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EUROPEAN UNION

GOVERNMENT OF ROMANIA

Structural Instruments 2007 - 2013

## Romania
## Climate Change and Low Carbon Green Growth Program

## Component B Sector Report

# Energy Sector Rapid Assessment

## January 2013

**Advisory Service Agreement between Ministry of Environment and Climate Change and the International Bank of Reconstruction and Development**

**Beneficiary**: Ministry of Environment and Climate Change

The World Bank
Europe and Central Asia Region

***Project co-financed by the European Regional Development Fund through OPTA 2007 – 2013***

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# Abbreviations and Acronyms

| | |
|---|---|
| ANRE | Autoritatea Nationala de Reglementare in Domeniul Energiei (Romanian Energy Regulatory Authority) |
| ANRSC | Autoritatea Nationala de Reglementare pentru Serviciile Comunitare de Utilitati Publice (Romanian National Regulatory Authority for Municipal Services) |
| BCR | Banca Comerciala Romana |
| CCGT | Combined-cycle gas turbine |
| CCS | Carbon capture and storage |
| CEB | Council of Europe Development Bank |
| CFB | Circulating fluidized bed |
| CFL | Compact fluorescent lamp |
| $CO_2$ | Carbon dioxide |
| COM | Covenant of Mayors |
| DG | Directorate General |
| DH | District heating |
| EBRD | European Bank for Reconstruction and Development |
| EC | European Commission |
| EE | Energy efficiency |
| EED | Energy Efficiency Directive |
| EEFF | Energy Efficiency Financing Facility |
| EEO | Energy efficiency obligations |
| EIB | European Investment Bank |
| EPBD | Energy Performance of Buildings Directive |
| EPC | Energy performance contract |
| ER | Exchange rate |
| ERDF | European Regional Development Fund |
| ESCO | Energy service company |
| ESD | Energy Services Directive |
| ESMAP | Energy Sector Management Assistance Program |
| ETS | Emission trading scheme |
| EU | European Union |
| FGD | Flue-gas desulfurization |
| FI | Financial institution |
| FREE | Romanian Energy Efficiency Fund |
| GC | Green certificate |
| GDP | Gross domestic product |
| GEF | Global Environment Facility |
| GHG | Greenhouse gas |
| HF | Holding Fund |
| HOA | Homeowners Association |
| HVAC | Heating, ventilation, and air conditioning |
| ICEMENERG | Energy Research and Modernizing Institute |
| IFC | International Finance Corporation |

| | |
|---|---|
| IFI | International Financial Institution |
| JESSICA | Joint European Support for Sustainable Investment in City Areas |
| kgoe | Kilogram of oil equivalent |
| kWh | Kilowatt-hour |
| LCOE | Levelized cost of energy |
| LED | Light-emitting diode |
| LULUCF | Land use, land use change and forestry |
| $m^2$ | Square meter |
| MDRAP | Ministry of Regional Development and Public Administration, formerly MDRT (Ministry of Regional Development and Tourism) |
| MECC | Ministry of Environment and Climate Change |
| META | Model for Electricity Technology Assessments |
| MOE | Ministry of Economy |
| Mtoe | Million tons of oil equivalent |
| M&V | Measurement and verification |
| MVA | Megavolt ampere |
| MW | Megawatt |
| MWh | Megawatt-hour |
| NEEAP | National Energy Efficiency Action Plan |
| NIP | National Investment Plan |
| NPV | Net present value |
| nZE | Nearly zero energy |
| OP | Operational Program |
| OPCOM | Societatea Comercială Operatorul Pieţei de Energie Electrică (Romanian Power Market Operator) |
| O&M | Operations and maintenance |
| PEC | Primary energy consumption |
| PPP | Public-private partnership |
| PPS | Purchasing power parity |
| PV | Photovoltaics |
| RLF | Renovation Loan Fund (Estonia) |
| ROSEFF | Romania SME Sustainable Energy Finance Facility |
| SME | Small and medium enterprise |
| SOE | State-Owned Enterprise |
| SOP | Sectoral Operational Program |
| T5, T8, T12 | Fluorescent lamp formats. A Tx tube diameter designation refers to a x/8 inch tube diameter, for example, T8 = 8/8 inch = 26mm |
| TA | Technical assistance |
| toe | Tons of oil equivalent |
| T&D | Transmission and distribution |
| TSO | Transmission System Operator |
| UNDP | United Nations Development Programme |

# Acknowledgement

The report is an output of the World Bank's Romania Climate Change Reimbursable Advisory Service (RAS) Program at the request of the Government of Romania (through its Ministry of Environment and Climate Change). It was prepared by a core team comprised of Feng Liu, Anke Meyer, Ana Otilia Nutu and Jean Constantinescu, with inputs from Silpa Kaza. This sector report benefited from the comments and suggestions of Jas Singh and Grzegorz Peszko. It was reviewed and cleared by Ranjit Lamech.

The work was carried out between June 2013 and September 2013 and is based upon the results of extensive discussions with officials in the relevant government agencies, including Nicolae Voineag, Advisor and George Guran, Director, SOP Competitiveness in the Ministry of Economy; Mariana Ionita, Director General, Sandu Moise, Director, Daniela Ionescu, Senior Consultant, Ministry of Regional Development and Public Administration; Emil Calota, Vice President, Corneliu Rotaru, Director General, Corneliu Radulescu, Director General, Maria Manicuta, Director General, and Otilia Marin, Director, the National Energy Regulatory Authority; Iulian Iancu, Committee President of the Chamber of Deputies; Silvia Vlasceanu, Parliamentary Advisor, and Rodin Traicu, Deputy. The team also benefited from discussions with experts, including Carmencita Constantin, Director for the Environment and Energy Division, Cristiana Ion, Consultant, and Anca Popescu, Director, Institute for Studies and Power Engineering; Ionut Purica, Energy Expert INCE – Romanian Academy; Virgil Musatescu, Senior Energy Consultant; Mircea Ghitulescu, Senior Energy Expert, and Camelia Rata, Executive Director ABMEE; Mihail Scvortov, Principal Banker and Venera Vlad, Senior Banker, EBRD; Cristina Cremenescu, Dalkia Romania; Bogdan Atanasiu, Buildings Performance Institute Europe.

The World Bank would also like to express gratitude to the Romanian Government for the excellent working relations established during this assignment and especially the assistance of the staff and members of the Project Implementing Unit in the Ministry of Environment and Climate Change, namely Mihaela Smarandache, Narcis Jeler, Alexandra Ulmeanu, Gabriela Popescu, and Bianca Moldovean.

The World Bank's Romania Climate Change program is managed by Jian Xie and Erika Jorgensen, under the general guidance of Laszlo Lovei, Mamta Murthi, Kulsum Ahmed, Satu Kristiina Kahkonen, and Elisabetta Capannelli from the World Bank.

# Executive Summary

The Energy Sector Rapid Assessment was conducted by the World Bank for the Government of Romania, as part of an advisory services program on climate change and low carbon green growth. The objective of this assessment is to identify climate change related investment priorities and necessary implementation support for the 2014-2020 Operational Programs, with a view to achieving the EU 20-20-20 targets and laying a foundation for continued de-carbonization of the energy sector.

This rapid assessment focuses on climate change mitigation actions in *power and heat generation* and in *energy use in manufacturing, residential, public and commercial sectors*. Issues and options for adaptation in the energy sector are not covered. Energy use in agriculture and forestry, which accounts for less than 2 percent of the total final energy consumption in Romania, is not analyzed. Energy use and efficiency in the transport sector is studied in a separate transport sector rapid assessment.

Due to the limitation of time, several pieces of important analyses are deferred to the later phase of the advisory services program. These include in-depth investigation of the main energy end-use sectors or subsectors, low-carbon energy supply optimization based on long-term energy demand patterns and trends, and the design and approaches of key energy efficiency intervention programs, such as thermal retrofit of residential and public buildings and economization and modernization of district heating systems.

## Main Findings

***The economic growth and energy consumption in Romania has been decoupled since 1998, and the energy intensity of the economy, measured by primary energy consumption per unit of gross domestic product, has decreased substantially***. After the large contractions of the economy and energy consumption in the 1990s, Romania's GDP rose by 53 percent from 2000 to 2011 while energy demand remained flat. This is in large part due to the structural adjustments of the economy toward higher-value-added manufacturing and services and significant improvements of energy efficiency in industries.

***Per capita energy consumption in Romania is substantially lower than that of high-income EU countries. A significant increase in energy demand is expected if the economy continues to grow***. Per capita fuel and electricity consumptions in 2011 were 51 and 47 percent of the EU27 average, respectively. Even with continued improvement in energy efficiency, energy demand is likely to grow significantly as Romania is catching up with the high-income countries.

***Primary energy consumption in Romania is characterized by a relatively high and increasing share of low-carbon energy sources, even though natural gas consumption is declining***. From 2000 to 2011, the share of primary energy sourced from nuclear, hydro and wind power and biomass increased from 15 to 22 percent, while that of natural gas declined from 37 to 30 percent.

The share of coal crept up from 20 to 22 percent. Overall, the carbon footprint of the energy sector shrank by approximately 7 percent, from 92.89 to 86.32 million tons of $CO_2$ equivalent.

***Final energy consumption patterns in Romania are expected to converge toward those of the largest EU economies in the long-term, indicating significant increases in quantity and share of energy for transportation and the services sector***. Energy demand of the services sector surged by 2.6 times from 2000 to 2011, albeit from a relatively small base. Transport energy demand also grew by 25 percent during the same period, while residential and industrial energy demand, the largest and second largest among all sectors, declined by 6 and 21 percent, respectively.

***Energy for selected industrial customers and all residential customers are subsidized.*** Energy-intensive state-owned enterprises (SOEs) benefit from low, preferential electricity and gas prices. State and local subsidies for residential district heating cover about 50 percent of residential customer cost. Under legislation passed in 2012 and 2013, regulated electricity and gas prices for non-households will be fully liberalized by January 2014 and January 2015, respectively, and regulated electricity and gas prices for households will be liberalized by January 2018 and January 2019, respectively. No definite timeline has been given for removing district heat subsidies.

***The energy sector is responsible for 70% of total greenhouse gas (GHG) emissions (excluding LULUCF) in Romania and has contributed 70% of the overall GHG emissions reduction since 1989***. Three quarters of the energy sector GHG emissions are from power and heat generation and non-transport fuel consumption. Continued de-carbonization of the energy sector, through low-carbon power and heat supply options and improved efficiency in energy conversion, transmission, distribution and consumption, is essential to the climate change mitigation agenda in Romania.

***Continued reduction of the carbon footprint of power and heat generation in Romania requires in the medium term (up to 2020) a significant increase of investments in wind and solar power and supporting infrastructure, and in high-efficiency gas-fired generation***. In the long term (beyond 2020), while these supply options will remain important, Romania's mitigation efforts may also benefit from increased nuclear power generation and potential opportunities offered by carbon capture and storage (CCS).

***The power and heat supply sectors have a large amount of obsolete physical assets which will need to be selectively modernized or scrapped***. For examples, about 80 percent of the fossil fuel-fired generation capacity is deemed inefficient and obsolete and about 60 percent of the power distribution networks need to be modernized. Investments in retrofitting fossil fuel-fired power plants in the last 20 years have yielded scant returns, since many of these plants remain too expensive to operate.

***The broad energy sector reforms advocated by the 2003 Road Map for the Energy Field remain largely unimplemented, hindering private sector investments and the development of viable public sector energy companies, both are crucial to Romania's energy security and cleaner energy future***. While some progress in sector reforms has been made, the key findings and recommendations on sector governance in the 2011 Functional Review by the World Bank are still relevant and valid.

***The continued deterioration and decline of the district heating systems is particularly distressing and undermine the quality of life in Romanian cities***. The number of operating district heating systems stood at about 100 in 2011, compared with over 300 in 1995. Many of the remaining operators are no longer economically viable because a substantial number of dissatisfied customers have disconnected themselves from the systems and chosen alternative heating options. The inefficiency and high losses in the district heating systems also make them among the most costly to operate in the EU. A multi-year comprehensive program is needed to modernize the economically viable district heating systems: improving their efficiency and service quality on the one hand and implementing sector reforms to restore district heating company financial sustainability on the other, while ensuring that subsidies to poor households are well targeted.

***Despite the substantial progress, Romania still lags significantly behind most EU countries in the broadest measure of energy efficiency and in key end-user sectors***. Its energy intensity denominated by GDP in purchasing power parity was about 18 percent higher than the EU average in 2011. The efficiency gap is most pronounced for residential space heating where specific heat consumption (kgoe/$m^2$) is 32 percent higher than comparable best EU practice. For the two dominating industrial energy users, chemicals manufacturing has a value-added energy intensity over 4 times higher than the EU average (indicating structural issues), and steel making has an energy intensity per ton of steel that is 70 percent higher than the EU average. These three areas of end-use together account for roughly 40 percent of Romania's final energy consumption.

***Thermal retrofit of residential buildings is a huge challenge financially and implementation-wise.*** Only about 1 percent of the 150 million $m^2$ or so apartment buildings which were determined in need of thermal retrofit had been retrofitted as of 2012. Despite very high capital subsidies (up to 80 percent) provided by the national and local governments, many low income households still are reluctant to participate. At about EUR80/$m^2$, total investment for retrofitting the above mentioned building stock amounts to EUR 12 billion. Turning this huge cost into a big economic opportunity is perhaps the most challenging energy efficiency agenda in Romania.

***Many of the legal and regulatory requirements to enable improved energy efficiency are dealt with on paper, but implementation is uneven***. Romania has transposed all relevant EU directives and has delivered the first and second National Energy Efficiency Action Plans. It has built up fairly successful appliance labeling, and started up energy auditing and management for large industries and the building sector. But particularly in the building sector actual energy savings have been disappointing compared to the potential. The major unfinished policy agenda in Romania is energy price reform, with large subsidies remaining for natural gas, district heat and electricity for some energy-intensive SOEs. These subsidies are major disincentives for energy consumers to engage in energy efficiency actions and divert public funds from more productive uses.

***Over EUR 2 billion of financing was available for energy efficiency investments during 2007-2013, including about EUR 800 million EU funds***. While this is far from being sufficient to address the large energy efficiency financing needs in Romania, the institutional support and technical capacity to implement and deliver energy efficiency investments do not appear to be adequate at either the national or the local levels. This is caused by a lack of incentives, information, necessary skills upgrades, and administrative improvements such as strategic planning, prioritization, systematic evaluations and coordination between the different levels of government. The implementation and delivery challenges will only grow in the next seven years.

## Estimated Investment Needs

***The overall investment cost of the government's power sector development plan during 2014-2020 is estimated to be about EUR 14 billion with an estimated public funding of EUR 3.6 billion***. About half of the total investment cost would be devoted to the construction of two new nuclear reactors and retrofitting existing coal-fired power plants which would be primarily used as back-up units for the nuclear capacity. Since the financing of the nuclear units still remains in limbo due to a lack of investor interest, it is unlikely that they will be completed by 2020. This would lead to a substantial increase in the use of inefficient fossil fuel-fired units in the latter years of the 2014-2020 period if power demand growth is robust.

***About EUR 2 billion of capital savings could be achieved with reduced overall cost of electricity in an alternative 2014-2020 power generation scenario,*** if the Government chooses to source additional generation capacity primarily from high-efficiency gas-fired units, wind power and solar PV. The reduced need for public funding amounts to EUR 636 million. The rapid assessment compared an alternative power generation scenario with the existing government plan drafted in 2011. The conclusion was that the alternative is cheaper and more likely attainable by postponing the construction of the nuclear units and scrapping the old coal-fired units instead of retrofitting them.

