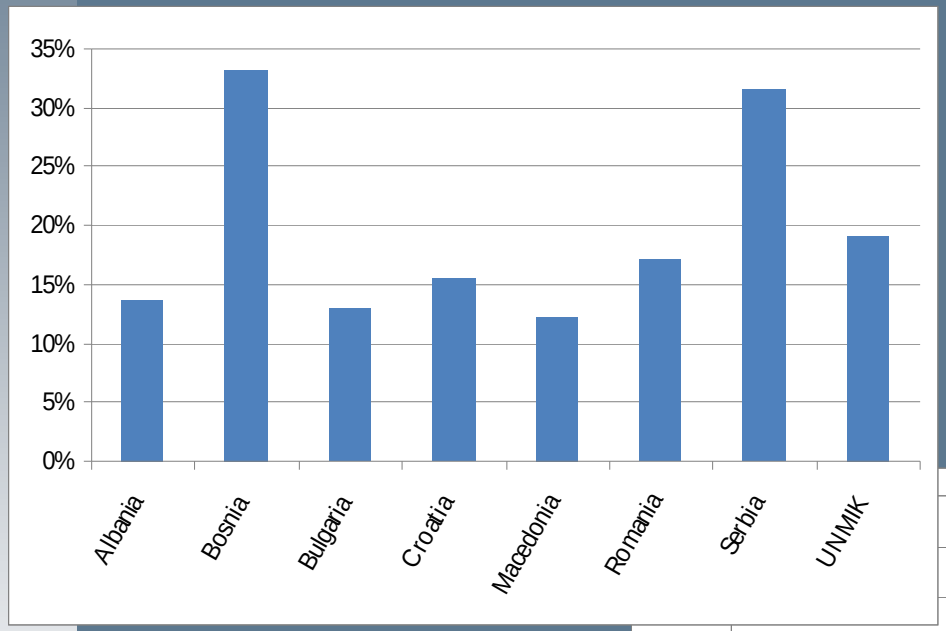
Savings in fuel expenditures overshadow increased investment in demand devices, and slightly reduced power sector investments



