

Potentials and Cost of Energy Efficiency Measures in the Western Balkan Countries and Turkey



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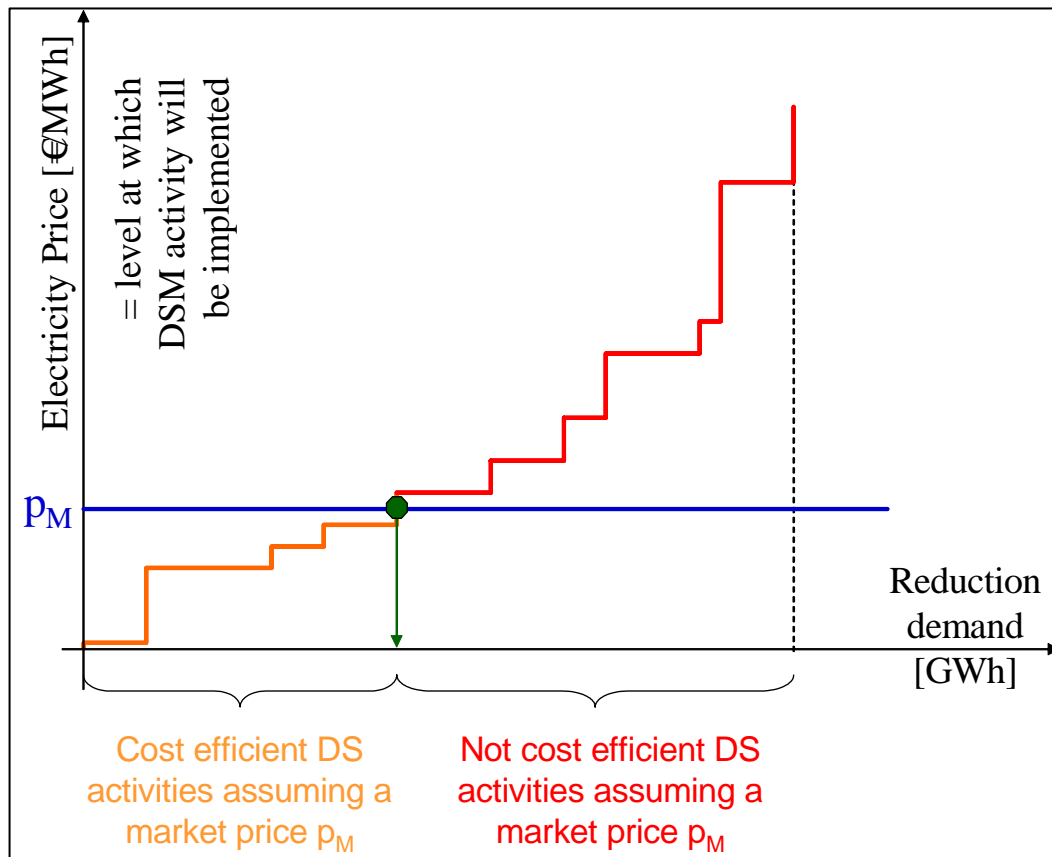
Outline

- 1. Modelling of Energy Efficiency Measures on the Demand Side in the **GreenNet-Europe** Simulation Software (incl. the Definition of Cost Curves: Potential and Costs for Different Energy Efficiency Measures)**
- 2. Sectors and End-Uses**
- 3. Overview of Results on Potentials and Cost in the Western Balkan Countries & Turkey**

1. Modelling Energy Efficiency Measures in the GreenNet-Europe Simulation Software

- Energy Efficiency Demand Side Measures are the energy efficiency activities for achieving an overall reduction of primary energy supply for end-use energy demand
- The aim of these activities is to reduce the total cost of energy services and to reduce primary energy consumption
- Typical activities investigated:
 - installation of efficient appliances or lighting devices
 - insulation measures
 - control system
 - fuel switching *where it implies a reduction of primary energy consumption*

Energy Efficiency Measures on the Demand Side



- Each possible energy efficiency activity is defined by the reduction of demand that it will generate (GWh) and its implementation cost (€/MWh)
- Given a price of electricity, we can therefore select cost efficient measures as those with a cost of conserved energy lower than the price of electricity

Saving Potential due to Energy Efficiency Measures

- The savings are calculated as the difference in consumption that the activity can generate
 - Insulation measures in buildings will reduce the consumption for heating during winter
- For efficient appliances we always consider the alternative appliance as the cheapest on the market
 - The saving generated by a new class A++ fridge freezer is the difference between its consumption and the consumption of the cheapest fridge freezer on the market (with the same volume)