***In the alternative scenario, the estimated subsidies for wind, solar PV and biomass (steam) through the existing green certificate scheme are expected to reach EUR 220 million by 2020 to support the significantly higher installed capacity of wind and solar PV***. The current green certificate scheme (which already was scaled back since July 2013) was evaluated and deemed sufficient to support the additional expansion of wind and solar PV power with a small impact on end-user electricity costs (about EUR 3/MWh additional cost).

***The estimated investment needs for end-use energy efficiency improvements based on a few selected large-scale interventions implementable during 2014-2020, such as building thermal retrofit, refrigerator upgrade and industrial energy efficiency, amounts to over EUR 6 billion.*** 28 percent of the estimated needs, or about EUR 1.7 billion, is expected to be financed by public funds, including EU and government funds.

## Recommended Actions

***Combined efforts in investments, sector reforms and implementation and delivery are required to secure reliable energy supply for economic growth and improving quality of life on the one hand while increase the share of clean energy sources, including energy efficiency, on the other. These efforts should be guided by an overarching national energy and climate strategy***

***jointly prepared by the concerned ministries.*** For the 2014-2020 period this rapid assessment has identified three thematic priorities for climate change mitigation in the energy sector: expanding cleaner power generation, restructuring the district heating sector and scaling up energy efficiency in manufacturing and buildings.

| | Investment | Sector Reform | Implementation and Delivery |
|---|---|---|---|
| **Expanding cleaner power supplies** | • Wind and solar PV generation capacity<br>• Balancing infrastructure for increased wind and solar generation capacity<br>• High-efficiency gas-fired generation capacity<br>• Modernization of distribution network | • Resume the implementation of the 2003 Road Map for the Energy Field;<br>• Improve governance of energy SOEs for transparency and accountability;<br>• Rebuild energy regulator ANRE‘s capacity, autonomy and accountability;<br>• Improve inter-ministerial coordination of energy functions across the Government; and<br>• Improve institutional set-up and governance arrangements for business environment functions | • Private sector participation<br>• Public and private partnerships<br>• Public sector energy companies |
| **Restructuring district heating sector** | • Modernization of economically viable district heating systems | • Unify sector regulation under ANRE<br>• Improve district heating company governance through commercialization<br>• Introduce two-part heat tariffs and consumption-based billing<br>• Replace general heat subsidy for suppliers with targeted subsidy for the poor<br>• Review and adjust the bonus scheme for high-efficiency con-generation | • Initiate strategic sector review of local district heating systems to prioritize investment<br>• Prepare long-term urban heating strategy led by MRDPA<br>• Private sector participation,<br>• Public and private partnerships |
| **Scaling up energy efficiency** | • Thermal retrofit of apartment buildings constructed during 1950-90<br>• Energy intensity reduction of chemicals and steel manufacturing<br>• Energy efficiency obligations for energy utilities to address highly disaggregated energy efficiency investments in residential, commercial and public services and industrial sectors | • Strengthen government oversight for energy efficiency on the basis of the national energy efficiency action plan and programs either within ANRE or by re-establishing a separate agency<br>• Implement pricing reforms for subsidized industrial users and the residential sector | • Strengthen enforcement of codes and standards;<br>• Establish a long-term financing and delivery platform for residential thermal retrofit<br>• Improve access to finance, especially mechanisms that support access to EU co-financing and expand the use of energy performance contracts<br>• Develop technical capacity of key energy efficiency market participants, such as |

| | | | |
|---|---|---|---|
| | | | enterprises, energy managers/auditors, banks, and ESCOs and energy service providers<br>• Increase information and data gathering and outreach to all stakeholders. |

**Supporting the expansion of cleaner power generation:**

- ***Review and adjust the medium to long term power sector development plan to reduce the implementation risks and costs of the proposed investments for the period 2014-2020***. The initial analysis of this rapid assessment suggests that a shift of investment priority in the next seven years toward additional wind and solar PV power and associated T&D infrastructure and major additions of high-efficiency gas-fired capacity could reduce the overall costs of electricity, increase private sector participation, and cut GHG emissions.

- ***Prioritize EU funds for investments in expanding and reinforcing the infrastructure for supporting intermittent renewables, transmission and cross-border interconnection, demonstration of smart grids and smart meters, high efficiency co-generation, and critical research and development activities for low-carbon energy options***. The estimated need for EU funds for the power sector amounts to about EUR 1.5 billion. This amounts to about half of the estimated public financing for the power sector in the alternative scenario to the government's current plan for 2014-2020.

- ***Accelerate sector reforms to create a stable and predictable business environment for expanding private sector investments in cleaner power generation***. A recent World Bank functional review of the Ministry of Economy provided suggestions for key actions to improve energy sector business environment. Among the most important are the following:
  - Cancel the plan to create the two national champions and the restart of the implementation of the 2003 Road Map: a balanced strategy of attracting private sector investment and developing viable public sector energy companies;
  - Enforce and implement of sound commercial practices by the Government, energy regulator ANRE and public sector energy companies;
  - Continue energy market liberalization and removes regulated prices for electric and gas supply for non-residential consumers;
  - Strengthen energy regulator ANRE's capacity, autonomy and accountability;
  - Prepare an energy and climate change strategy
  - Provide policy and legislative stability to increase investor confidence and lower the perception of investment risks.

**Supporting the restructuring of the district heating sector:**

- ***Develop and begin to implement a comprehensive investment and sector reform program to address the multitudes of issues and constraints of the district heating sector, within the overall framework of a long-term urban heating strategy*.** Some of the reforms that need to be implemented to stem the further deterioration of district heating in Romania include the following:
  - Strategic reviews of local district heating systems to establish the most efficient and cost-effective heat supply options, taking into account economic levels of fuel prices and environmental costs of burning fuels, as well as modern heat and cogeneration technologies, efficient and cost-effective distributed systems;
  - Acceleration of electricity and natural gas price liberalization, maximizing the role of the market in proper resource allocation;
  - Abolishment of all price subsidies; only low-income families would receive targeted subsidies in the form of cash payments within the social protection system and possibly some support for energy-retrofit of their dwellings;
  - Investment support for truly high-efficiency cogeneration in economically viable district heating systems;
  - Unification of district heating sector regulation under one regulator (ANRE);
  - Introduction of a two-part (binomial) heat tariff system;
  - Consumption-based billing at dwelling level for heat and hot water;
  - Consideration of additional policies to "protect" district heating in areas where it is already supplied and cost-effective.

- ***Focus initial investment efforts on a few selected cities where 1) district heating is deemed economically viable and competitive compared with distributed alternatives, and 2) local governments are committed to sector reforms***. Thorough analyses need to be carried out to determine whether a district heating system can be modernized to the point of being efficient and competitive compared to distributed alternatives based on economic costs and benefits before a funding decision is made. Under certain conditions, modernization of district heating systems should be eligible for EU funding in the 2014-2020 period.

**Scaling-up energy efficiency investments:**

- ***Prioritize policy support toward scalable energy efficiency interventions where investments have been held back by market barriers and weak implementation capacity***. There does not appear to be a general lack of financing for energy efficiency investments in Romania, although large financing gaps do exist in selected market segments, such as residential thermal retrofit. Public financing support is particularly important for scalable energy efficiency interventions that have relatively high cost of saved energy due to low market uptake as illustrated in the table below.

**Scalability and cost of selected energy efficiency interventions**

| Aggregate potential energy savings | | Cost of saved energy: Low | Cost of saved energy: Medium | Cost of saved energy: High |
|---|---|---|---|---|
| | High | • Energy efficiency measures in steel and chemicals manufacturing | • Energy efficiency of major consumer appliances<br>• Industrial motors energy efficiency | • Thermal retrofit of residential buildings |
| | Medium | • Energy efficiency measures in SMEs<br>• Residential lighting (CFL)<br>• Commercial lighting (CFL and high performance T8) | • Modernization of district heating systems<br>• Thermal retrofit of public buildings, such as schools<br>• Retrofit or new commercial HVAC systems | • New nZE buildings<br>• Residential lighting (LED)<br>• Commercial lighting (LED) |
| | Low | | • Public lighting (sodium lamp)<br>• Energy efficiency in water supply and wastewater treatment | • Public lighting (LED)<br>• High efficiency residential air conditioners |

➢ ***Match financing and delivery mechanism with specific sector needs and constraints***. Of particular interest in the long term is the use of financial instruments to increase the leverage of public funds in energy efficiency investments in the public and residential sectors, especially for the thermal retrofit of buildings. Increasing the role of energy service companies (ESCOs) in delivery of energy efficiency projects also has the added benefit of bringing in third party commercial financing, especially for public sector energy efficiency investments. More specifically, the following should be considered for financing:

- Manufacturing sector energy efficiency investments should in general be financed through commercial means. Nevertheless, public funding in supporting information dissemination, awareness raising and capacity building among key stakeholders (enterprises, ESCOs and banks) has proven to be of catalytic value.

- A dedicated energy efficiency revolving fund for the public sector could be an effective way of addressing some of the critical financing and implementation constraints faced by municipal public entities while also helping nurture and develop Romania's nascent ESCO market. Such a fund may be seeded by a combination of EU funds and government grants while also potentially attract private financing if proven successful.

- A financing mechanism/platform that matches the needs for long-term (up to 20 years) and low interest rate loans in residential thermal retrofit while also providing streamlined processing and necessary assistance to home owners associations (HOAs) will help mitigate the challenges facing thermal retrofit programs in Romania. There have been some successful operations of housing renovation loan funds in other EU countries, which could inform the design of a similar program in Romania.

- As part of the transposition of the EE directive, the Romanian government should also consider the introduction of energy efficiency obligations (EEOs), perhaps first on a limited basis, requiring that a certain fraction of energy savings is achieved among vulnerable groups.

- ***Match government support with critical needs***. The characteristics of key government support are summarized in the table below.

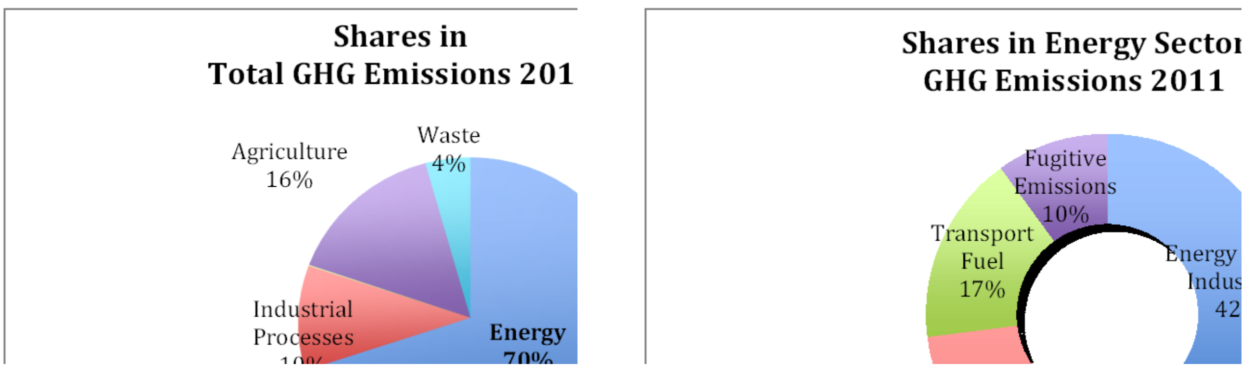
| Key areas of intervention | Critical constraints to scaling-up EE investment | Means of government support |
|---|---|---|
| Basic policies | Subsidized energy prices | Cost reflective prices (remove general price subsidies) with targeted support for low-income families |
| | Metering and consumption-based billing | Requiring consumption-based billing as part of district heating modernization investments |
| | Lack of clear legal regulation of ESCO contracts, lack of deliberate policy support for ESCOs, and insufficient market recognition and credibility | Market development support efforts to improve the credibility of ESCOs (such as accreditation and certification) and access to project financing; changes in public sector budgeting, accounting and procurement regulations |
| | Reliance on grant financing | Expanded menu of support for energy efficiency: monetary and non-monetary incentives, financial instruments that leverage private financing |
| Institutional support | Lack of EE planning, policy implementation and supervision capacity | Improved governance and strengthening of the EE agency - either within ANRE or as re-establishment of a separate EE agency |
| Selected energy-intensive manufacturing | Competing demands on funds, sector restructuring, SOE privatization in some industries | Long-term agreements<br>Information dissemination, awareness raising and capacity building |
| Small and medium enterprises | Information, creditworthiness, credit terms | Support for audits and dedicated energy efficiency credit line<br>Information dissemination, awareness raising and capacity building |
| Residential thermal retrofit | HOA credit-worthiness/ decision making process, poverty/ affordability;<br>lack of information on building stock and energy performance | City-level market assessment, program design and implementation support<br>Dedicated financing mechanism with appropriate blending of long-term and low-interest loans and grants<br>TA/grants for engaging and informing HOAs, preparing, supervising and monitoring projects |
| Public buildings thermal retrofit | Lack of information and capacity, budgeting/accounting/ procurement restrictions;<br>lack of information on building stock and energy performance | Market assessment, program design and implementation support for municipal public buildings<br>Changes in budgeting, accounting and procurement regulations<br>Dedicated financing mechanism with consideration of introducing a revolving fund |
| nZE buildings | Untested, new technologies | Grants for demonstrations |
| Large appliances upgrade | Up-front incremental cost | EEOs, on-bill financing, rebates |
| Residential and commercial lighting upgrade | Poverty, up-front capital costs | Ideal for EEOs, on-bill financing, rebates; regulation to phase out incandescent lamps |
| Other municipal services, such as public lighting and water supply | Access to financing | PPPs, for example, ESCO arrangements<br>Energy assessment support to water utilities |

# 1 The Energy Sector and Climate Change Mitigation in Romania

## 1.1 Energy sector contribution to greenhouse gas emissions

1. In Romania, the energy sector is responsible for 70% of total greenhouse gas (GHG) emissions (excluding LULUCF[1]) and has contributed 70% of the overall GHG emission reduction since 1989. Power and heat generation and non-transport fuel use contribute three quarters of energy sector GHG emissions (Figure 1). The de-carbonization of the energy sector, is essential to the success of climate change mitigation in Romania. This can occur through low-carbon power and heat supply options as well through improved efficiency in energy conversion, transmission, distribution and consumption,

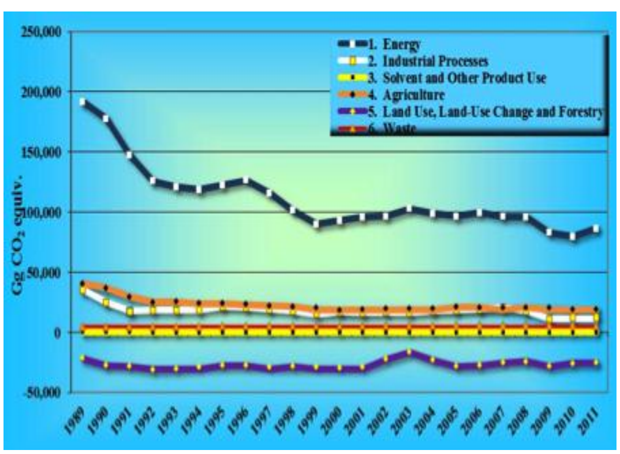
**Figure 1: The Energy Sector Dominates GHG Emissions in Romania**




Source: MECC 2013

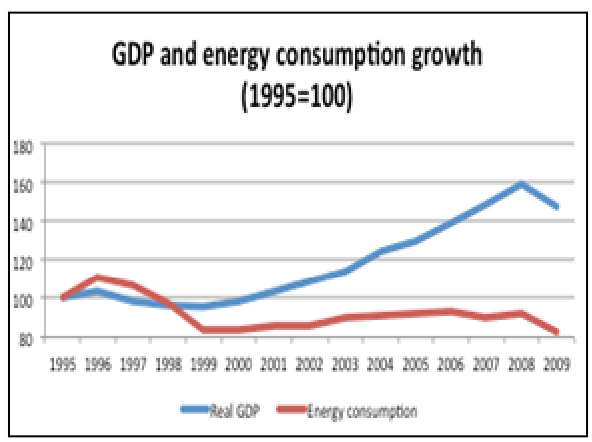
2. From 1989 to 2011 total GHG emissions in Romania have been reduced by almost half (Figure 2). Most of this decline is due to lower emissions from energy related activities caused by structural changes in the economy and energy efficiency (EE) improvements. Energy consumption and GDP growth have decoupled since the late 1990s (Figure 3).