USAID
FROM THE AMERICAN PEOPLE

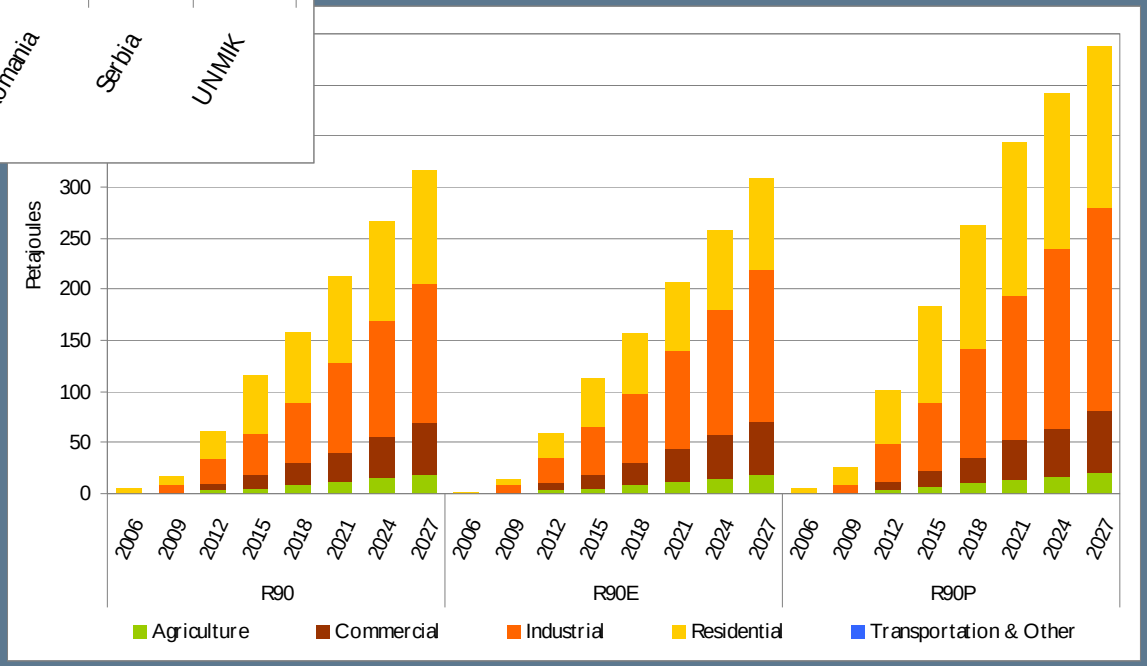
IRG

Energy Intensity Reduction and Energy Savings



Reduction in 2027 energy intensity, 16% for the region in the R90P scenario

Energy savings by sector for the region

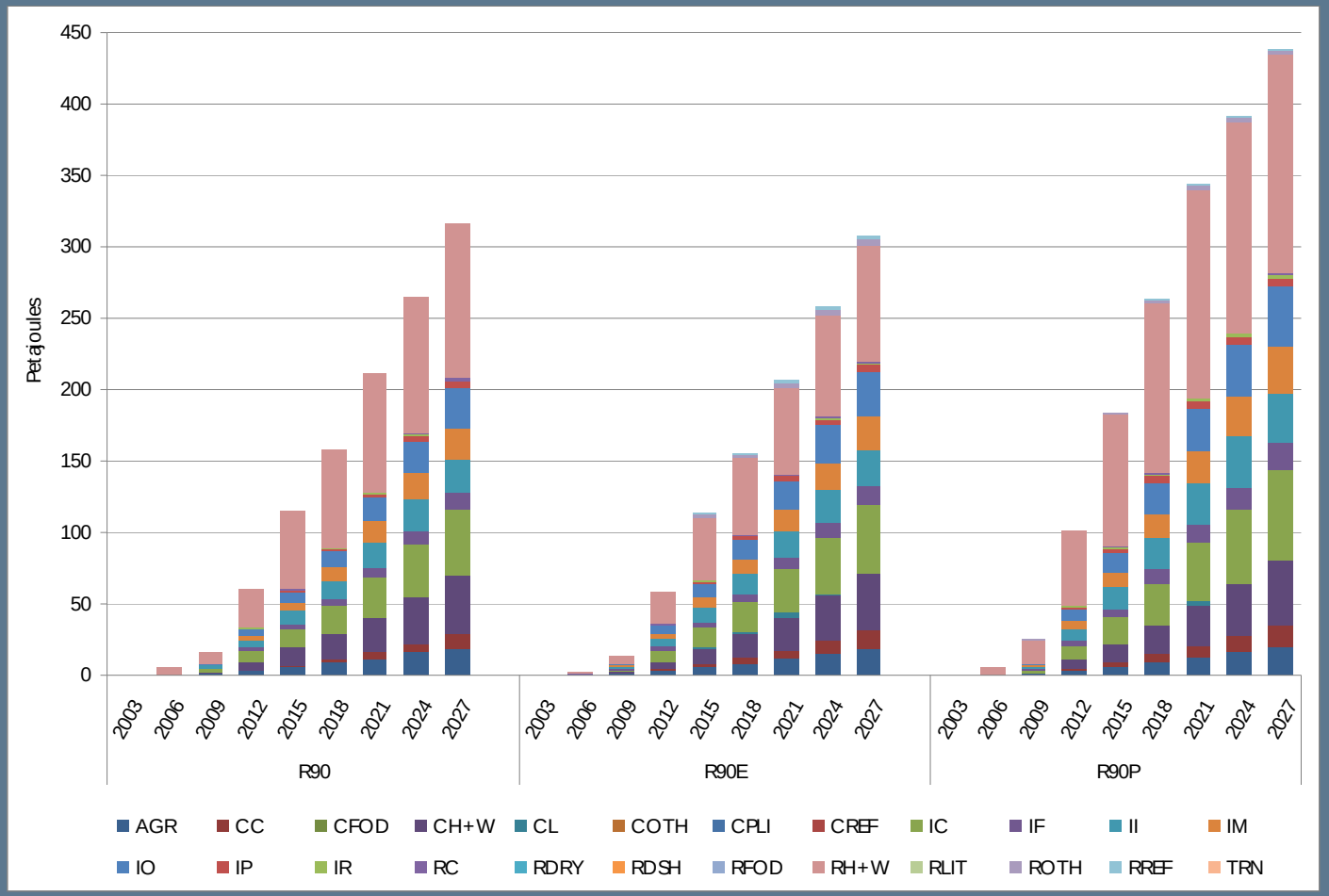


USAID FROM THE AMERICAN PEOPLE

IRG

Savings in Final Energy by Sector

The largest savings potential is in Residential and Commercial heating (and hot water), air conditioning and lighting, and various industrial sectors