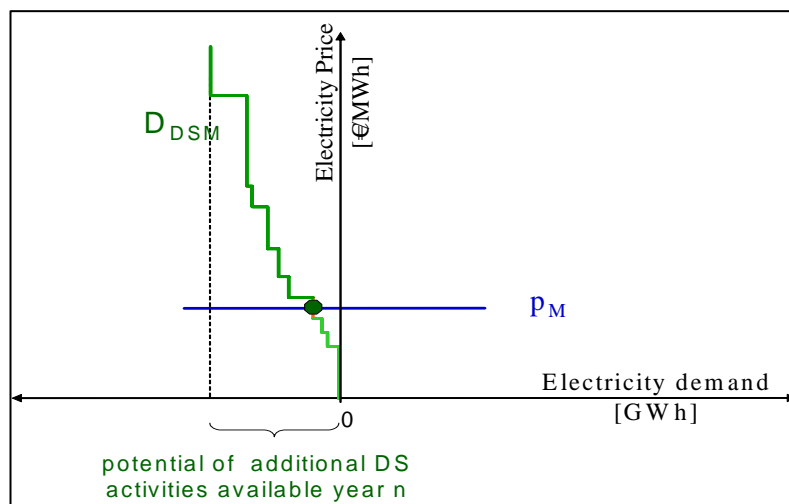
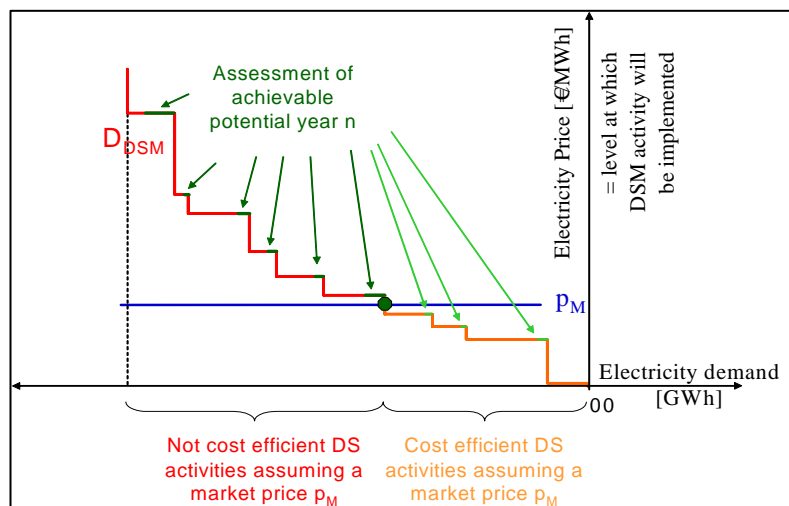
Saving Cost due to Energy Efficiency Measures

- The Cost of Demand Side Measures is the total cost incurred when implementing it
- In case of an alternative option the cost is the extra cost generated
 - The extra cost of a new class A++ fridge freezer is the difference between its price and the price of the cheapest fridge freezer on the market (with the same volume)
- In case the Demand Side Measure generates new operation and maintenance costs, they are included into the analysis

The Cost of Saved/Conserved Energy

- When a Demand Side Measure is implemented, it will generate savings for a number of years, depending on the technology.
- When we calculate the cost of saved/conserved energy (€/MWh), all savings generated will be taken into account.
- The calculation of the Capital Recovery Factor is needed to take into account depreciation:
$$CRF = \frac{z * (1 + z)^{PT}}{[(1 + z)^{PT} - 1]}$$
- Measures with no costs (behavioural changes, standby reduction, ...) cannot be included.

Demand Side Energy Efficiency Measures in the GreenNet-Europe Model



- The GreenNet-Europe simulation model is based on annual iterations.
- Therefore, the potentials are calculated on an annual basis (% of the total saving potential achievable in year n).

2. Sectors and End-Uses

- Since costs vary depending on the sector in which we implement a demand side energy efficiency measure, three different sectors are highlighted (residential, industrial and tertiary sector).
- For each sector, six different end-uses are analysed.

1. Residential	2. Industry	3. Tertiary sector
a. Single family houses		a. Commercial service
b. Multi-family houses		b. Public service
i. Space heating	i. Space and water heating	i. Space and water heating
ii. Sanitary (potable) hot water	ii. Air conditioning	ii. Ventilation – air conditioning
iii. Lighting	iii. Lighting	iii. Lighting
iv. Refrigeration	iv. Refrigeration	iv. Refrigeration
v. Electrical appliances	v. Motors/drives	v. Motors/drives
	vi. Compressed air	vi. ICT/office machinery

Residential Demand Side Energy Efficiency Measures

- Space Heating

- control devices
- fuel substitution
- ground insulation
- roof insulation
- wall insulation
- double glazing

- Water heating

- fuel substitution

- Lighting

- efficient bulbs

*For each measure we considered
the most cost efficient option
(e.g. the insulation technology with
lower cost of conserved energy)*