**Figure 2: Romania: GHG emission trends, 1989-2011**




Source: MECC 2013

**Figure 3: Decoupling of energy and GDP growth**



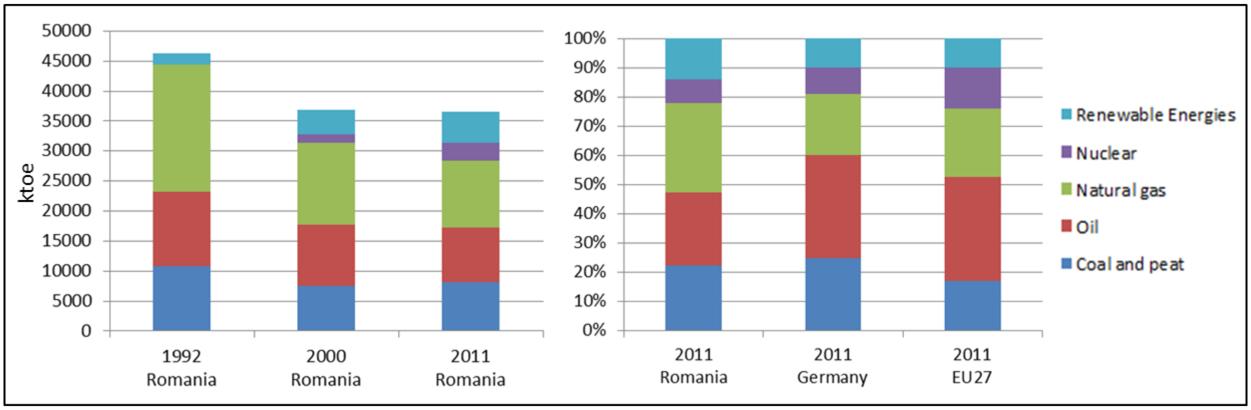

Source: Eurostat

[1] LULUCF has been a net sink of GHG in Romania since the record keeping began in 1989 (Figure 2).

## 1.2 Main characteristics of energy supply and demand

3. After declining significantly in the 1990s, Romania's primary energy consumption remained flat in the 2000s and was 36.35 Mtoe in 2011. Romania has decreased its production of dwindling domestic oil and gas resources and increased its reliance on non-GHG emitting energy sources – nuclear, hydro and biomass. Domestic lignite continues to play a large role, particularly in power and heat production (Figure 4). It is notable that biomass (included in renewable energies) accounts for about 10 percent of Romania's primary energy and an even higher share in end use due to a large rural population relying primarily on biomass for space heating. In fact, total biomass consumption increased by nearly 30 percent from 2000 to 2011.

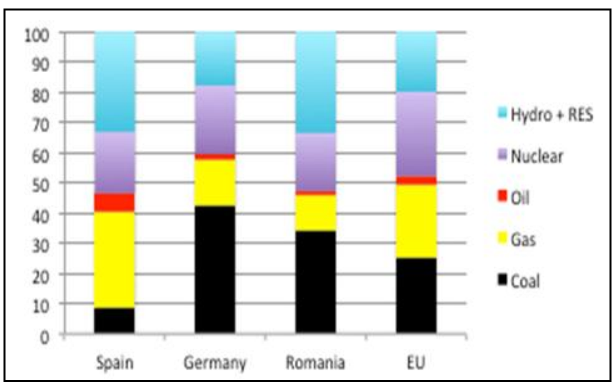
**Figure 4: Romania: primary energy consumption by fuel, and compared with Germany and EU27**




Source: Eurostat

4. Total electricity generation increased by 1.6 percent annually from 51.93 TWh in 2000 to 62.22 TWh in 2011. This compares with a GDP growth rate of 4 percent per annum in the same period. Although coal-fired thermal plants still provide about one-third of electricity supply, the share of low-carbon power generation—hydro, wind, solar and nuclear—is large, increasing and higher than the EU average. The share of coal-fired power generation also is significantly higher than the EU average (Figure 5).

**Figure 5: Romania: electricity generation mix by fuel, 2011, compared with Spain, Germany and EU**

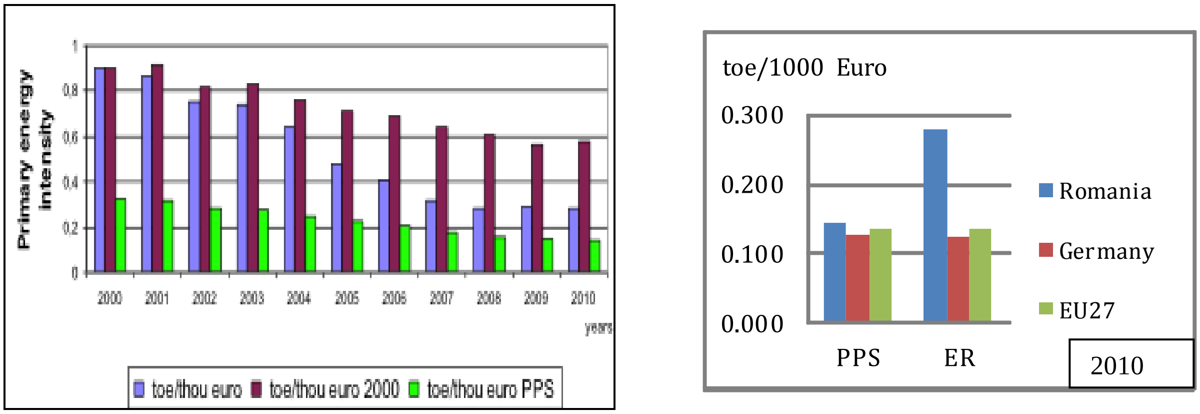



Source: Eurostat

5. The energy intensity of the economy, measured by primary energy consumption per unit of GDP, remains comparatively high, especially when GDP is converted using exchange rate (ER).

If the GDP is measured in purchasing power parity (PPS), energy intensity in Romania is much lower (Figure 6), reflecting the under-valuation of the non-traded production and services in Romania in the exchange rate denominated GDP.  However, this type of aggregate energy intensity comparison masks some major underlying issues, such as the structure of economic activities and the EE of some specific activities.  These are explained in more detail in the efficiency gap analysis in Chapter 3.

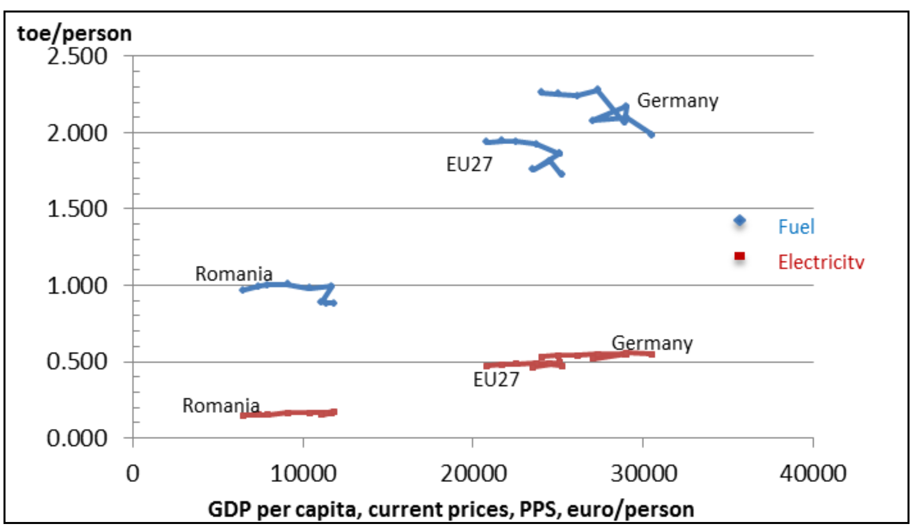
**Figure 6: Indicators for primary energy intensity in Romania, 2000-2010, and EU**




Source: ICEMENERG/ANRE, 2012; Eurostat

6.  Among EU27 countries, Romania has the lowest per-capita energy consumption (Figure 7), a disadvantage which can be turned into an advantage in view of decarbonizing energy. Per capita consumption of electricity is particularly low, but significant growth in electricity demand is already occurring, driven mainly by residential and services sectors.

**Figure 7: Romania consumes significantly less energy per capita than high-income EU countries: Per capita final fuel and electricity consumption vs. per capita GDP in PPP, 2003-2011**

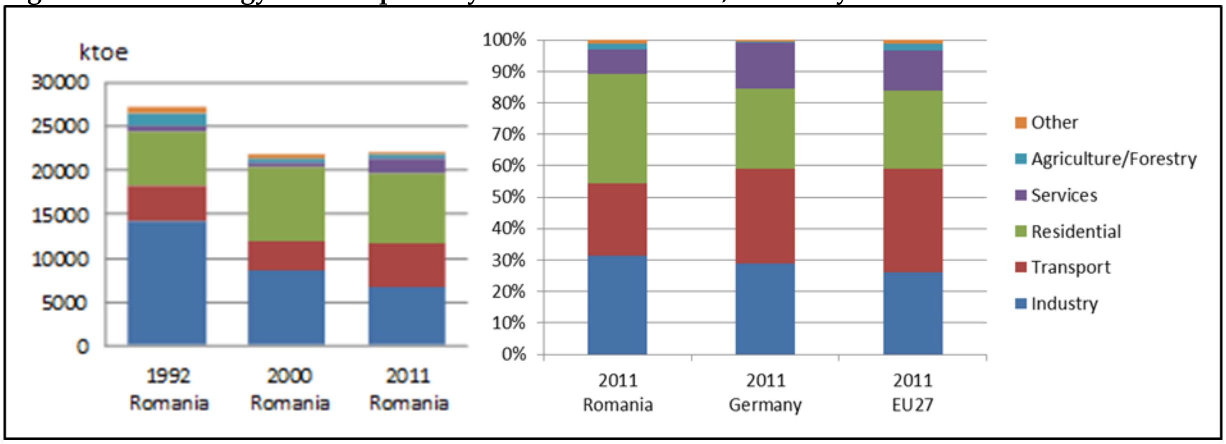



Source: Eurostat

7.  Final energy consumption remained flat during 2000-2011 (Figure 8).  A decline in final fuel consumption was offset by increased demand for electricity. Consumption reduction in the

industrial and residential sectors was offset by demand growth in transportation and services. Industrial energy consumption decreased by 21% during this period. Household energy consumption also declined by 6% during 2000-2011 in large part due to an 57% drop in consumption of district heat. This drop is a reflection of the general and dramatic decline of district heating services in urban areas, a topic which will be revisited in Chapter 4.

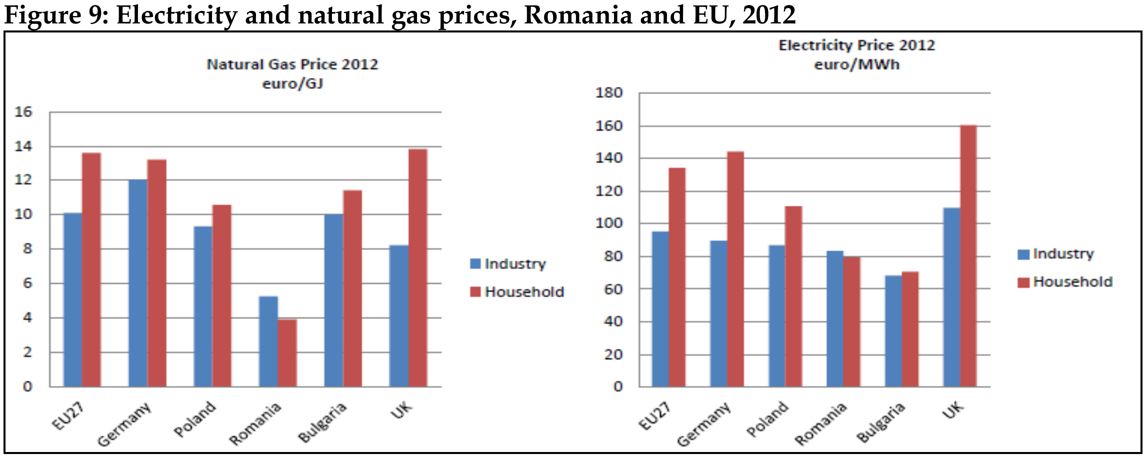
**Figure 8: Final Energy Consumption by Sector for Romania, Germany and EU27**




Source: Eurostat

8. Both electricity and natural gas prices are below EU averages (Figure 9). Electricity prices are largely recovering costs (with the exception of nuclear and hydro prices for regulated consumers who are subsidized). Natural gas prices are the lowest of any EU country due to regulatory distortions – regulated prices of domestic gas suppliers are roughly half of the European market prices. Under legislation passed in 2012 and 2013,[2] regulated electricity and gas prices for non-households will be fully liberalized by January 2014 and January 2015, respectively. Regulated electricity and gas prices for households will be liberalized by January 2018 and January 2019, respectively.

**Figure 9: Electricity and natural gas prices, Romania and EU, 2012**

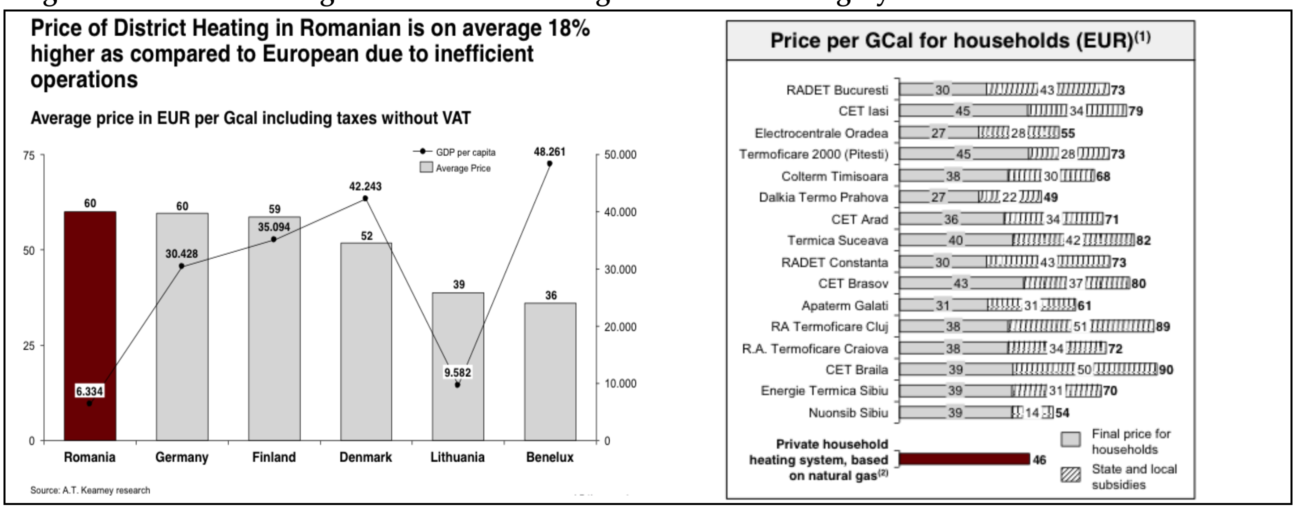



Source: Eurostat

[2] For electricity, article 22 (8) of the Law No. 123/2012, and for natural gases, GD No. 22/2013.