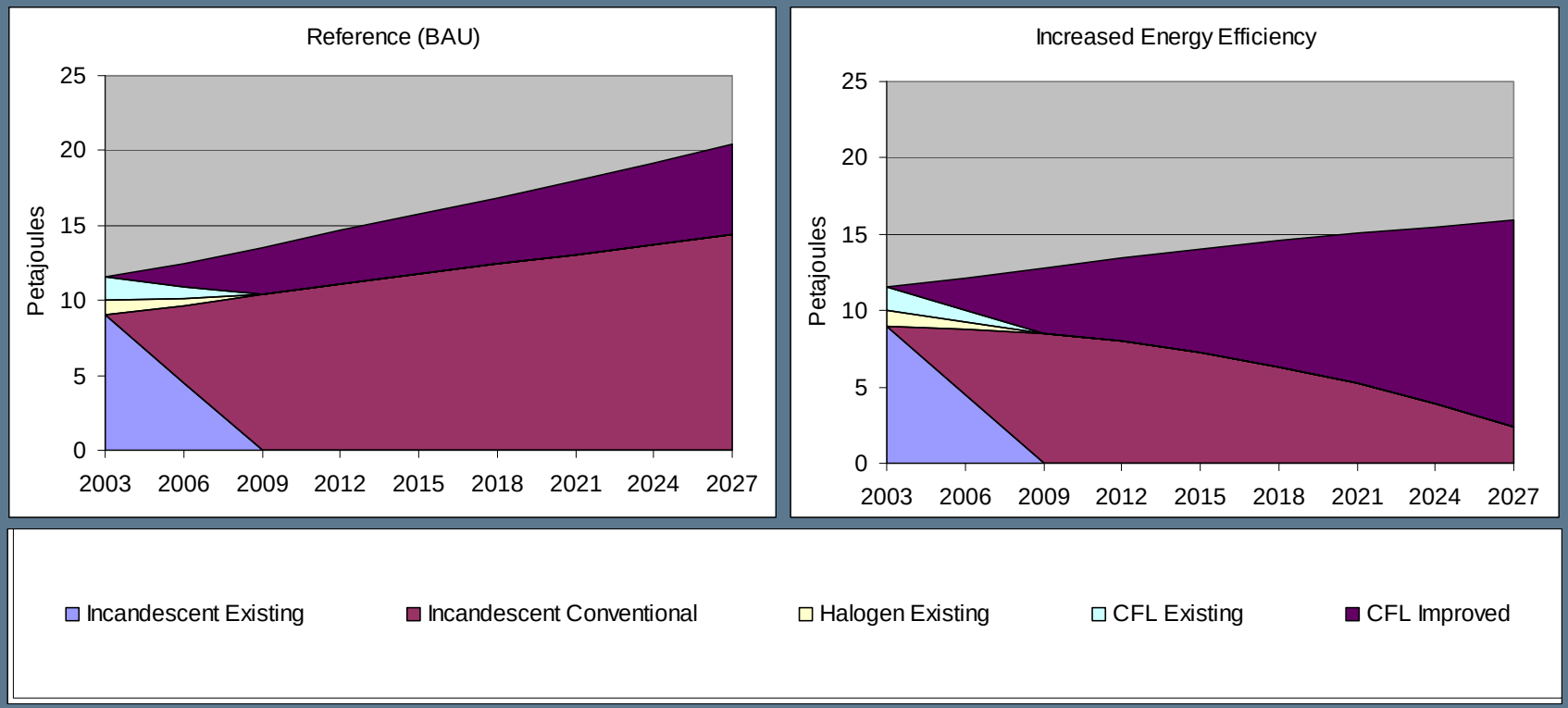
A Closer Look at Final Energy Savings in Commercial and Residential Sectors: Croatia

- Final energy savings most pronounced in:
  - Space and Water Heating
  - Lighting
  - Cooling
- No savings realized (at this stage) in:
  - Refrigeration - efficient devices are too expensive, except for slight penetration in the R90E scenario
  - Limited building shell improvements (only insulation) owing to lack of data
  - Public lighting, cooking and others – lack of improved devices options (in the current models)