- Refrigeration

- freezer
- refrigerator

- Appliances

- washing machine
- dish washer
- television

Tertiary and Industrial Demand Side Energy Efficiency Measures

- Space and Water Heating
 - Auto/manual control devices
 - Insulation
- Air Conditioning
 - Auto/manual control devices
 - Insulation
- Lighting
 - High efficiency Lamps
 - High efficiency Fixtures
 - High Efficiency Ballasts
 - Occupancy Sensors
 - Daylight Control
- Motors
 - High Efficiency Motors
 - Variable speed drivers
 - All system redesign
- Refrigeration (*very small potential*)
 - Thicker Insulation
 - Improved Insulation
 - Floating Head Pressure
 - Anti-sweat Heat Controls
 - Defrost Controls
 - High-Efficiency Fan Blades
- ICT (*only for tertiary sector*)
 - LCD Monitors
- Compressed Air (*only for industrial sector*)
 - Upgrading of compressor
 - Recovering waste heat
 - Overall system design
 - Reducing pressure losses
 - Reducing air leaks
 - Frequent filter replacement

Addressed Countries

- Albania
- Bosnia/Herzegovina
- Croatia
- Macedonia
- Montenegro
- Serbia
- Turkey

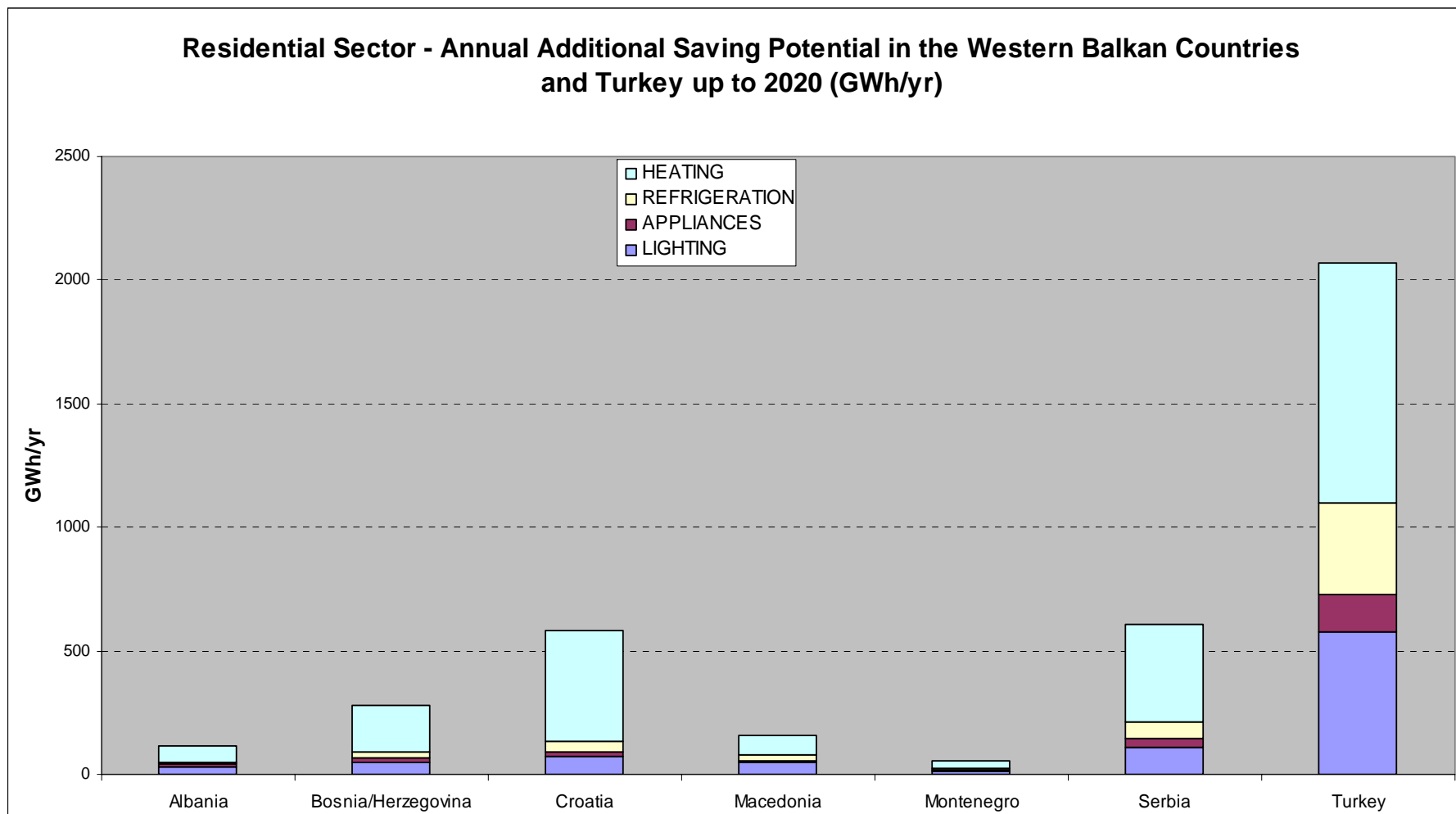
Data Sources

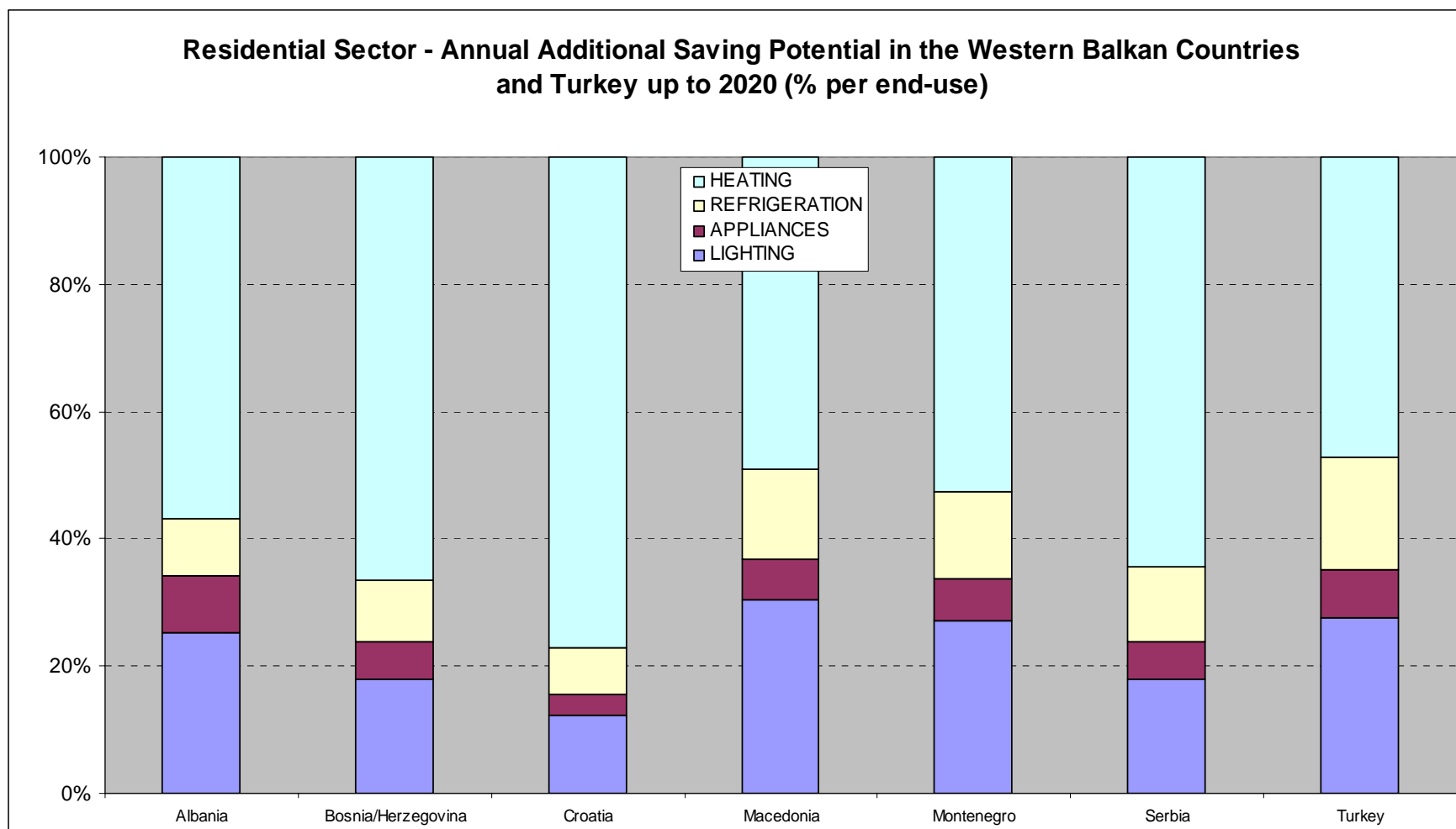
Investigated countries are not included in the *MURE* database. Therefore, the following data sources are used:

- ✓ National Statistical Offices and Energy Institutes
- ✓ Enerdata Country Profiles
- ✓ Country-Specific Data Profiles from enerCEE.net
- ✓ World Bank Data
- ✓ CEEC Indicators - Energy Efficiency Indicator for Central and Eastern European Countries
- ✓ Data from national/regional consultants