9. The supply cost of district heating (DH) is among the highest in the EU due to inefficient production and high network losses. But tariffs for residential consumers are highly subsidized, on average about 50% (Figure 10). Low gas tariffs for residential consumers and dissatisfaction with DH services have caused many consumers to disconnect from DH. Since 1990 the number of households connected to DH, mostly in multi-apartment buildings, went down by about 0.8 million to 1.4 million in 2012 (ANRSC). Since residential natural gas consumption only increased marginally by about 3 percent during the same period, it is likely that many of the households disconnected from the DH systems are under-heated and/or rely on other types of fuels (biomass or electricity). Fuel-poor households are frequently forced to limit their energy consumption to sub-optimal levels because of financial hardship. Because of this suppressed demand[3], energy efficiency improvements may not result in an equivalent reduction in consumption – instead, the benefits may be taken in the form of increased comfort (UNDP 2011).

**Figure 10: District heating cost in Romania is high and tariffs are highly subsidized**




Source: AT Kearney, 2009

10. In summary, judging from global historical trends and the income growth trajectory of Romania, there is significant room for growth in electricity demand in residential, public and commercial sectors and for fuel demand in road transport, given low historical equipment ownership levels. Industrial energy demand could be tempered by further structural adjustment of the manufacturing sector and by EE improvements. Space heating energy demand will be determined by the pace and depth of thermal retrofit, efficiency of DH systems, pace of tariff reform for heat and gas, and potential rise in thermal comfort level. These issues will need to be further investigated to develop appropriate policy interventions in view of Romania's sustainable development objectives.

[3] Based on INS household survey data from 2008 there is some evidence of underheating ("suppressed demand"): expenses of poorer households for heating (per m2) are about 20-25% lower than those of wealthier households. This relatively low level of underheating can be attributed to targeted heating subsidies for poor households. UNDP 2011, p. 153.

## 1.3 EU priorities and targets for sustainable energy in 2020 and Romania's commitments

11. The European Union sets the framework for the sustainable energy policies of its member states. The overarching long-term goal is the commitment of the EU to reduce GHG emissions to 80-95% below 1990 levels by 2050. The two main pathways to reach this goal are investments in low-carbon and smart energy infrastructure and in the efficient use of energy (Table 1).

**Table 1: EU measures to reduce GHG emissions**

| Low-carbon and smart energy infrastructure | Efficient use of energy |
|---|---|
| • Electricity and heat generation from low-carbon sources, especially renewables<br>• Smart grids and smart meters<br>• Electricity storage technologies<br>• Efficiency in energy supply, especially generation of heat and electricity | • Energy efficiency in buildings, especially heat energy savings in existing buildings<br>• Industrial energy efficiency<br>• Energy efficiency in transport |

12. The medium-term EU energy and climate policy is expressed in the 20-20-20 targets that were adopted in 2007. By 2020, GHG emissions should be 20% below 1990 levels; renewable energy (RE) should reach a share of 20% of final energy consumption, and primary energy consumption should be reduced by 20%, compared with the projected baseline (Table 2).

**Table 2: EU and Romanian 20-20-20 targets and current status**

| | Greenhouse Gas Emissions | Renewable Energy (RE) | Energy Efficiency |
|---|---|---|---|
| **EU 2020 target** | Reduce emissions by 20% by 2020, compared to 1990 | RE sources contribute to 20% of final energy consumption | Reduce primary energy consumption from the baseline by 20% |
| **Romania 2020 target** | Reduce emissions by 20% by 2020, compared to 1990 | RE sources contribute to 24% of final energy consumption | Reduce primary energy consumption from the baseline by 19% (10 MToe) |
| **Romania actual status in 2012** | Actual emissions are down by 52% in 2011, compared to 1990 | RE accounts for 20.8% of final energy consumption | Actual primary energy consumption is down by 16.6% from the baseline |

13. Romania's GHG emissions in 2011 were far below its 2020 reduction target. GHG emissions are expected to rebound due to increasing primary energy demand, driven primarily by transport. But the rebound is unlikely to threaten the 2020 GHG target. Romania is close to the other two targets now and appears to be poised to achieve them. These general figures partially reflect a relatively carbon-intensive economy that suffered a huge contraction. Romania has a real interest to continue to reduce the carbon intensity of the economy by increasing low-carbon energy supplies and improving EE in both supply and demand sides. The EE target is discussed in more detail in Box 1.

**Box 1: Energy Efficiency Target Discussion**

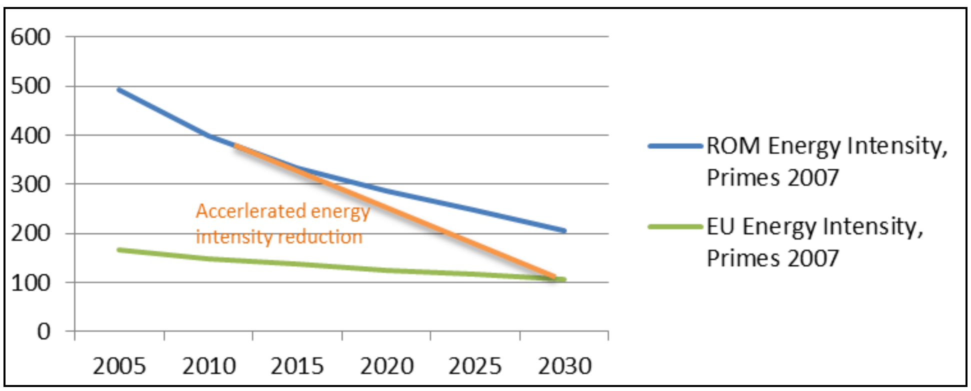
The Romanian energy savings target 2020 is a 19% reduction of primary energy consumption (PEC), compared to the projected baseline of the Primes 2007 model (business as usual). The 2020 baseline PEC according to PRIMES 2007 is 52.99 Mtoe. Targeted energy savings of 19% would equal 10.07 Mtoe, resulting in an expected PEC in 2020 of 42.92 Mtoe. De facto the PRIMES 2007 model did/could not take into account the economic downturn after 2007 and additional EE and RE measures implemented since 2005. Thus, it overestimates GDP and energy consumption growth.

If GDP would grow by 3.7% on average between 2010 and 2020 (as assumed in the PRIMES 2009 forecast), an average energy intensity reduction of 1.5% would be enough to reduce primary energy consumption by 10 Mtoe in 2020, compared to the PRIMES 2007 forecast. Energy intensity reduction of 1.5 % p.a. is far below the 4% p.a. rate achieved during 2000-2010. Romania is thus expected to achieve its 2020 energy savings target.

Source: World Bank staff based on European Commission 2008 and 2010a

14. Romania could reach the average EU27 energy intensity level by 2030, if energy intensity decreased by 5% annually, close to the historical rate of 4% (Figure 11).[4] Not only does a higher level of EE reduce GHG emissions, but it would contribute to improving energy security by reducing the need for energy imports, improving local and regional air and water quality, and contributing to social cohesion as well as improved public finances[5]. EU structural and cohesion funds could provide substantial help in accelerating EE improvement through investments and policy support.

**Figure 11: 5% annual decrease in energy intensity (toe/MEuro) necessary to achieve EU27 level by 2030**




Source: World Bank Staff

## 1.4 Objective and focus of the energy sector rapid assessment

15. The objective of this rapid sector assessment is to identify climate change related investment priorities in the energy sector to be supported under the 2014-2020 Operational Programs with a view to achieving the EU 20-20-20 targets.

[4] Note that future energy intensity trends used exchange rate denominated GDP value because PPS denominated GDP values in future years are not available. In principle, this should not affect trends analysis.
[5] Evaluation of the KfW thermal rehabilitation program in Germany has identified that, for every €1 of public subsidy, as much as €5 is returned through increased tax receipts and reduced unemployment payments; KfW 2011.

16. The energy assessment focuses on the climate change mitigation opportunities and investment priorities in power and heat generation and in manufacturing, residential, public and commercial sectors. Energy use in agriculture and forestry, which account for less than 2 percent of total final energy consumption, is not analyzed. Energy use and efficiency in the transport sector is analyzed in a separate transport sector rapid assessment.

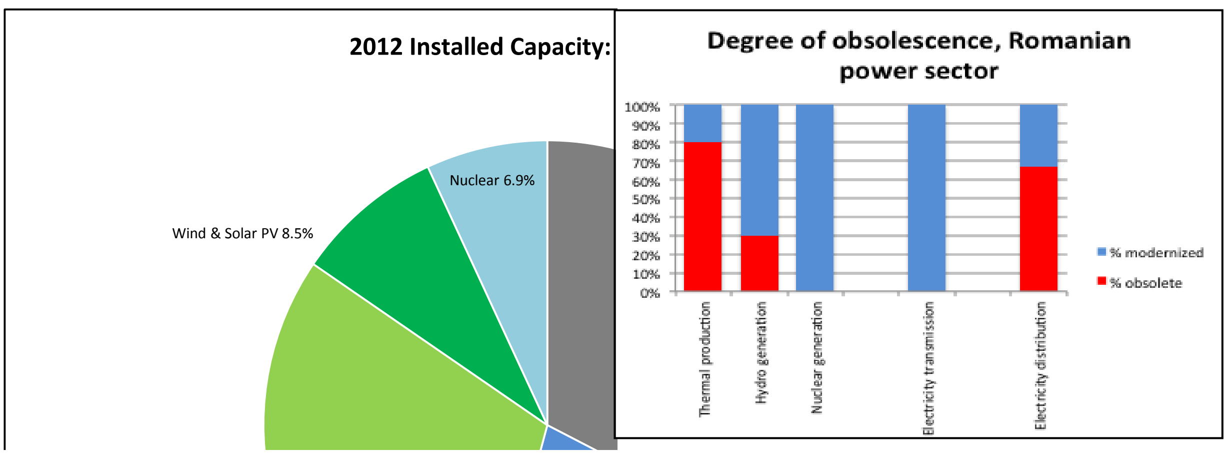
17. Overall energy supply optimization and several important demand-side EE issues, including thermal retrofit for residential, public and commercial buildings and district heating system modernization, will need to be investigated in more detail (beyond the rapid assessment) to develop specific policy recommendations and intervention programs.

## 2 Low-carbon Investment Priorities and Policy Support in the Electric Power Sector

### 2.1 Technologies, infrastructure and sector management

18. Romania has made progress in modernizing and decarbonizing its power generation capacity in recent years. Of the total installed capacity of 20,425 MW by the end of 2012, the shares of fossil fuel-fired, renewable and nuclear capacity were 54, 39 and 7 percent, respectively (Figure 12).[6] The share of renewable capacity (predominantly hydro and wind) is among the highest in Europe. The fossil fuel-fired plants consist of predominantly obsolete, high-emission coal/lignite and gas-fired generation units which need to be decommissioned or modernized. About one-third of the fossil fuel-fired capacity is co-generation.

**Figure 12: Installed power generation capacity in Romania and degree of obsolescence**




Source: ISPE, 2013 Source: Ministerul Economiei 2011

20. Following the adoption of a generous green certificate (GC) scheme (Amended Law 220/2008), wind power in particular experienced hyper growth, adding over 1,700 MW during 2010-2012. The GC scheme has been scaled back since July 1, 2013 when the government's decision to postpone granting a part of the GCs to investors in small hydropower plants, solar power plants and wind farms took effect. The amendment to the GC scheme caused significant disturbance of the investment climate for renewables, especially wind and solar. But the long-term effect of these changes on Romania's ability to deliver its 2020 RE commitment remains to be seen. The national government decision is currently contested by the industry at the DG Competition. A resolution may take more than 1 year.

21. The only other major generation capacity addition in the last 3 years was the 860 MW combined-cycle gas turbine (CCGT) in Brazi, which was commissioned at the end of 2012. The Government also completed environmental upgrades for 5×330 MW coal-fired units with EU

[6] Romania also has a very small amount of oil-fired capacity, mostly in the form of dual-fuel (gas and oil) units. The share of oil-fired generation in electricity production ranges from 0.5% to 1%.

financing. Despite formal political commitments, successive Governments have not managed to move forward on a series of major projects, including Energonuclear (2×700 MW nuclear reactors in Cernavodă), seven planned PPPs for thermal generation, and the Tarnița-Lăpuștești pump storage station (4×250 MW).

22. Romania's power sector follows the model of liberalized wholesale and retail markets. Electricity production is unbundled from transmission (Transelectrica). On the wholesale market there are over 60 active suppliers. Half of the market is liberalized; the other, "captive" segment (which is regulated both on the wholesale and retail levels) follows a liberalization schedule that would be completed by the end of 2013 for industrial consumers and by the end of 2017 for residential users. Legally, regulated consumers have been free to switch suppliers since 2007, but chose not to do so because regulated prices are well below the free market prices. The current liberalization schedule gradually reduces the differential between regulated and market prices. The national regulator ANRE sets and oversees market rules, non-discriminatory access, and tariff regulation.

23. Power generation is dominated by six large state-owned companies administered by the Ministry of Economy. They are divided by fuel type (lignite – Oltenia, hard coal – Hunedoara, hydropower – Hidroelectrica, nuclear – Nuclearelectrica, and several gas-fired units in ELCEN and Romgaz). There are a few combined heat and power plants owned by municipalities. The private sector dominates the new and fast growing wind and solar market. Major private producers include Petrom (the CCGT plant in Brazi) and CEZ (which has a 600 MW wind farm).

24. The TSO Transelectrica, previously under the Ministry of Economy, has been recently transferred in 2013 to the Ministry of Finance to meet EU's condition on ownership unbundling of TSO from producers. The distribution network consists of 8 regional companies of which 5 are private and 3 remain state-owned under Electrica. The power exchange OPCOM has been operating since 2000 and has developed into a well-functioning, transparent platform on par with other European exchanges, with day-ahead and term prices following EU trends.

25. The transmission grid has been modernized in the early 2000s and is largely in line with EU standards. Additional reinforcements and upgrading are necessary to accommodate the new and fast growing intermittent renewable capacity. Following partial privatization, a total of EUR 1.7 billion was invested in the distribution system during 2005-2010. Substantially more investments are still needed in rehabilitating and modernizing the electric distribution network, where 60 percent of the physical assets are deemed obsolete. Additional investments are also needed to introduce smart grids and smart metering and to allow direct connection of future distributed energy sources to distribution grids.

## 2.2 Alternative scenarios for achieving EU 2020 target for renewable energy

26. Romania has committed to achieving a 24% RE share in final energy consumption. This translates into a target for renewables (hydro, wind, solar and others) to contribute to 38% of total electricity production in 2020. The Government also committed to closing down or

modernizing large fossil fuel-fired plants.[7] The Government has a draft energy strategy (2011-2035) that would allow it to meet the EU targets. However, some of the measures proposed by the Government would be difficult to implement. An alternative scenario was constructed by the assessment team to demonstrate a pathway which could avoid those implementation difficulties and still meet the EU RE target. This alternative scenario was compared with the Government's draft plan in this assessment.