USAID
FROM THE AMERICAN PEOPLE

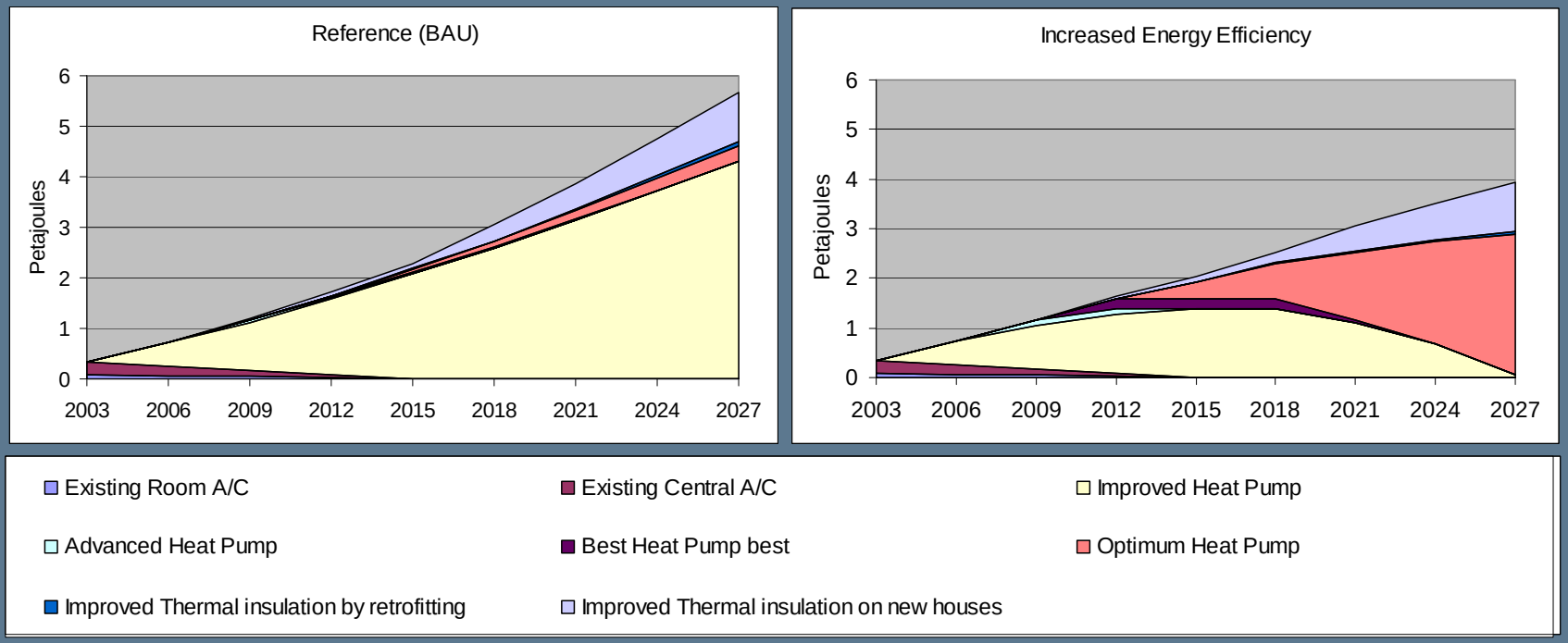
IRG

Penetration of Improved Lighting Devices in Commercial Sector: Croatia



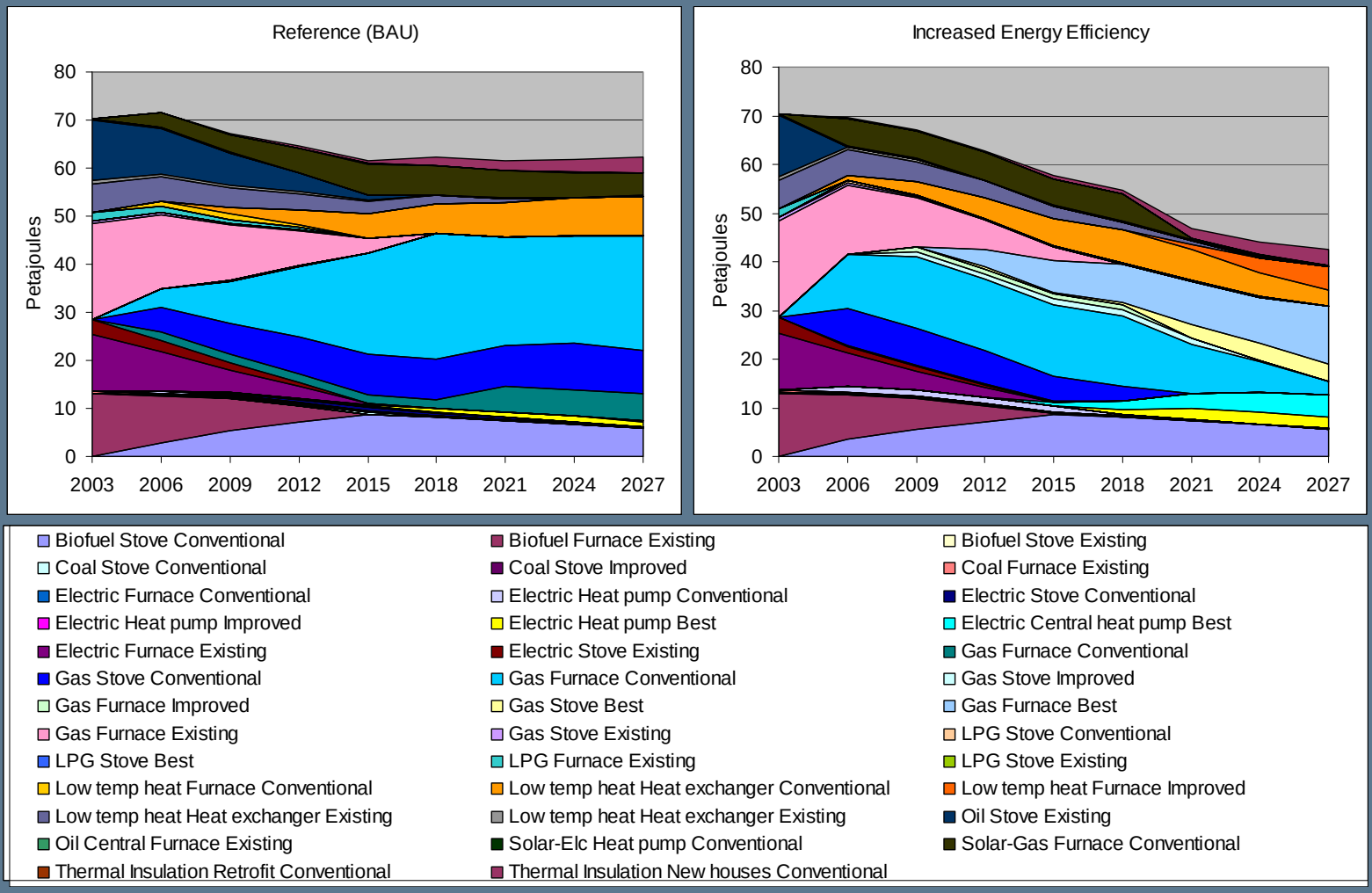
Given access to higher efficiency lights a 10.8% reduction in electricity for lighting can be realized in 2015 and a 22.1% reduction by 2027.