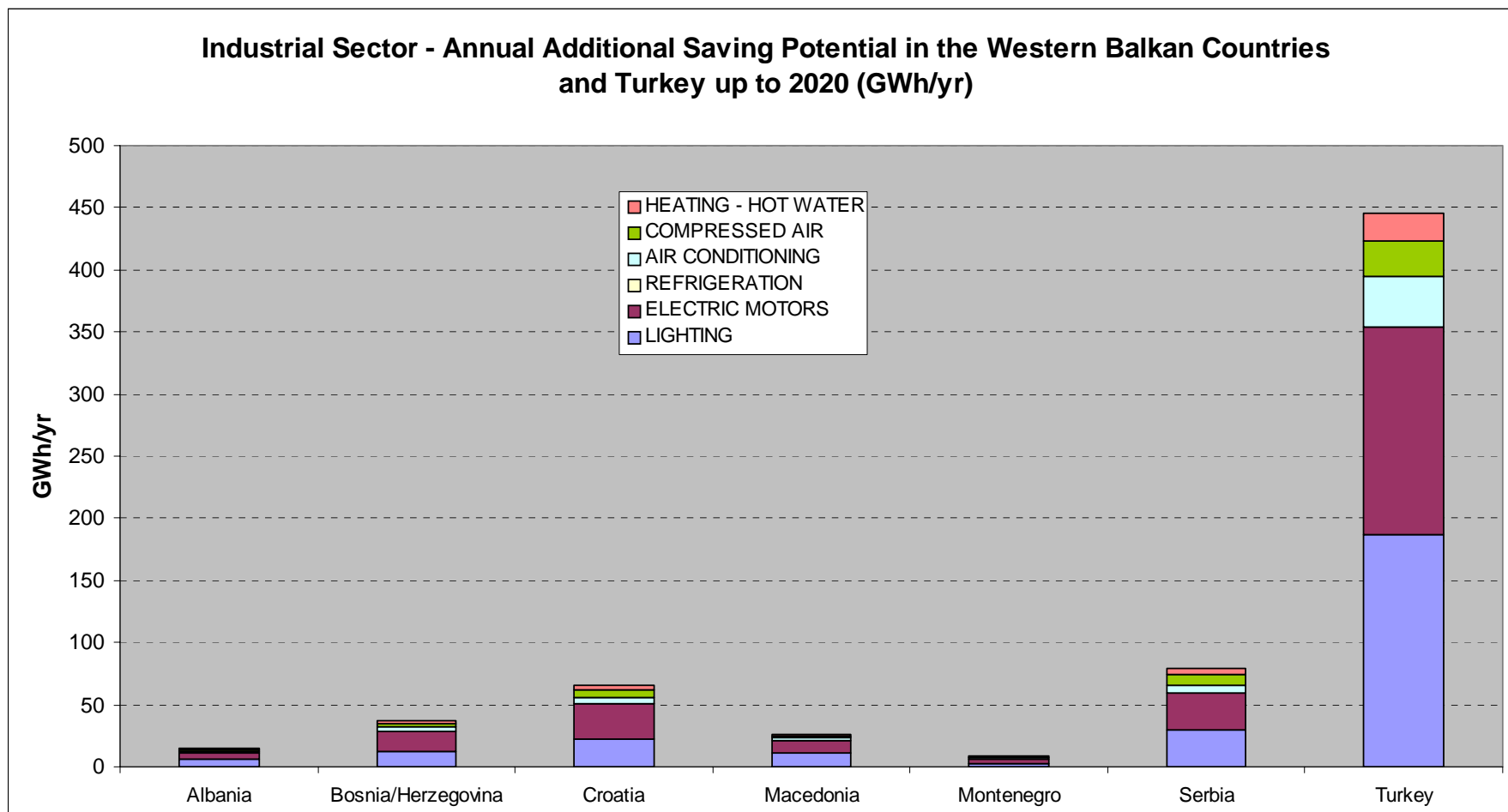
3. Overview of Results: Western Balkan Countries & Turkey