27. **Government draft plan (Scenario A).** In order to achieve its climate change targets, the Government proposed a power sector development plan for 2020, in the Draft 2011-2035 Energy Strategy. Though not formally approved as a Strategy, the major projects identified in the draft strategy have been announced by the Government as the official development plan for the energy sector. The details of the planned investments in the power sector are depicted in Table 3.[8]

**Table 3: Government Power Sector Investment Plan, 2013 – 2020 (Scenario A)**

| | 2013-2016 | 2017-2020 | 2013-2020 |
|---|---|---|---|
| **GENERATION (MW)** | | | |
| **Wind (on-shore)** | 500 | 500 | 1,000 |
| **Solar PV (arrays)** | 75 | 75 | 150 |
| **Biomass (steam)** | 200 | 200 | 400 |
| **Large hydro** | 250 | 250 | 500 |
| **Pumped storage (large)** | - | 500 | 500 |
| **Pumped storage (distributed)** | - | - | - |
| **Nuclear** | - | 1,400 | 1,400 |
| **FGD* installation 6 x 330MW** | Yes | Yes | Yes |
| **Upgrade coal / gas** | 1,100 | 1,100 | 2,200 |
| **Coal supercritical** | - | 500 | 500 |
| **Coal CFB dispersed** | - | - | - |
| **CCGT F-type** | - | - | - |
| **CCGT E-type** | - | - | - |
| **INFRASTRUCTURE** | | | - |
| **Single overhead line 400 kV (km)** | 600 | 600 | 1,200 |
| **Double overhead line 400 kV (km)** | 500 | 500 | 1,000 |
| **Transmission substations (MVA)** | 1,500 | 1,500 | 3,000 |
| **Distribution substations (MVA)** | 1,000 | 1,000 | 2,000 |
| **Distribution lines (km)** | 100 | 100 | 200 |
| **Smart infrastructure** | *Yes* | *Yes* | *Yes* |

Note: FGD: Flue-gas desulfurization, Source: Ministerul Economiei 2011; Transelectrica's investment plan

[7] The complete list with conformation deadlines in Government Decision 440/2010 and Ministry of Economy / Energy Functional Review 2011, World Bank.

[8] For simplicity and given the limited scope of the rapid assessment, in both scenarios, additional projects that are not directly related to climate change objectives (e.g. the proposed interconnectors with Turkey, Serbia etc.) were excluded.

28. The planned investments in new generation capacity would cover the increase in demand and offset the expected phasing out of 5,500 MW of old thermal plants by 2020. The draft strategy and other official documents did not include cost estimates, nor did they detail investments in transmission and distribution infrastructure to accommodate the new capacities.

29. The Government's program has two main risks. First, the planned nuclear plant is unlikely to be constructed by 2020. EnergoNuclear, the project company formed to construct the two additional units at Cernavoda, failed to reach agreement with the Government after two years of discussions. Efforts to attract new investors have not yet materialized. Even if new partners with investment capital are found, the construction is expected to be completed after 2020 and possibly using a different technology. The Fukushima disaster in 2011 heightened the uncertainty in financing as banks became reluctant to lend money for nuclear projects. Second, the planned upgrading of 2,200 MW coal-fired units is likely to be uneconomic based on past experience and would not be an optimal solution for increasing generation efficiency and reducing emissions.[9]

30. **Proposed alternative (Scenario B)**. Given the difficulties to realize the Government's nuclear plan by 2020, and the risks associated with the rehabilitation of thermal units with no technology improvements, an alternative approach to meet the generation gap is proposed (Table 4). Due to the limited scope of this rapid assessment, the alternative was not determined by an optimization modeling exercise but through a cost of technology screening process and implementation feasibility assessment.

31. The proposed alternative (Scenario B) differs from the government plan (Scenario A) in the following respects:

- the two additional nuclear units are not considered, neither is the upgrading of 2,200MW coal-fired units;
- significantly higher investments in wind and solar PV, more than double the capacity planned by the government;
- significantly higher investments in flexible conventional power generation to enable increased system load of intermittent renewables, including distributed pumped storage, dispersed (small and medium size) gas-fired combined cycle power plants, and a limited number of circulating fluidized bed (CFB) combustion units working in cogeneration mode;
- additional investments in grid infrastructure to integrate intermittent renewables; and
- additional investments in reduction of distribution losses.

32. The alternative scenario aims to achieve the same power output[10] as the Government's plan but with less $CO_2$ emissions and lower levelized energy cost (Figure 13). This is achieved in large part through a significant increase in high-efficiency gas-fired capacity and an increased capacity factor of gas- and coal-fired units in the alternative scenario.

[9] Thermal units 'rehabilitated' in the last 20 years (at Borzesti, Doicesti, Braila, Brazi, Bucharest South, Brasov, Iasi, Suceava, Oradea, Mintia etc power plants), except for the 330 MW lignite-fired units, have proved to be uneconomic due to their high generation costs and remained largely out of operation even after 'rehabilitation'.
[10] The power demand forecast is based on a 19% reduction of primary energy consumption by 2020 (see Box 1).

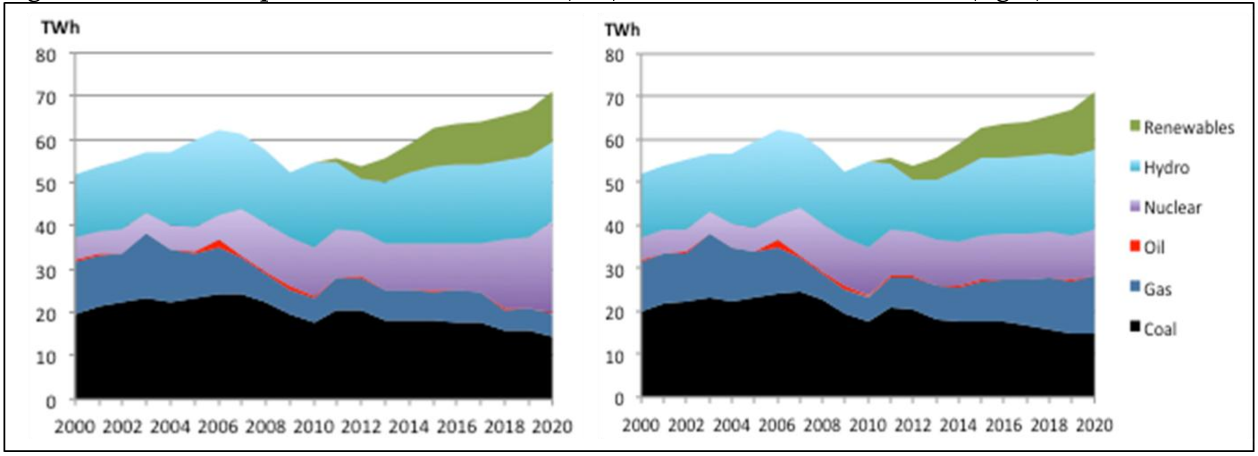
33. Note that the power demand projection of the Government already considered the aggregate impact of potential demand-side energy efficiency gains. The specific impact of demand-side measures on power generation investments is not analyzed in this rapid assessment. Such dynamics will be studied in the latter phase of the advisory service program.

**Table 4: Alternative Power Sector Investment Plan, 2013-2020 (Scenario B)**

| | **2013-2016** | **2017-2020** | **Scenario B 2013-2020** | **Scenario A 2013-2020** |
|---|---|---|---|---|
| **GENERATION (MW)** | | | | |
| Wind (on-shore) | 1,000 | 1,000 | 2,000 | 1,000 |
| Solar PV (arrays) | 250 | 240 | 490 | 150 |
| Biomass (steam) | 200 | 200 | 400 | 400 |
| Large hydro | 250 | 250 | 500 | 500 |
| Pumped storage (large) | - | 500 | 500 | 500 |
| Pumped storage (distributed) | 100 | 100 | 200 | No |
| Nuclear | - | No | No | 1,400 |
| FGD installation 6 x 330MW | No | No | No | Yes |
| Upgrade coal / gas | No | No | No | 2,200 |
| Coal supercritical | - | 500 | 500 | 500 |
| Coal CFB dispersed | 150 | 150 | 300 | No |
| CCGT F-type | 400 | 400 | 800 | No |
| CCGT E-type | 200 | 200 | 400 | No |
| **INFRASTRUCTURE** | | | | |
| Single overhead line 400 kV (km) | 600 | 600 | 1,200 | 1,200 |
| Double overhead line 400 kV (km) | 750 | 750 | 1,500 | 1,000 |
| Transmission substations (MVA) | 2,250 | 2,250 | 4,500 | 3,000 |
| Distribution substations (MVA) | 1,750 | 1,750 | 3,500 | 2,000 |
| Distribution lines (km) | 100 | 100 | 200 | 200 |
| Smart infrastructure | ***+ upgrade*** | ***+ upgrade*** | ***+ upgrade*** | ***Yes*** |

Note: the items in orange shade are different in Scenario B, compared with Scenario A
Source: World Bank staff estimates

**Figure 13: Power Output in Government Plan (left) and in Alternative Scenario (right)**




Source: Ministerul Economiei 2011 and World Bank estimates

## 2.3 Analysis of investment options and needs during 2014-2020

33. To compare the costs of the two scenarios, the META model developed by the Energy Sector Management Assistance Program (ESMAP) of the World Bank was used.[11] The costs of the two scenarios were estimated using data from META and are presented in Table 5.[12] For several figures (nuclear generation; large hydro; pumped storage; and T&D), some upward cost adjustments were necessary to better reflect Romania's current conditions, using the most recent official estimates for specific projects such as Tarnița or Cernavodă Units 3 and 4.

34. Overall, the proposed alternative (Scenario B) costs EUR 2 billion less than the government plan (Scenario A), and balances investments more evenly during the two sub-periods. The main difference arises from the proposed alternative to the 2 x 700 MW reactors in Cernavodă (where cost estimates have increased significantly after the failure of the Energonuclear consortium and after the Fukushima disaster). The proposed alternative is also cheaper in terms of both levelized cost of energy and emission costs, at a post-2020 cost for $CO_2$ emissions (23 EUR/t, or 30 USD/t, the assumption used in the META model). For higher $CO_2$ prices, the benefit would increase proportionally.

35. The savings in terms of emissions seem relatively low in the alternative scenario for two main reasons. First, the Government's nuclear program would have ensured a higher share of

[11] Model for Electricity Technology Assessments, http://www.esmap.org/node/3051. The META model is an instrument to determine consistent performance and cost estimates for power generation and delivery technologies, taking into account specific differences among countries. Costs are denominated in end-2010 USD values. The model provides, by technology, estimates of unit investment costs; O&M; environmental costs; levelized costs per MWh by technology (annualized total costs per MWh, which includes capital investments, emissions, operation and maintenance, fuel) and levelized transmission and distribution costs. Thus, the model allows the costing of various options/scenarios and prioritization of options proposed by the user, but without generating by itself a complete integrated optimal solution for the power system.

[12] Both scenarios focus on the development up to 2020 to meet the forecasted energy demand and exports within the limits of the EU climate change policy. The analysis focused mostly on differences between the scenarios and did not examine additional projects that are important in both scenarios, such as grid interconnections with Turkey, Serbia and Moldova.

$CO_2$-free nuclear electricity output (30% of total power output, compared to just 15% in the alternative scenario). The nuclear program was only partially offset by more renewables and partially by more high-efficiency gas-fired CCGT capacity, as opposed to rehabilitation of existing coal-fired units. Second, the capacity factor of thermal units (and most importantly, coal) is much lower in the Government's program than in the proposed alternative because much of the coal-fired capacity would be used to back up the nuclear units. [13]

**Table 5: Investment Costs: Government Plan (Scenario A) vs. Proposed Alternative Scenario B**

| | Scenario A 2013-2020 | Scenario B 2013-2020 |
|---|---|---|
| **GENERATION INVESTMENT COST (euro)** | | |
| **Wind (on-shore)** | 1,652,500,000 | 3,305,000,000 |
| **Solar PV (arrays)** | 449,475,000 | 1,469,950,000 |
| **Biomass (steam)** | 971,600,000 | 971,600,000 |
| **Large hydro** | 1,250,000,000 | 1,250,000,000 |
| **Pumped storage (large)** | 900,000,000 | 900,000,000 |
| **Pumped storage (distributed)** | - | 360,000,000 |
| **Nuclear** | 5,880,000,000 | - |
| **FGD installation 6 x 330MW** | 360,000,000 | - |
| **Upgrade coal/gas** | 1,000,000,000 | - |
| **Coal supercritical** | 806,000,000 | 806,000,000 |
| **Coal CFB** | - | 520,200,000 |
| **CCGT F-type** | - | 753,600,000 |
| **CCGT E-type** | - | 341,400,000 |
| **INFRASTRUCTURE INVESTMENT COST (euro)** | - | - |
| **Single overhead line 400 kV** | 234,000,000 | 234,000,000 |
| **Double overhead line 400 kV** | 299,000,000 | 448,500,000 |
| **Transmission substations (MVA)** | 105,943,500 | 238,372,875 |
| **Distribution substations (MVA)** | 70,928,000 | 217,217,000 |
| **Distribution lines** | 34,658,000 | 34,658,000 |
| **Smart infrastructure** | 60,000,000 | 133,000,000 |
| **TOTAL INVESTMENT (euro)** | **14,074,104,500** | **11,983,497,875** |
| **$CO_2$ emission cost (euro)** | **255,437,220** | **241,535,100** |

Source: World Bank staff estimates

36. The alternative scenario also has the benefit of requiring less public resources for implementation (Table 6). However, it requires a coherent policy to attract private capital and better leveraging of public resources, including EU financing. The proposed alternative relies on private capital for renewables and recommends private greenfield or brownfield investments in coal- and gas-fired units instead of investments from state-owned companies or the EU in

[13] In the Government's plan, 5100 MW of coal would produce 14.5 TWh and 4100 MW gas would generate 5.3 TWh; whereas in the alternative scenario, just 3740 MW of coal produces 14.8 TWh and 2900 MW of high-efficiency gas generators produce 13.6 TWh.

environmental upgrades and modernization of existing plants.[14] Feasibility and policy recommendations are examined at the end of this chapter.

**Table 6: Public Investments under the Government Pan and the Alternative Scenario (in EUR)**

| | Financing source | Scenario A | Scenario B |
|---|---|---|---|
| **Wind (on-shore)** | Private | - | - |
| **Solar PV (arrays)** | Private | - | - |
| **Biomass (steam)** | Private | - | - |
| **Large hydro** | Hidroelectrica JV (50% private) | 625,000,000 | 625,000,000 |
| **Pumped storage (large)** | Hidroelectrica | 900,000,000 | 900,000,000 |
| **Pumped storage (distributed)** | Hidroelectrica | - | 360,000,000 |
| **Nuclear** | Private (JV) | - | - |
| **FGD installation 6 x 330MW** | SOEs (Oltenia, Hunedoara); EU | 360,000,000 | - |
| **Upgrade coal/gas** | SOEs (Oltenia, Hunedoara, ELCEN) | 1,000,000,000 | - |
| **Coal supercritical** | Private | - | - |
| **Coal CFB** | Private | - | - |
| **CCGT F-type** | Private | - | - |
| **CCGT E-type** | Private | - | - |
| **INFRASTRUCTURE** | | | |
| **Single overhead line 400 kV** | Transelectrica & EU funds | 234,000,000 | 234,000,000 |
| **Double overhead line 400 kV** | Transelectrica & EU funds | 299,000,000 | 448,500,000 |
| **Transmission substations (MVA)** | Transelectrica & EU funds | 105,943,500 | 238,372,875 |
| **Distribution substations (MVA)** | Private & Electrica | 26,598,000 | 81,456,375 |
| **Distribution lines** | Private & Electrica | 12,996,750 | 12,996,750 |
| **Smart infrastructure** | Private & Electrica | 22,500,000 | 49,875,000 |
| | **Total public funding** | **3,586,038,250** | **2,950,201,000** |

Source: World Bank staff

38. The above-mentioned scenario focuses on developments up to 2020 to meet the forecasted energy demand and exports within limits caused by the EU climate change policy. To simplify the analysis, it focused mostly on differences between the scenarios, and did not examine additional projects that are critical in the view of the Government as well as the World Bank assessment team, such as cross-border power interconnections and adjacent infrastructure with Turkey (400 kV submarine cable, estimated at 150 million EUR), Serbia (400 kV Romania - Serbia, 400 kV Iron Gates – Reșița including substation modernizations), and Moldova (400 kV Suceava – Bălți, Suceava - Gădălin and Gadalin – Oradea/Mintia). These projects would add up some 250 million EUR to the estimated costs in both scenarios and would increase the

[14] The World Bank Functional Review of the Ministry of Economy and Energy Sector (2011) recommends majority privatization of the lignite-based Oltenia and, if possible, the viable hard coal units. The main reason for the proposal to privatize thermal generation is that the public sector does not have the funds to undertake all the necessary investments in the obsolete thermal sector.

interconnection capacity from 10% today to 15-20% in 2020, allowing regional trading and regional balancing of renewables.