Penetration of Improved Cooling Devices (and Insulation) in Residential Sector: Croatia



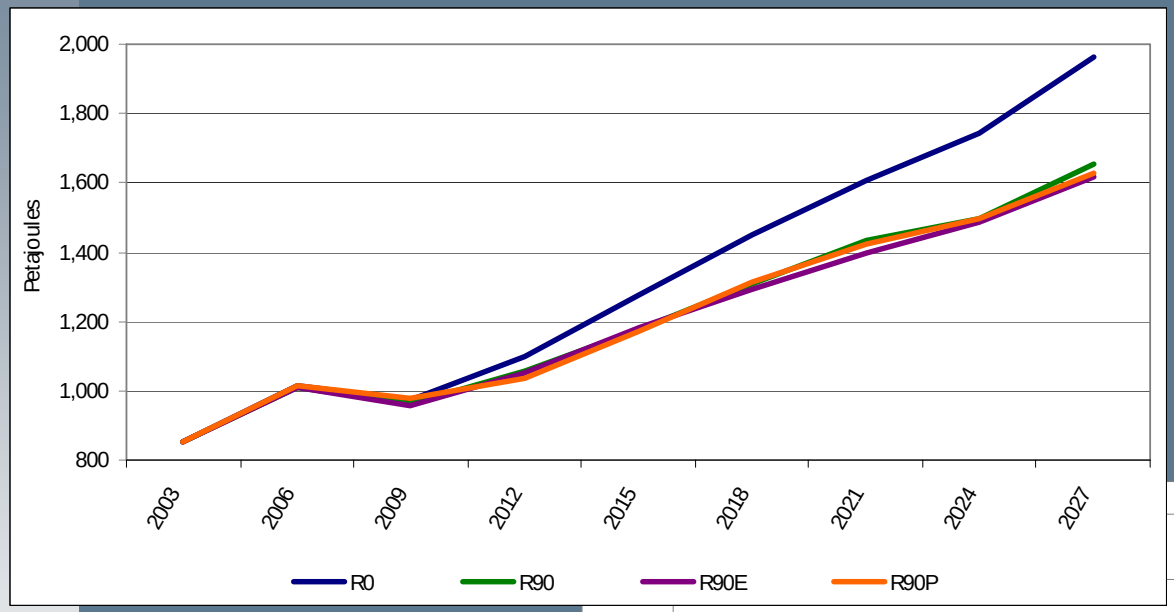
Given access to higher efficiency air conditioners an 11.2% reduction in electricity for cooling can be realized in 2015 and a 30.5% reduction by 2027.

Penetration of Improved Space Heating Devices (and Insulation) in Residential Sector: Croatia



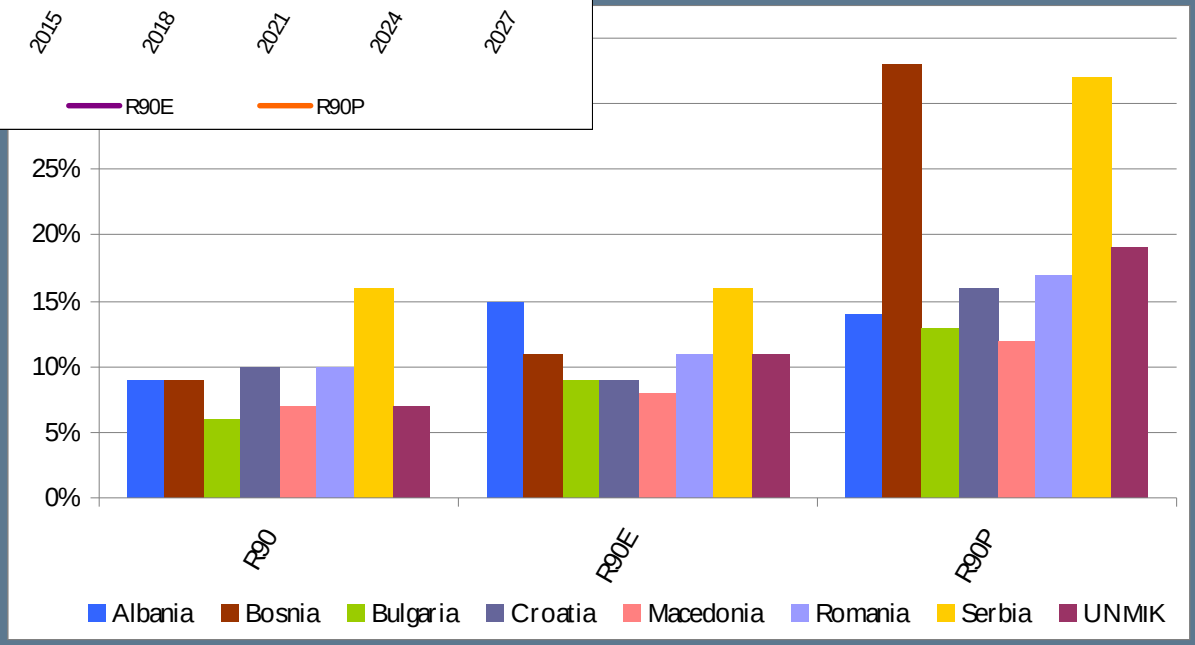
Access to higher efficiency space heating devices results in a 5.1% reduction in energy use in 2015 and a 34% reduction by 2027.