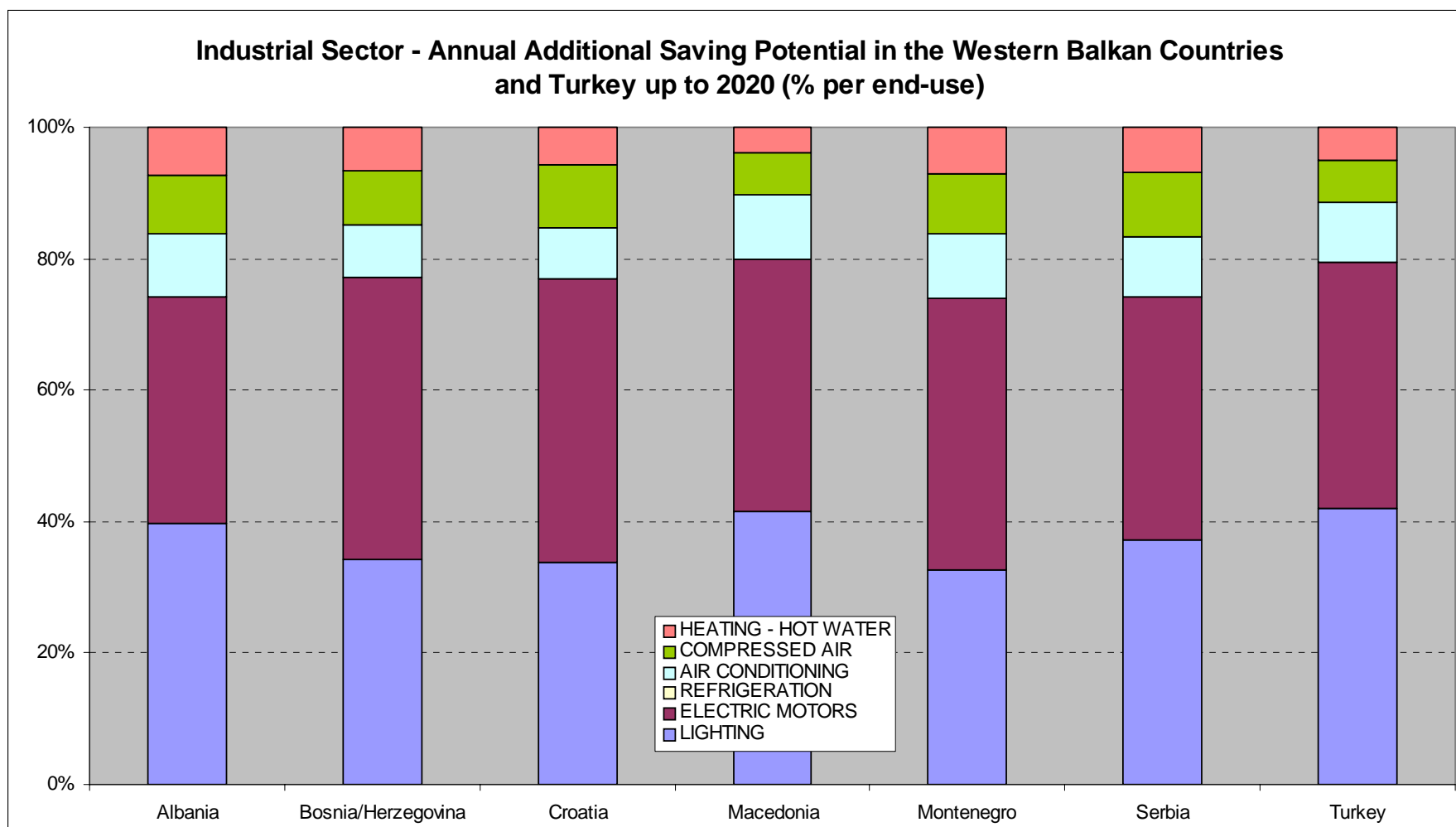
Results: Potentials in the Residential Sector