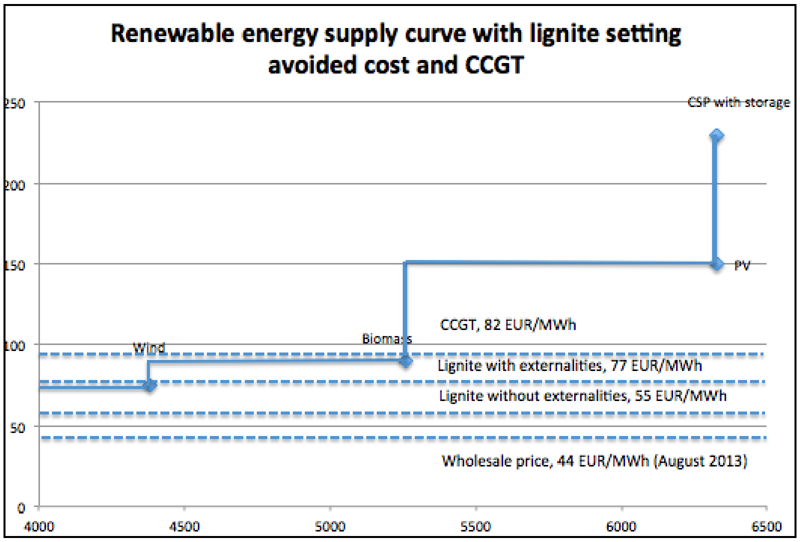
39. Given the short time frame to 2020 and the fact that the capacities are discrete (indivisible), the capacity development plan is not affected by variations in energy demand over the same period. The Government strategy includes only one scenario for generation capacity development, despite taking into account three scenarios for GDP growth and energy demand. Given the development of interconnections and the projected energy shortage in the Western Balkans, Romania could profitably sell excess supply abroad if significant energy savings were achieved at home. Therefore, it is assumed that the variations in energy demand would not significantly alter the capacity development needs.

40. Post-2020, the proposed scenario allows better integration of future plants than the Government's scenario. Scenario B focuses on distributed thermal and pump storage units, to avoid grid bottlenecks and risks of interruptions. The large share of flexible units allows a future integration post-2020 of two nuclear units at Cernavoda and substantial additions of intermittent renewables. Also, the proposed technologies are more diverse and up-to-date, reducing technology and supply risks, and increasing the overall system stability margin and its efficiency. While not computed for the quick assessment, the alternative scenario also has a lower levelized cost of energy than the Government's draft plan, given that a cheaper solution to nuclear is provided and capacities have a higher utilization rate than in the Government's draft plan, where a large share of thermal (coal) capacity sits idle during periods of low market prices or to back up nuclear generation.

## 2.4 Economic analysis of the renewable expansion

41. The analysis includes the calculation of levelized cost of energy (LCOE) for renewables included in the proposed alternative scenario and the construction of an economic supply curve based on this plan. The calculation of LCOE is based the META model, with adjustments based on the expected technological development for renewable technology over 2014-2020. The levels estimated are within international ranges and in line with the latest public statements of the EU officials. A supply curve was constructed (Figure 14) to understand what RE options can be considered least costly, as well as the incremental cost (required subsidies) associated with the proposed RE scale-up. This is useful also in assessing the effectiveness of the current subsidy scheme through GCs in closing the incremental cost gap between RE power and conventional thermal generation. All RE options considered have higher LCOE than fossil fuel-fired generation technologies, although the LCOE of on-shore wind generation is close to that of the lignite-fired generation, if $CO_2$ pricing is factored in.

**Figure 14: Supply curve of power from renewable energy options**




Source: World Bank estimate

42. Table 7 shows the amount of subsidy that would be required in 2020 to support the RE capacity, assuming the price for the $CO_2$ is USD 30/t or EUR 23/t. Considering that the capacity would be installed gradually, the annual subsidy would increase gradually to EUR 220 million.

**Table 7: Subsidies for renewable energy**

| **LIGNITE avoided cost** | | | | | | |
|---|---|---|---|---|---|---|
| RE option | Production - GWh | LCOE EUR/MWh | Incremental cost if CO2 internalized | Incremental cost if CO2 not internalized | Subsidy volume | |
| Wind | 4380 | 75 | -2 | 20 | 87,600,000 | |
| Biomass | 876 | 90 | 13 | 35 | 30,660,000 | |
| PV | 1073.1 | 150 | 73 | 95 | 101,944,500 | |
| Total (annual) | | | | | 220,204,500 | |
| Per unit annual subsidy if CO2 price not internalized | | | | | 34.79 | EUR/MWh |
| Subsidy to be paid by consumers per MWh consumed in Romania | | | | | 3.09 | EUR/MWh |
| **CCGT** | | | | | | |
| RE option | Production - GWh | LCOE EUR/MWh | Incremental cost if CO2 internalized | Incremental cost if CO2 not internalized | Subsidy volume | |
| Wind | 4380 | 75 | -10 | -5 | - | |
| Biomass | 876 | 90 | 5 | 10 | 8,760,000 | |
| PV | 1073.1 | 150 | 65 | 70 | 75,117,000 | |
| Total (annual) | | | | | 83,877,000 | |
| Per unit annual subsidy if CO2 price not internalized | | | | | 13.25 | EUR/MWh |
| Subsidy to be paid by consumers per MWh consumed in Romania | | | | | 1.18 | EUR/MWh |

Source: World Bank staff

43. The calculation shows that:

- If the price of $CO_2$ is internalized in the conventional thermal generation (using lignite-fired generation as a benchmark), wind capacities would no longer require any form of subsidy by 2020. The other RE would require support beyond 2020.
- The average support for renewables to replace the lignite capacity is 35 EUR/MWh, which falls within the minimum and maximum price range of a GC today (27 EUR – 55 EUR / MWh)
- The current GC scheme, slashed in July 2013, allows: 1 GC for wind, 4 GC for PV, 2 GC for geothermal and biomass, 1 GC for biogas and 0.5-1 GC for micro-hydro (the development of micro-hydro will however be limited soon because of other environmental constraints, and neither the Government's scenario nor the proposed alternative consider additional development of micro-hydro). Table 7 indicates that even current support over 2014-2020 is sufficient to allow profitability for wind and solar PV, and that indeed the GC scheme before July 2013 had been excessively generous. Moreover, additional savings should occur during the next few years as a result of regulatory monitoring.
- The total support for renewables, divided by the total electricity consumption (assumed at 65 TWh in 2020) amounts to some 3 EUR/MWh on the invoice of end-consumers.[15] As of mid-2013, ANRE reported a contribution of 11 EUR/MWh. This figure does not take into account that the GC scheme increased the supply of renewables and replaced the most expensive coal-based marginal generation that normally sets the market-clearing price. This resulted in a reduced wholesale market price for electricity, partially offsetting the end-user price increase caused by the certificates. Thus, the proposed GC support would be more affordable than today.

## 2.5 Policy recommendations and use of EU funds

The major challenge in the proposed alternative scenario is implementation feasibility, as it is in the case of the Government's plan. Scenario B reduces total costs for investments by more than EUR 2 billion and the cost to the public sector by EUR 635 million, making it a significantly less expensive option than Scenario A. However, implementation depends on the willingness of the private sector to contribute investments in greenfield/brownfield projects and on the Government's capacity to attract EU funds for infrastructure development and environmental cleanup. The latter is more feasible under Scenario B with its emphasis on renewables and necessary T&D infrastructure. The following priority EU-financed projects and policy measures that would support Scenario B, as well as integration of additional capacities post-2020, are recommended.

44. **EU funds**: Overall, in the proposed Scenario B, EU support could amount to EUR 1,500 million, about half of the estimated public investments (Table 6). This may be allocated for investments that support RE investments such as pumped storage, transmission & cross-border interconnections, and smart grids (distribution and meters) as well as for high efficiency co-generation and carbon capture and storage (CCS). The specific allocations will need to be substantiated with in-depth studies.

[15] In reality, this calculation also does not consider a substitution effect: RE replace expensive lignite or hard coal production and contribute to lower prices for energy on the market.

- The EU is quite restrictive in providing financing directly to companies, due to state aid rules. However, the EU is willing to finance environmental rehabilitation costs. In Scenario A the investment needs for flue-gas desulphurization (FGD) of 6 x 330 MW units is estimated at about EUR 360 million (EUR 90 million from the Government and EUR 250 million from the EU). In Scenario B, this investment would not be needed, and the EU funding could be used to support other investments.
- The EU is willing to finance T&D infrastructure projects. Through the Large Infrastructure OP, Romania could cover investments in the smart grids and part of the interconnections. Interconnectors are also financeable through the Connecting Europe Facility. [16] The estimation of the needs for smart grid infrastructure would need further investigation.
- Continued efforts in developing viable CCS solutions may be justified to address potential mitigation needs and risks. As envisaged previously by the Government, CCS could be supported through "NER 300",[17] an EU/EIB member states financing instruments resulting from the sale of emission allowances.
- Renewables: the current (amended) GC scheme is considered as sufficient for the development of wind and solar PV. EU funds might be requested for the development of energy balancing capacities including different energy storage facilities; and for research and development of new renewable technologies.
- EU funds from the cohesion policy, as well as earmarked funds directly allocated from Brussels, support investments in TEN-T infrastructure. In Scenario B these investments are closely connected to climate change mitigation, since they would contribute to integration of a higher share of renewables. Romania should focus on the completion of the 400 kV 'inner ring' with the missing segments Suceava – Gadalin – Oradea/Mintia and Arad – Iron Gates, and execution of the 400 kV cross-border interconnections with Moldova, Turkey and Serbia. These are transmission network interconnections within the 12 Trans-European corridors and zones, including the Black Sea ring as well, that can remove transmission congestion, connect additional 2000 MW of variable renewables, interconnect the Tarnita pump-storage plant and ensure balancing of variable green energy regionally.

45. **Other significant sources of grant financing** are also available for power sector climate change mitigation investments, notably, the funds generated from the trading of $CO_2$ certificates, as explained in Annex 2.

46. **Policy support**: To attract private investments, Romania needs to adopt a set of transparent policies that would provide potential investors assurance of a stable and predictable business environment. The following measures were recommended in the World Bank's 2011 Functional Review of the Ministry of Economy, Energy Sector and Business Environment:

[16] The list of eligible projects – for grants for studies and / or investments - is available at: http://ec.europa.eu/energy/infrastructure/pci/doc/2013_pci_projects_country.pdf

[17] New Entrants' Reserve of the European Emissions Trading Scheme for subsidizing installations of innovative RE technology and CCS. 300 million allowances (rights to emit one ton of $CO_2$) were put aside and would be sold on the carbon market. The money raised — expected to be around EUR 2 billion at current carbon prices — would be made available to projects.

- Improvement of corporate governance and energy contracting of state-owned companies, to ensure non-discriminatory access to markets and fully commercial behavior of SOEs, which control 85% of power generation. All SOEs should be required to sell energy competitively, transparently and non-discriminately on OPCOM
- Cancellation of any plans to set up integrated champions in the power sector, as agreed with the IMF/EC/World Bank, to avoid market concentration, uneconomic prices, cross-subsidies and non-transparent energy deals
- Liberalization of the electricity (and gas) markets, development of OPCOM as a power/gas exchange, in parallel with deployment of a new social energy assistance system fully decoupled from the energy markets
- SOE energy consumers pay their bills (particularly the railways sector) to avoid cash flow issues in the electricity sector
- Full implementation of regulations and laws (e.g., cost pass-throughs for regulated components, subsidies for public service obligations, incentive-based regulations for infrastructure)
- Privatizations in the thermal generation sector (Hunedoara, Oltenia) to reduce the state monopoly in power generation and ensure private investments in existing plants/replacement of current technologies
- Preparation of an energy and climate change strategy by an internationally and competitively selected consultant. Investors need a clear, public strategy with information on Government plans, proposed regulations and legislation, forecasts of energy supply and demand, and infrastructure development
- Stabilization of policy and legislation, and sound justifications for each policy. Frequent amendments in laws (e.g., renewables, thermal support, subsidies for coal, cogeneration bonus etc.) negatively affect investor confidence and increase the perception of investment risks. Policy and legislative stability is currently mentioned as the number one issue by all investors.

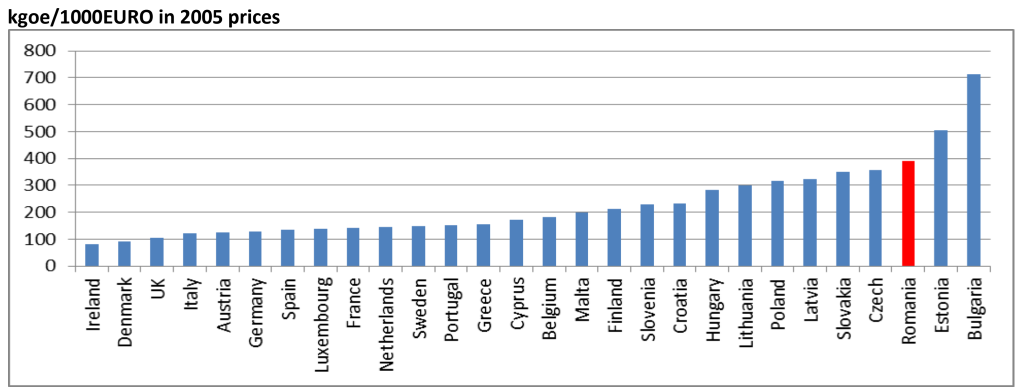
47. The simultaneous realization of the proposed measures would attract private investments in the Romanian power sector to meet the targets in the alternative Scenario B.

# 3 Energy Efficiency Opportunities and Challenges in the End-use Sectors

## 3.1 Main energy efficiency gaps

49. The overall energy intensity of GDP in Romania declined by about 35% from 2000 to 2011, but remains among the highest in the EU, whether GDP is measured in PPS or ER. Figure 15 only depicts the energy intensity with exchange rate denominated GDP. What matters is that in key energy end-uses, Romania still lags significantly in EE in comparable conditions, including space heating and energy-intensive manufacturing.