Improved Energy Security



Total Reduction in imports

Reduction in imports share of total primary energy (2027) by Country

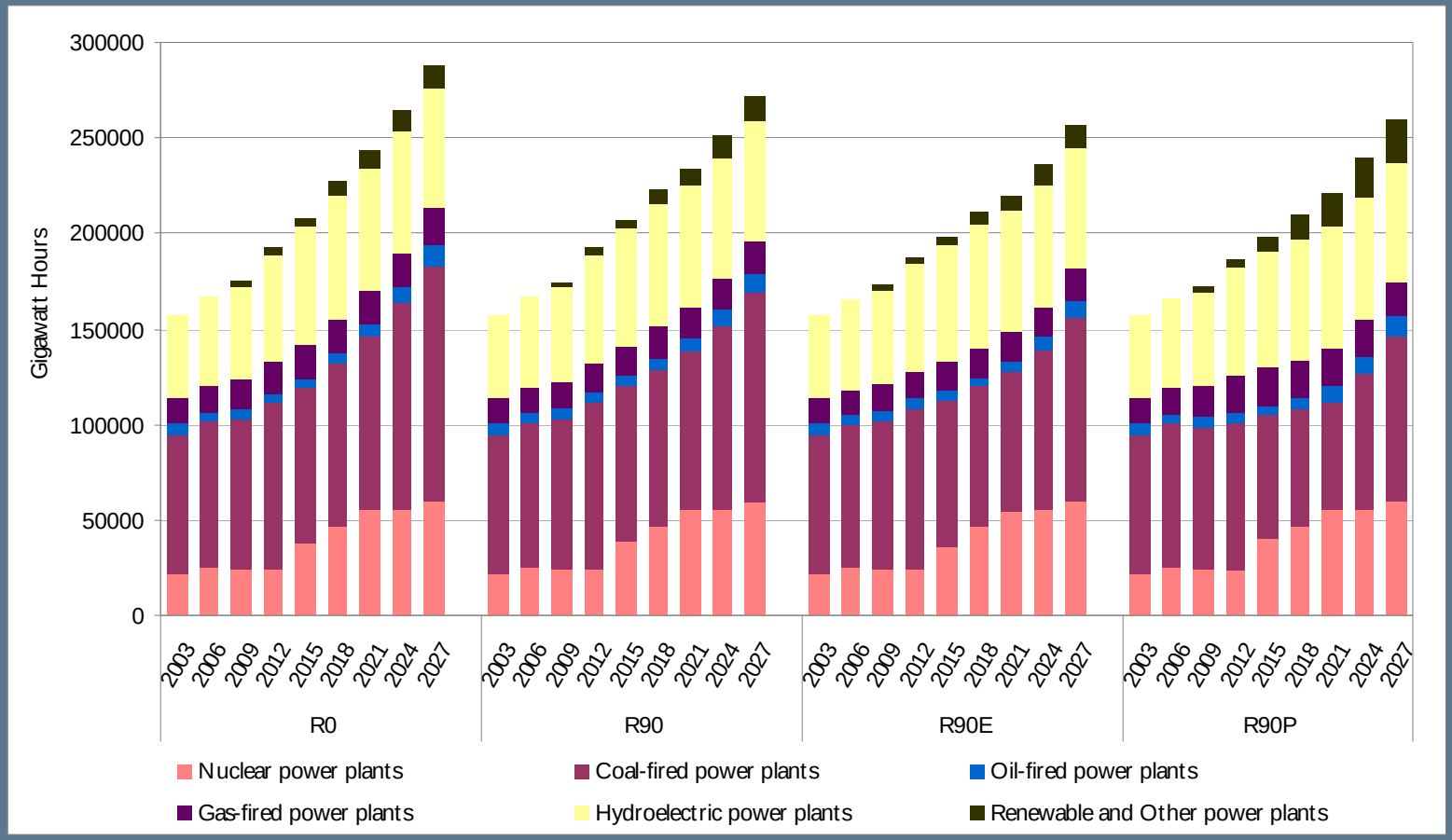


USAID
FROM THE AMERICAN PEOPLE