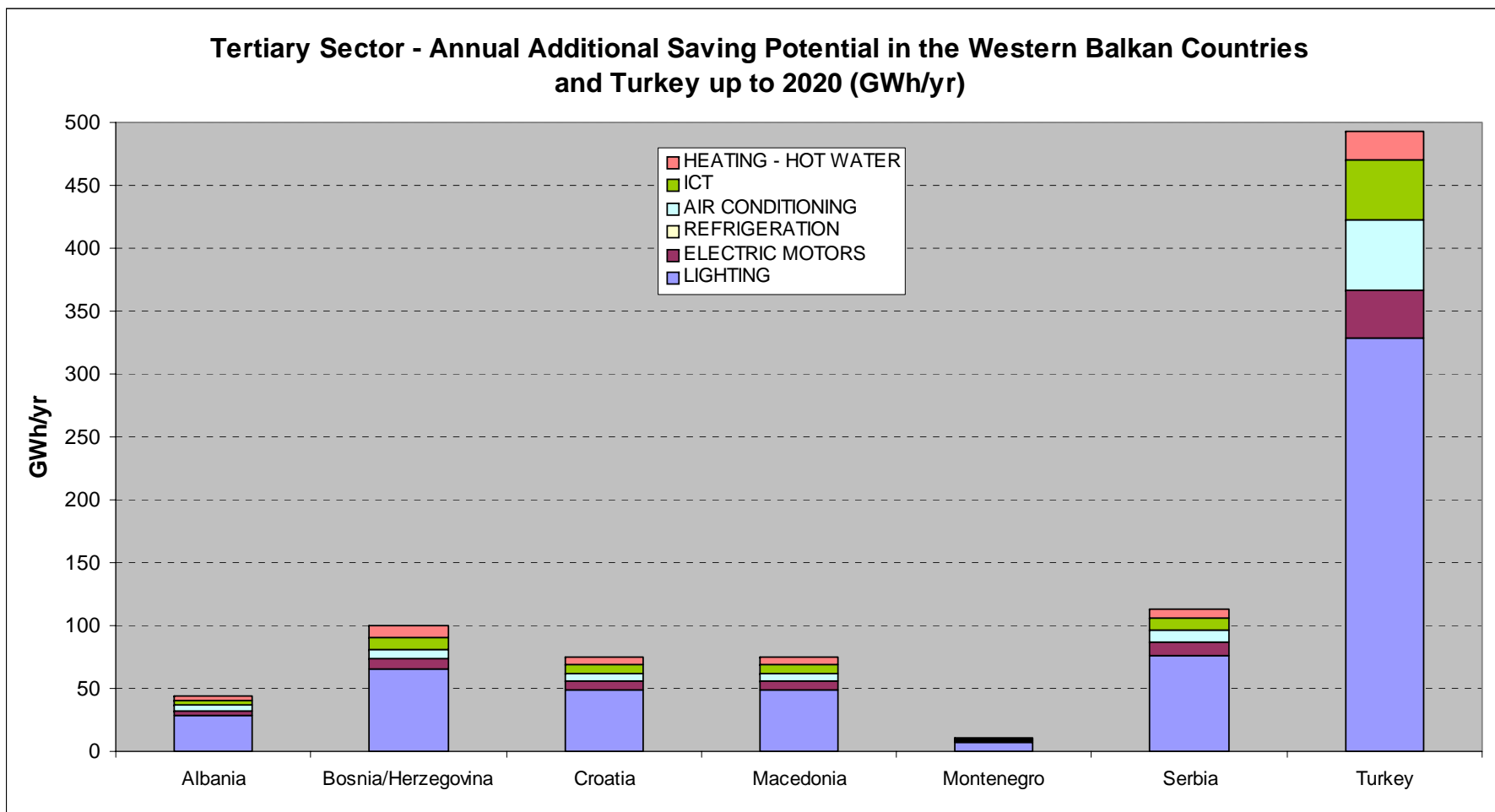


Results: Potentials in the Industrial Sector

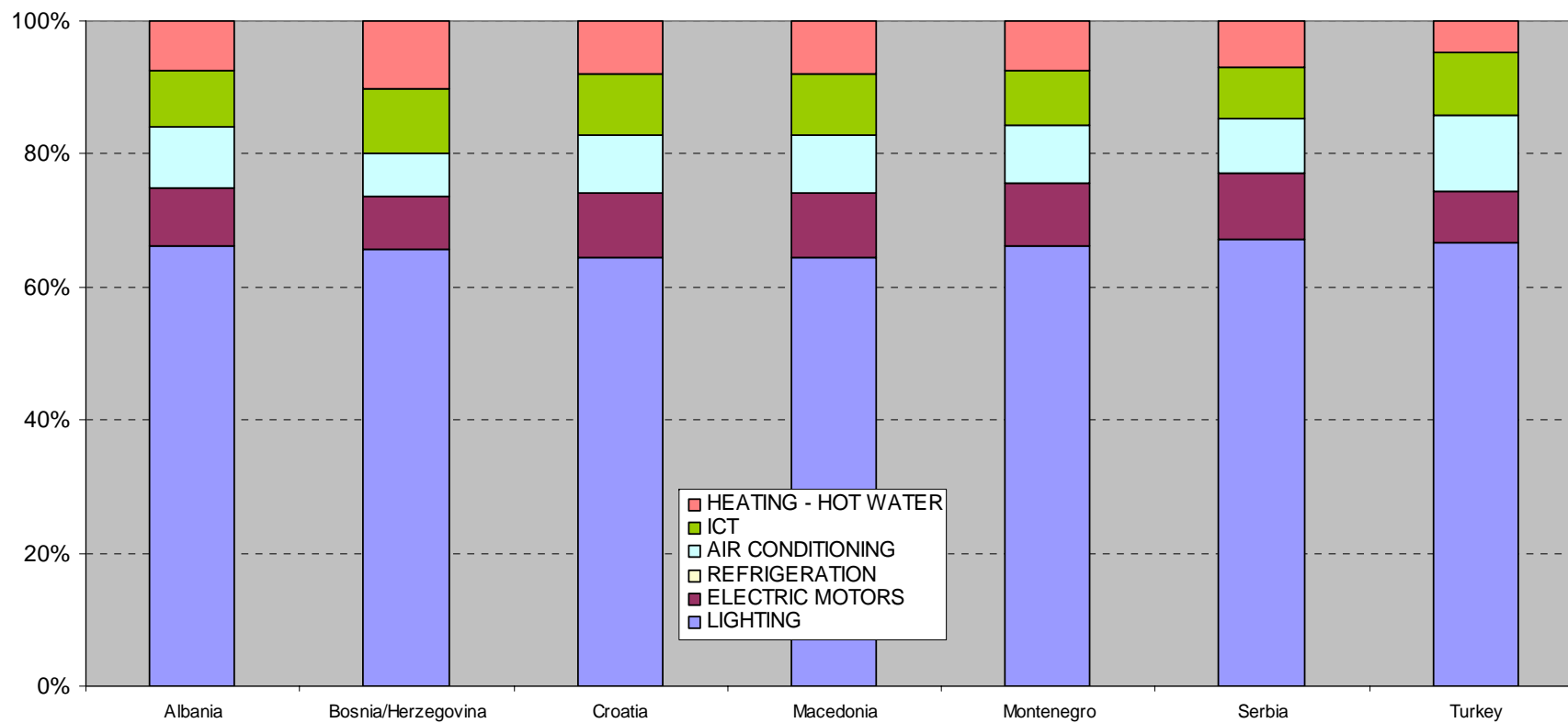




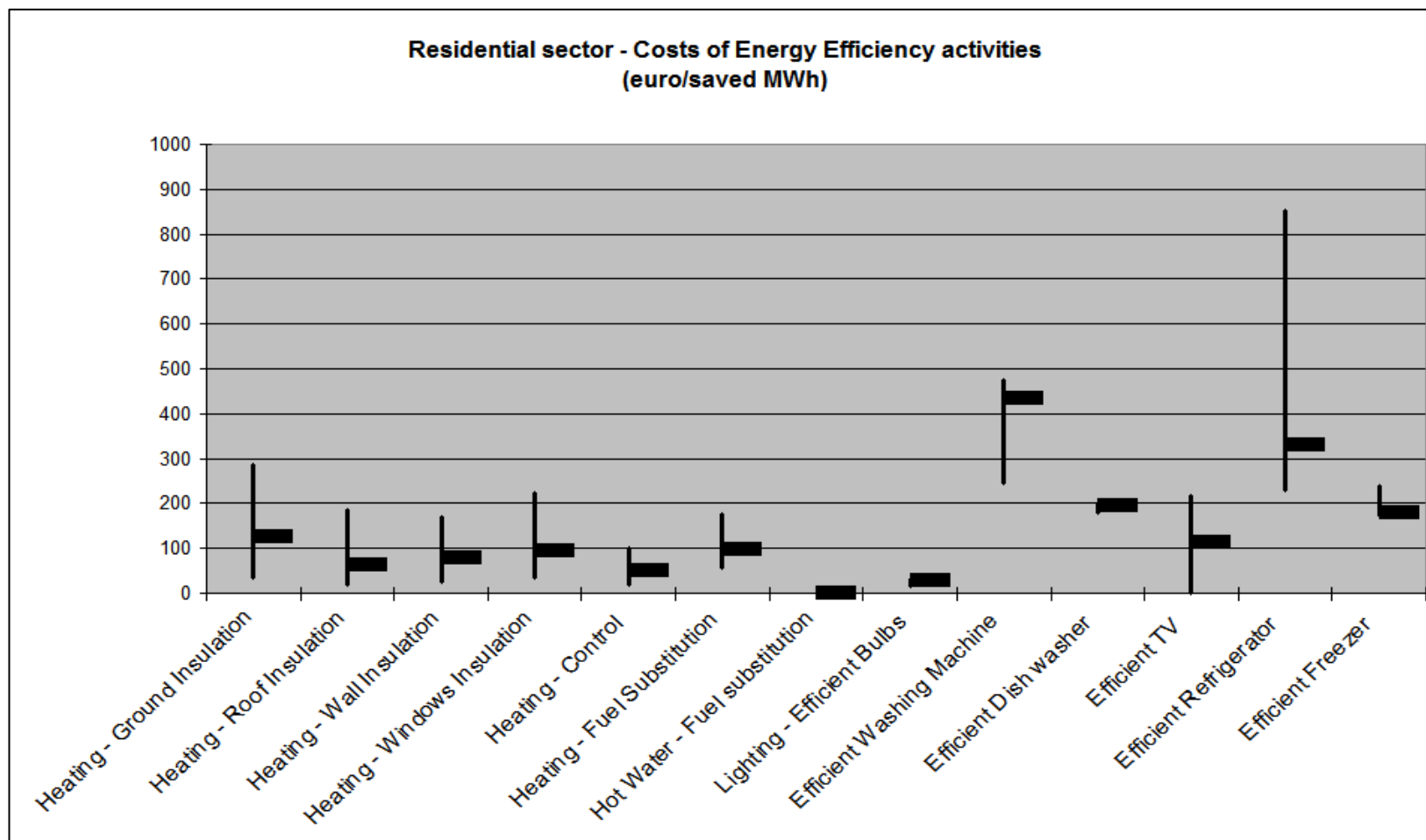
Results: Potentials in the Tertiary Sector



Tertiary Sector - Annual Additional Saving Potential in the Western Balkan Countries and Turkey up to 2020 (% per end-use)



Results: Bandwidth of Energy Efficiency Cost in the Residential Sector



Results: Bandwidth of Energy Efficiency Cost in the Industrial and Tertiary Sector