**Figure 15: GDP energy intensity of EU member countries, 2011**



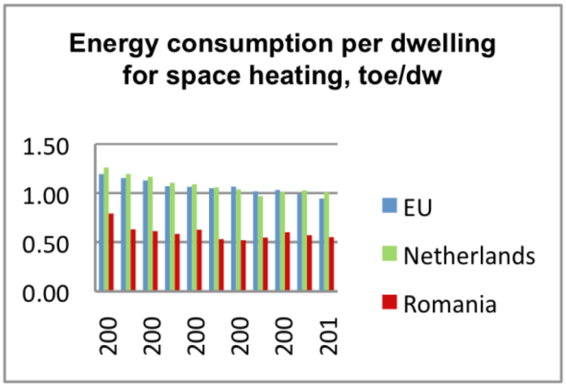

Source: Eurostat

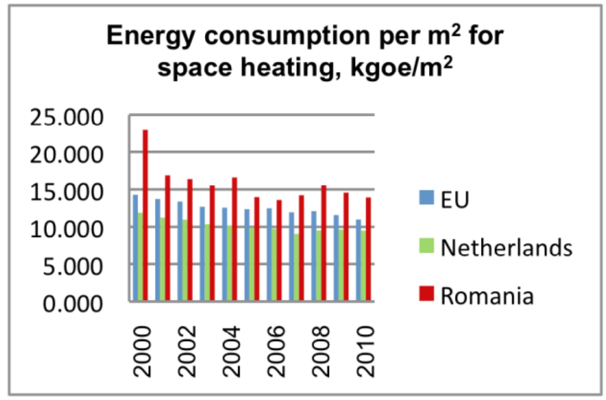
50. About 60 percent of Romania's residential energy consumption is for space heating. Heating energy use per dwelling remains substantially lower than in most other EU countries, likely a reflection of significantly smaller dwellings in Romania[18]. But heating energy use per $m^2$ is high in EU comparison (Figure 16). Among the EU's cold climate countries, Netherland has the lowest residential heating energy consumption per $m^2$ at 9.445 kgoe/$m^2$, compared with 13.942 kgoe/$m^2$ of Romania, which has similar heating degree days, indicating significant potential for improving the efficiency of heating systems and the thermal performance of buildings in Romania

51. Electricity consumption of Romanian households is very low in comparison with other EU countries (Figure 7). Electricity is used almost exclusively for lighting (about 25%) and electrical appliances, with refrigerators and freezers accounting for one quarter of residential electricity consumption. Saturation of appliances is fairly low and electricity consumption therefore is growing with increasing ownership. Sales trends confirm that consumers are gradually purchasing more energy efficient appliances. For example, sales of A+ refrigerators have grown from 3% in 2004 to almost 30% by mid-2007 (Energy Charter Secretariat 2009).

[18] The average dwelling size in Romania is 40$m^2$ compared to 85$m^2$ for the average EU dwelling; http://www.odyssee-indicators.org/online-indicators/.

**Figure 16: Residential energy consumption for heating is low per dwelling, but it is high per unit of heated area**

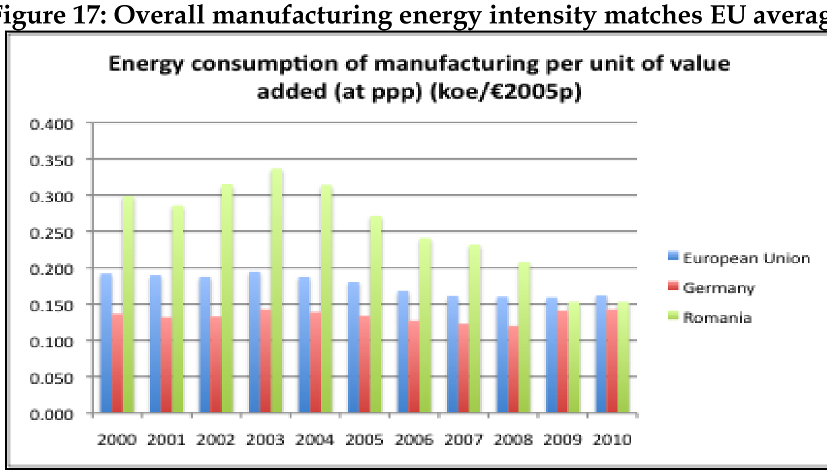



Source: http://www.odyssee-indicators.org/online-indicators/

52. Energy intensity in the manufacturing sector has declined substantially, falling by 4.2 percent per year between 1995 and 2007. According to analysis done by ODYSSEE, an EU sponsored energy indicators program, one-third of that reduction was due to efficiency gains and two-thirds were linked to structural changes, namely a shift toward less energy-intensive manufacturing. In PPS terms manufacturing energy intensity in Romania is approaching more developed EU member states (Figure 17).

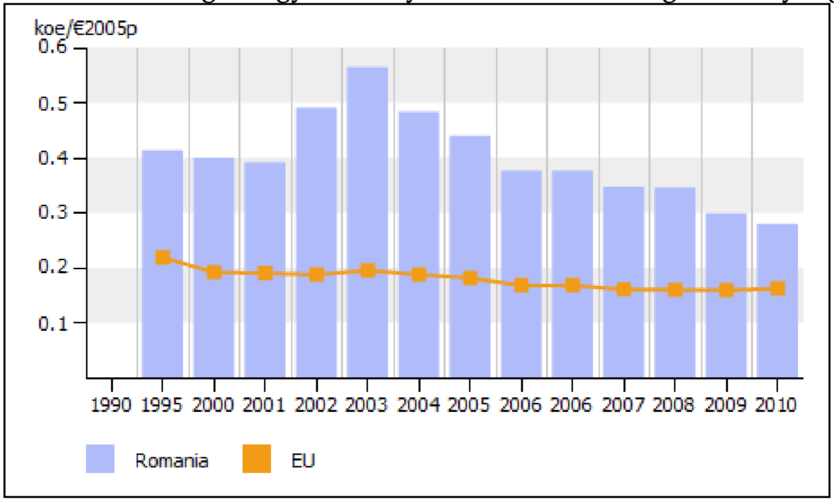
**Figure 17: Overall manufacturing energy intensity matches EU average**




Source: http://www.odyssee-indicators.org/online-indicators/

53. But after adjusting for industrial structure, the manufacturing energy intensity of Romania in PPS measurement is still over 70% higher than the EU average (Figure 18), indicating structural issues. The low value-added share (16%) of the chemicals and steel subsectors, which together account for 64% of energy consumption, mask the significantly higher energy intensity of these two energy-intensive sub-sectors in Romania manufacturing industry.

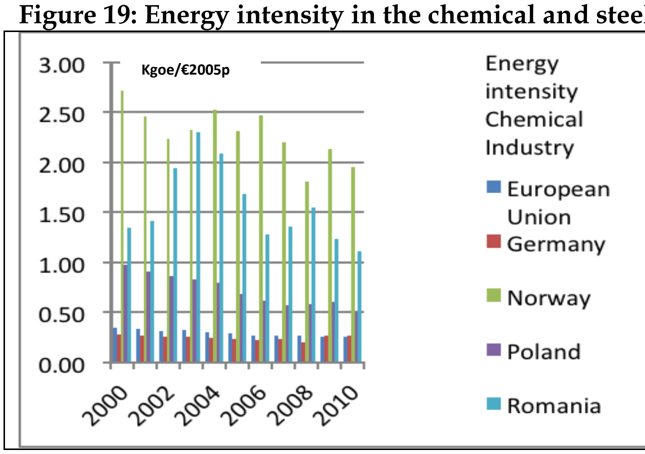
**Figure 18: Manufacturing energy intensity at EU structure is significantly higher than EU average**

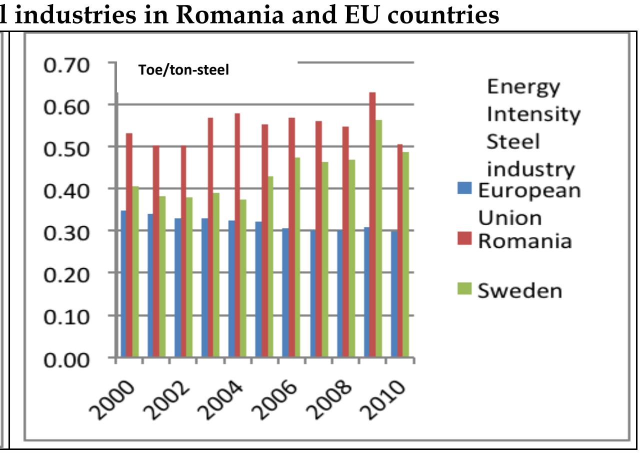



Source: http://www.odyssee-indicators.org/online-indicators/

54. The energy intensity picture differs for different industries, depending to some extent on the production process used and the product mix. Both in the steel industry and in the chemical industry, energy intensity has had its ups and downs during the past decade (Figure 19). A clearly improving trend is not noticeable in the steel industry. Here the gap between the Romanian industry and the average EU energy intensity has remained almost as wide as it was at the beginning of the decade. In the chemical industry, energy intensity has improved compared with the beginning of the decade and narrowed the gap with the EU average somewhat.

**Figure 19: Energy intensity in the chemical and steel industries in Romania and EU countries**



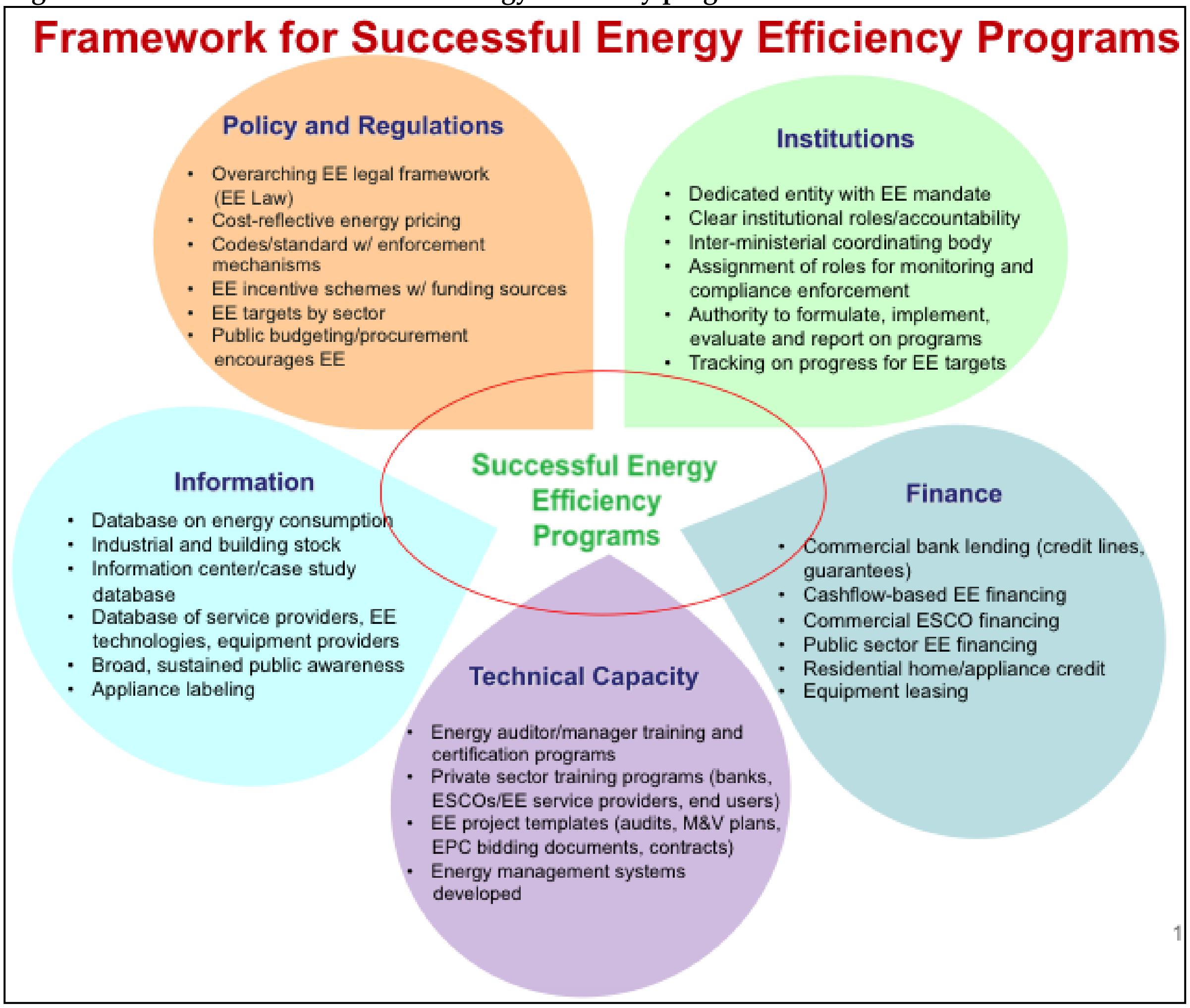

Source: http://www.odyssee-indicators.org/online-indicators/

55. Summarizing, Romania's GDP energy intensity has declined substantially, but is still higher than the EU average (18% using PPS denominated GDP). The efficiency gap is most pronounced in the residential sector where specific heat consumption (kgoe/$m^2$) is 32 percent higher than comparable best EU practice, and in two dominating manufacturing energy users—the chemical industry where value-added energy intensity is over 4 times higher than the EU average (indicating structural issues) and the steel industry where energy intensity per ton of steel is 70 percent higher than the EU average. These three areas of end-use together account for roughly 40 percent of Romania's final energy use.

## 3.2 Ingredients of successful energy efficiency programs

56. The economic benefits of EE investments usually far outweigh their costs. Nevertheless, the implementation of successful EE programs is a fairly difficult and complex process. As the experience in many countries has demonstrated, the successful implementation of EE programs usually requires certain elements to be in place. As shown in Figure 20, these elements refer to policies and regulations, institutions, finance, technical capacity and information.

**Figure 20: Framework for successful energy efficiency programs**




Source: World Bank, 2013

57. Table 8 summarizes in which areas of the EE framework positive achievements were made in Romania and where efforts need to be stepped up to deliver scaled-up EE investments in the future. In the remainder of the chapter, the important gaps with respect to policies and regulations, financing and implementation capacity are examined in more detail.

**Table 8: Summary of EE framework in Romania – Achievements and necessary improvements**

| | Good | Adequate | Improvement necessary |
|---|---|---|---|
| **EE Policies and Regulation** | | | |
| 1. EE legal framework (EE Law) | X | | |
| 2. Cost-reflective energy pricing | | X (electricity) | Gas and DH for residential; electricity and gas for some energy-intensive SOEs in the manufacturing sector |
| 3. Codes/standard w/enforcement mechanisms | | X | |
| 4. EE incentive schemes w/ funding sources | | | Tax incentives and non-monetary incentives |
| 5. EE targets by sector | | | To be established |
| 6. Public budgeting/ procurement encourages EE | | | Changes required |
| **Institutions** | | | |
| 1. Dedicated entity with EE mandate | | X (in ANRE) | Needs better governance with stronger mandate and resources |
| 2. Clear institutional roles/accountability | | | X |
| 3. Inter-ministerial coordinating body | | | X |
| 4. Assignment of roles for monitoring and compliance enforcement | | | M&V lacking except for donor-funded programs |
| 5. Authority to formulate, implement, evaluate and report on programs | | X (in ANRE) | Needs stronger mandate and resources |
| 6. Tracking on progress for EE targets | | X (only for national EE targets mandated by EU) | Once sectoral targets (see EE policies) are established they need to be tracked |
| **Finance** | | | |
| 1. Commercial bank lending (credit lines, guarantees) | | X (for industry) | State guarantee for residential thermal building retrofit is barely used |
| 2. Cash flow-based EE financing | | | X |
| 3. Commercial ESCO financing | | X (just starting-EBRD) | X |
| 4. Public sector EE financing | | | For residential and public sectors sustainable financing mechanisms need to be designed and funded |
| 5. Residential home/appliance credit | | | Credit lines for HOAs |
| 6. Equipment leasing | | X (mostly for consumables – e.g., cars, computers) | |
| **Technical Capacity** | | | |
| 1. Energy auditor/manager training and certification programs | X | | |
| 2. Private sector training programs (banks, ESCOs/EE service providers, end users) | | X | To be implemented more broadly |
| 3. EE project templates (audits, M&V plans, | | X (some | X |

| | | | |
|---|---|---|---|
| ESPC bidding documents, contracts) | | templates and standard contract) | |
| 4. Energy management systems developed | | X | |
| **Information** | | | |
| 1 Database on energy consumption | | | To be developed |
| 2 Industrial and building stock | | | To be investigated |
| 3 Information center/case study database | | X (limited) | Some available at local level; to be created on national level |
| 4 Database of service providers, EE technologies, | | | |
| 5 Broad, sustained public awareness | | | |
| 6 Appliance labeling | X (enforced by ANRE) | | |

Source: Authors

## 3.3 Energy policy and regulatory issues

58. Romania has in general conformed to existing EE related legislation and regulations and transposed the relevant EU directives, shown in Table 8.