IRG

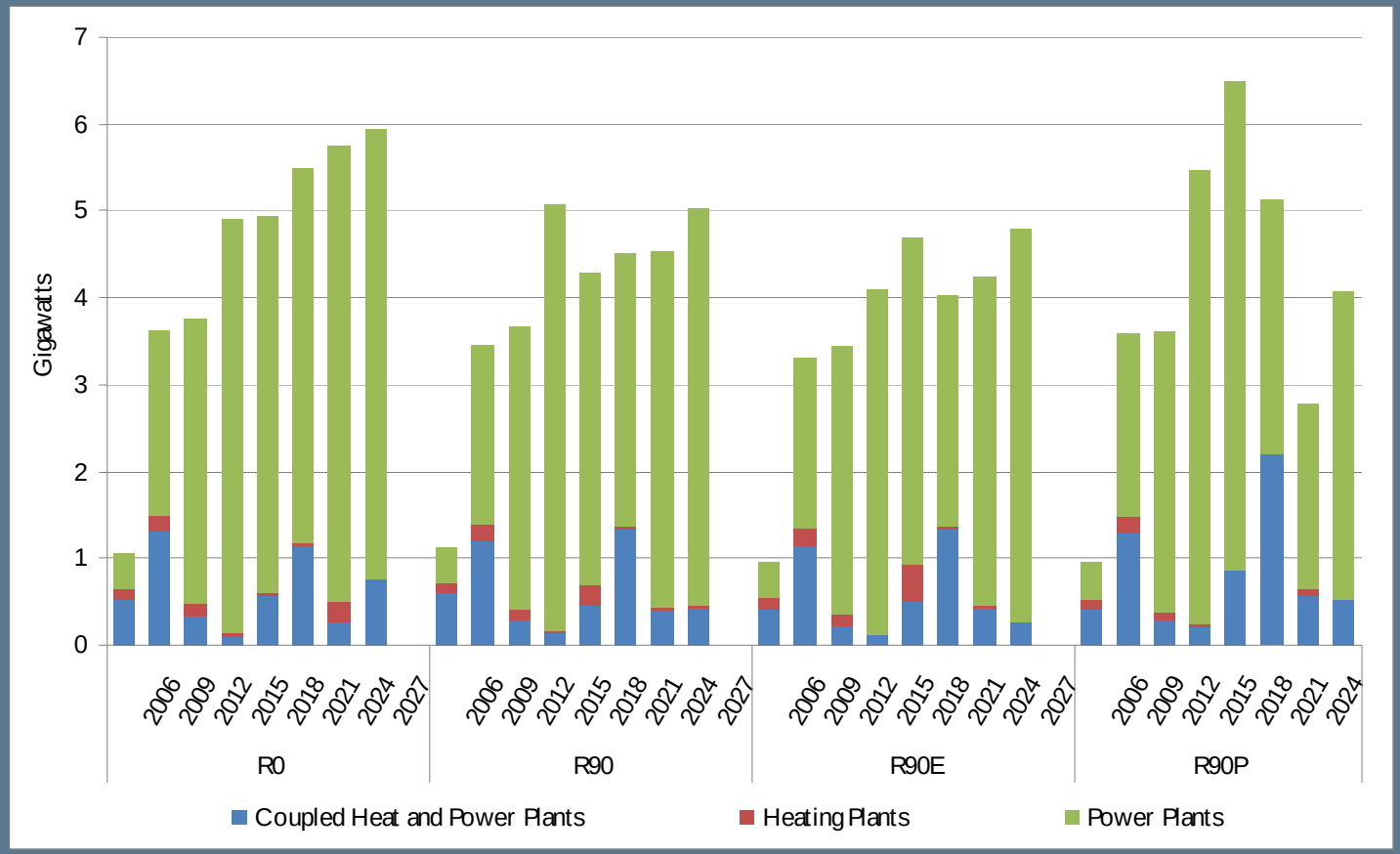
Impact on Electricity Generation – Demand and Mix

Efficiency improvements reduce electricity generation requirements 6 – 10%, mainly from coal/lignite



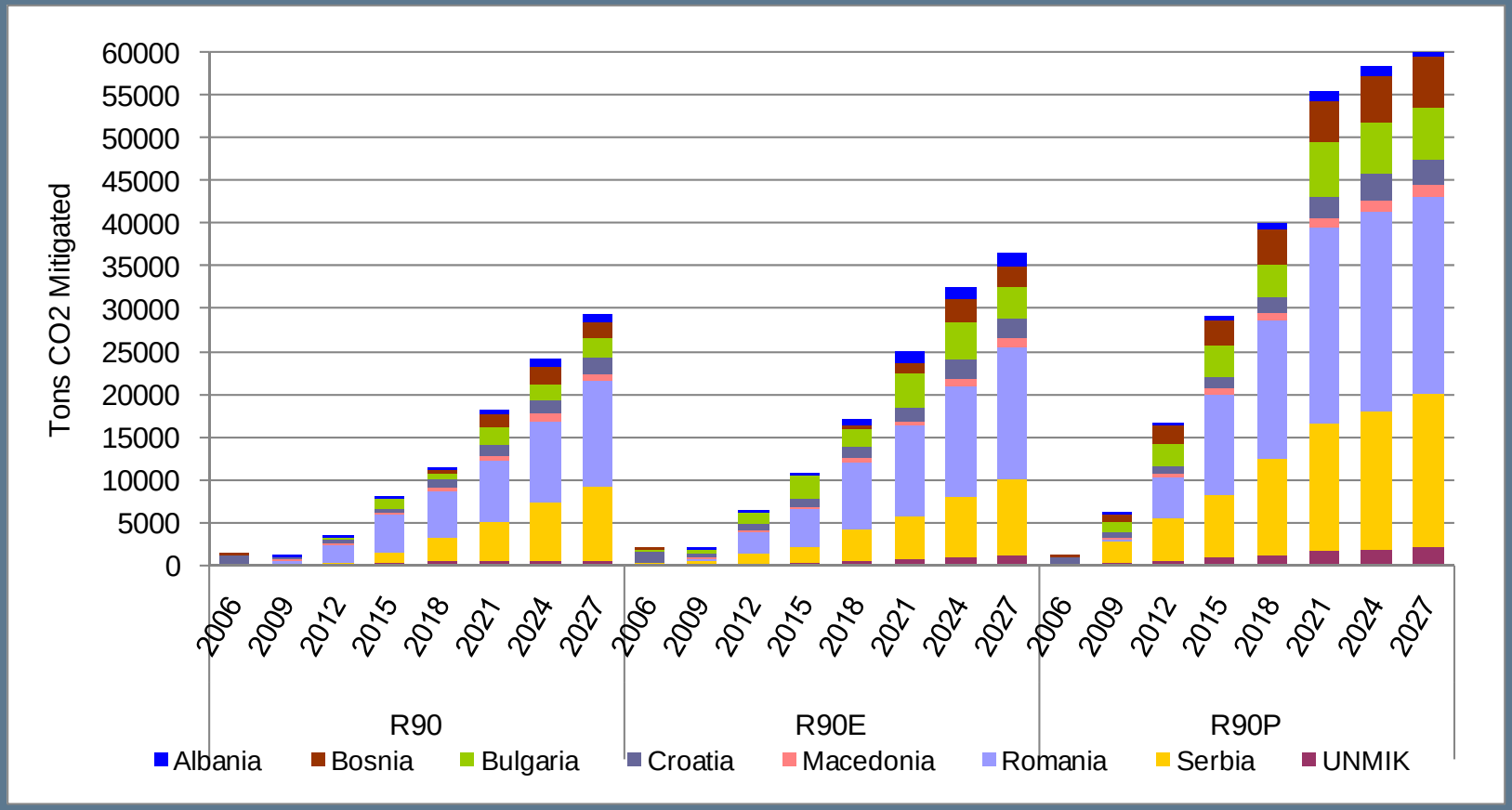
Impact on Electricity Generation – Investments by Plant Type

Power sector investments are reduced through demand side actions, but shift when primary energy limits are imposed



Reduction in CO_2 Emissions

Emission reductions are achieved primarily through the drop in coal and natural gas consumption



USAID FROM THE AMERICAN PEOPLE

IRG

Summary of the Benefits Arising from Promoting Energy Efficiency

Improvement	Benefit Range (in 2027)
Total discounted energy system cost savings	1.5 - 2% (€3.78 - €6.06 billion) over the planning horizon
Change in undiscounted annual costs	
Power plant investment	Decrease of 0.2 – 15% (5 - 455€ million)
Demand-side investment	Increase of 14 – 28% (1.59 – 3.16€ billion)
Fuel Expenditure	Decrease of 13 – 16% (€3.43/3.36/4.04 billion)
Annual energy savings	9 – 18% (417 – 793 PJ)
Annual electricity savings	6 – 11% (17 - 33GWh)
Reduction of imports	16 – 17% (309 – 343 PJ)
Decrease in energy intensity	9.4 – 18%
Reduction in CO_2 emissions	11 – 23%

USAID
FROM THE AMERICAN PEOPLE

IRG

Where Things Stand

- Capacity and models are in place and ready for use to examine a diverse set of energy (and environmental) issues for 8 SEE countries
  - A continual process of refining, improving and utilizing the models is necessary to ensure their usefulness
- Experts in the region have been familiarized with the use of the model, though they still require guidance for ongoing development and its application
  - Finding time to work with the model on a regular basis is difficult, and thus most all learning and usage currently happens at workshops
- Models should be
  - Expanded for complete coverage of the energy system (add transportation and emissions)
  - Linked (electricity and natural gas trade) into an integrated regional framework

USAID FROM THE AMERICAN PEOPLE

IRG

Key Energy Policy Issues in the Region

- Assessment of the role of energy efficiency
- Potential for renewable energy
- Roadmap for attaining EU targets
- Removal of market distortions
- Role of nuclear
- Higher economic growth
- Increased access to natural gas
- Integration of the electricity network
- Post-Kyoto scenarios
- Integrated regional assessments of common issues

USAID
FROM THE AMERICAN PEOPLE

IRG

Where Are Things Headed?

- Determination of the role of the SEE-REDP network and tools with respect to
  - Integrating into the national planning process of the countries
  - Examining regional issues and fostering development of coordinated investment strategies
- Need to examine ways of
  - Sustaining and expanding the TWG capacity
  - Bring in additional countries in the region
  - Fostering closer interaction and coordination with other regional undertakings

USAID
FROM THE AMERICAN PEOPLE

IRG