**Table 9: Adoption of EU Energy Efficiency Directives in Romania**

| EU Requirements | Romania Status Quo |
|---|---|
| National EE Law | Law No.199/2000 on efficient use of energy, amended and updated by Law No 56/2006, provides the legal framework for the development and implementation of national policies for the efficient use of energy |
| National Energy Efficiency Entity | Incorporated into ANRE, the energy regulatory agency, after dissolving it as an quasi-independent agency (ARCE) with regional offices, in the subordination of the Ministry of Economy and Commerce |
| National Energy Efficiency Strategy | GD 163/2004 |
| National EE Action Plan, according to Directive 32/2006 (energy end-use efficiency and energy services - ESD) | GO 22/2008 on energy end-use efficiency and promotion of renewable energy source utilization by the end-consumers<br>+ 1st NEEAP 2007<br>+ 2nd NEEAP 2012 |
| EPBD 2002 | Transposed through Law 372/2005, in force since January 1st, 2007 |
| • EE Building Codes<br>- for New Buildings<br>- for Renovations | <br>For Residential and Non-Residential Buildings<br>For Non-Residential Buildings only |
| • Building Energy Performance Certificates | For public and other non-residential buildings starting in 2007<br>For residential buildings starting in 2011 |
| • Inspection of boilers, heating systems and air-conditioning | Periodical inspection (option a) |
| EPBD Recast 2010 | Transposed through Law 159/2013, in force since July 19, 2013 (however, in September 2013, the European Commission issued a formal request to Romania to ensure full compliance with their obligations under EU legislation on energy efficiency in buildings) |
| Equipment Standards | Efficiency standards for various household appliances |

| | |
|---|---|
| Eco-Design Directive 2009/125/EC | GD 1043/2007 |
| Labeling Directive 2010/30/EU recast | Labeling is in place for energy efficient household appliances |
| CHP Directive 2004/8/EC | With very few exceptions, none of the existing CHP plants comply with the EU definition of CHP plants in terms of efficiencies and power/heat ratio |
| Energy Efficiency Directive 2012 (amending Directives 2009/125/EC and 2010/30/EU recast and repealing Directives 2004/8/EC and 2006/32/EC) It covers all sectors except transport and includes measures for supply side efficiency | To be transposed into national law by 5 June 2014 (this could be done by amending GO no. 22/2008). It needs to include measures to accelerate energy-efficient building retrofit as well as Energy Efficiency Obligations (EEOs) for energy distributors and retail energy sales companies to save 1.5 % of their annual energy sales between 2014 and 2020 or alternatives, such as energy or CO2 taxes, national energy efficiency fund, financing instruments and/or fiscal incentives, voluntary agreements, standards and norms, energy labeling |

Source: Authors

59. There is also a fair amount of secondary legislation and regulations as well as guidance documents that are important for the actual implementation of EE relevant legislation. In some areas, enforcement mechanisms such as fines exist for the non-compliance with labeling requirements or energy manager employment/auditing in industrial companies.

60. For public and residential buildings, the following have been adopted:

- Energy performance of buildings: methodological norms for most requirements of the EPBD (for details see EPBD country report Romania, 2011), technical guidance documents for energy performance of buildings
- Public procurement of EE products: Guides for procurement of IT equipment (computers, including monitors, printers, copiers) and high-efficiency public lighting equipment;
- Provisions for enabling energy performance contracts (EPCs): Standard documents for EPCs are posted on the ANRE website, training seminars for all stakeholders
- Local energy planning required in municipalities with more than 20,000 inhabitants (according to EE law). Municipalities that signed the Covenant of Mayors have to complete Actions Plan for Sustainable Energy until 2020
- Regulations and licensing/certification for building energy auditors
- HOA legislation (cp. para. 6138).

61. For the industrial sector, the following have been adopted:

- Regulations and licensing/certification for industrial energy managers: requirement for large companies to employ energy managers and carry out energy audits
- EU Emission Trading Scheme (ETS) for the 244 largest GHG-emitting companies in the energy and industrial sectors, 2008-2012 (see Annex 2 for details)
- Long-term agreements (LTAs) to improve EE in the industrial sector (modeled on Dutch LTAs) had been planned for 2008, but postponed to 2014.

62. The implementation of the EE legislation summarized in Table 8 and of subsequent secondary legislation and regulations has seen its first result, including the completion of about

30,000 building energy performance certificates (for about 12 million $m^2$, mostly in residential buildings) by the end of 2012 with more than 1,400 qualified experts authorized to perform certification and energy audits of buildings;[19] certification of energy managers and auditors[20] for industrial companies; and employment of energy managers in companies according to the ANRE website as of September 2013 287. The NEEAPs contain almost exclusively measures that are a derivative of EU EE directives and/or are funded from government budgets or EU funds (see section 3.4).

63. **EE policy and strategy issues that have remained unresolved or incomplete.** There are some policy barriers that are detrimental to the full implementation of EE measures, unless they are overcome.

64. The most important issue is energy pricing. The prices for electricity, natural gas and district heat are not yet completely market-based for all consumers. Natural gas and DH remain heavily subsidized. Regulated electricity and gas prices for non-households are scheduled to be fully liberalized by January 2014 and January 2015, respectively, and regulated electricity and gas prices for households will be liberalized by January 2018 and January 2019, respectively. The current price support schemes for DH are expected to remain in place for the foreseeable time (see Chapter 4).

65. Metering and consumption-based billing at the household level is fully implemented for electricity and gas. DH metering is complete only at the building level. Individual apartment heat metering (or heat cost allocation) and heat controls were implemented in 2012 for 50% of the blocks of flats identified in the Strategy for Residential Heating (GD 882/2004). Thus many homeowners are still billed for heat consumption according to heated area, rather than actual consumption.

66. Regulations about public budgeting, accounting and procurement in the public sector continue to restrain the use of energy service companies (ESCOs) through energy performance contracts (EPCs). In many countries the public building sector has been the first market segment targeted by ESCOs. For example, changing the restrictive rules to the use of ESCOs has enabled countries such as Germany, France, the US and Canada to open the way for third party financing of public sector EE investments.[21] These issues are expected to be addressed under the EBRD/GEF Public Sector EE/ESCO project.[22]

67. The Romanian government has not been able to develop and implement effective strategies to deal with the ailing DH sector which is under municipal ownership as well as to accomplish the huge task of retrofitting buildings with apartments that are almost all privately owned. The resolution of these two problems requires substantial amounts of financing over a long period of time and needs to be addressed in a coordinated manner. Without this financing, the heating and building infrastructure will continue to lose much of its value. Ultimately poor households that are unable to move into better housing and/or install their own heating devices

[19] Source: Concerted Action EPBD 2013
[20] ANRE's website lists a total of 200 energy auditors as of September 2013.
[21] See Singh, Jas et al (2010)
[22] EBRD/GEF (2011)

will lose out. In-depth investigations beyond this rapid assessment will be required to identify appropriate solutions to these two problems.

## 3.4 Energy efficiency financing during 2007-2013

68. In Romania no single agency has an overview of implemented EE projects, their costs, financing sources and main results and benefits. In the following section, information on EE investments in three energy-using sectors – manufacturing sector, residential buildings and public sector - was assembled for an approximate picture of financing available in the period 2007-2013. Since information on disbursements is scarce, the assessment is not able to put together a full picture for the actual spending of the available funds.

69. **EE financing for the industrial sector, especially in SMEs.** Outside of EU financing, the main sources of external funds for EE investments in manufacturing are several programs set up by IFIs: The Romanian Energy Efficiency Fund (FREE), established by the World Bank and GEF, and the Energy Efficiency Financing Facility (EEFF) and Romanian SME Sustainable Energy Financing Facility (ROSEFF), both established by EBRD and the EC.

70. FREE is a free-standing loan facility that is not restricted to the private sector, but has in fact provided most of its loans (17) to industrial clients. Between 2004 and 2012, FREE has made 28 loans totaling USD 14.5 million (EUR 11 million) for a total investment amount of USD 44 million (EUR 33 million). Activities are currently limited since FREE is a revolving fund and has not been able to attract any additional capitalization since its initial GEF grant funding.

71. EEFF is structured as a credit line, based on a EUR 80 million loan from EBRD. Six Romanian banks are currently participating and provide low-interest loans of up to EUR 2.5 million to their clients. The borrowers have access to free energy audits and receive a grant of 15% of the original loan amount when investment is verified to be complete and operational. The EC is providing grant funding for these incentives. Between 2009 and mid 2013, 104 projects were financed with a total loan amount of EUR 64 million and total investment of EUR 100 million. Three of the six banks have already fully committed their credit line.

72. ROSEFF is a follow-up EBRD credit line operation of EUR 60 million, under which EBRD provides funding to commercial banks and leasing companies in Romania for on-lending to SME borrowers. Four banks are currently participating.[23] ROSEFF is similar to EEFF, including free audits and up to 15% loan forgiveness, funded by the EC. In addition, it has a streamlined facility for small projects, provides funding for both EE and renewable energy investments, and includes among the eligible borrowers housing/homeowner associations as well as manufacturers, suppliers of EE and RE technology, equipment and materials. Disbursements under ROSEFF are small so far.

73. EIB has provided a similar credit line of EUR 50 million to Banca Comerciala Romana (BCR) for investments within its SME Financing Facility *Energy Efficiency Window - Green*

[23] Information on disbursements is not publicly available; see information on three loans at https://www.seff.ro/downloads/9/page.html

*Initiative*. ESCOs and municipal entities would also be able to borrow. Technical support and a grant element are a part of this facility as well.

74. All financing programs through banks (both for the private and public sectors) employ conventional asset-based securitization – borrowers have to provide collateral, often in excess of 100% of the loan amount. The use of future cash flows from energy cost savings is not accepted yet as loan security.

75. Under the SOP *Increase of Economic Competitiveness*, private companies in the manufacturing sector can receive EU financing for efficiency improvements. By mid-March 2013, 23 contracts amounting to RON 495.2 million (EUR 113 million) had been signed, out of a total allocation of EUR 191 million.

76. *Based on the above information, the total financing available for EE investments in the non-ETS industrial sector between 2007 and 2013 amounted to about EUR 543 million*.[24]

77. Among the barriers that prevent companies in the manufacturing sector from carrying out financially viable EE projects are a lack of awareness of the cost-saving opportunities by enterprises, competing needs for capital, and relatively high transaction costs of financing such projects. In energy-intensive industries, SOEs benefit from subsidized energy prices. SMEs on the other hand often have problems accessing commercial financing and face high capital costs.

78. **Financing for EE retrofit of residential buildings.** The national program for thermal rehabilitation of multi-story family buildings constructed during 1950-1990 started in 2002, was re-launched in 2007 and has since undergone many changes in its rules and regulations. Initially in 2007, the state government would contribute 34%, and the local governments and beneficiaries would contribute 33% each. In 2008, the allocation was changed to 50, 30, and 20%, where local governments could also cover the beneficiaries' share. In 2010, grant funding for block buildings was supplemented by a guarantee mechanism covering all residential buildings. The state budget provides a 100% State guarantee for loans to beneficiaries of up to 5 years and all interest payments, while local governments finance up to 30% of the eligible costs, and beneficiaries the remainder. In 2011/12, use of the guarantee mechanism has been negligible with five loans totaling RON 51,000 (EUR 12,000). One reason may be the short term of the guarantee coverage compared to the much longer payback time of the investment from energy savings.

79. There is no consistent information about the overall expenditure, number of renovated buildings and energy savings results under this program. According to information from MDRAP, the national budget provided RON 451.6 million (EUR 108 million) for the renovation of 55,000 apartments in 1375 buildings between 2009 and 2012. Assuming that local governments and beneficiaries supplied another EUR 108 million (according to the co-financing requirements), the total costs amount to EUR 216 million. The cost per apartment would thus total roughly EUR 4000 or EUR80/$m^2$. Renovated apartments account for about 1% of apartments in multi-family buildings (blocks). The overall pace of renovation should increase

[24] Assuming that own contribution of beneficiaries under SOP IEC is 40% on average.

somewhat with financing from the EIB for Bucharest [25] and the eligibility of thermal rehabilitation investments in block buildings of EU OP funding for 2013. EU funding is budgeted with EUR 150 million and would have to be matched by state and local budgets.

80. Green House Program – The Environmental Fund Administration provides grants (90% of equipment cost) to the residential sector, territorial administrative units and public institutions that are replacing traditional heating systems with units that use solar energy, geothermal energy and wind energy or other systems that improve quality of air, water and soil. The program budgets for 2010 and 2011 amounted to RON 110 and 100 million, respectively. Until early 2012, about 12,000 individual households and 170 legal bodies received funding under the program for the installation of heating systems using renewable energy.

81. *Based on the above information, the total financing available for EE investments in residential thermal retrofit between 2007 and 2013 would amount to about EUR 827 million, assuming that the EU funding will be contracted in its entirety and matched completely by state and local budgets*.

82. Future financing mechanisms for the residential sector have to take into account several barriers that are hampering EE investments. Key barriers include: (i) small project size and relatively high transaction costs; (ii) perception of high risk on the part of commercial banks; (iii) lengthy decision-making processes and lack of creditworthiness of HOAs; (iv) diverse population with respect to income in block buildings; (v) relatively high commercial bank interest rates and short term of loans compared to payback periods; and (vi) high discount rates (or hurdle rates) on the part of residential consumers. Financing mechanisms that could mitigate those barriers will be examined in Chapter 6.

83. **EE financing for the public sector.** In general, Romanian local governments have a limited ability to borrow. Annual budget laws limit overall indebtedness of municipalities for the next year. For example, the ceiling in 2013 was RON 680 million (some EUR 150 million). In addition, borrowing by local governments has to be pre-approved by the Ministry of Finance. Municipalities can borrow (including existing and new loans, interests and fees) up to 30% of the average of their own revenues (mainly local taxes, shared personal income tax plus EU funds) over the past 3 years. In 2012, overall local public debt was RON 14 billion (some EUR 3 billion), or 5.8% of total public debt. Commercial financing is overwhelmingly from commercial banks, in addition to some IFI lending and a few bond issues.

84. Commercial financing has been provided by FREE and by EBRD. FREE financed 12 municipal projects, including eight public lighting improvements, three DH projects (geothermal production, biomass heat production, and substation improvements), and one ESCO project for cogeneration in an administration building. The total investment amounted to about EUR 3.7 million, of which about EUR 1 million fell into the 2007-13 period. EBRD set up a municipal finance facility in parallel to its other two EE financing facilities. In April 2012, it provided EUR

[25] Three districts in Bucharest have taken loans from EIB totaling EUR192 million for the thermal renovation of about 730 apartment buildings between 2011 and 2013. The districts will contribute between 25 and 50% of the cost, including grants from the national program.
http://www.eib.org/attachments/general/bei_info/bei_info144_en.pdf - page=19

10 million to BRD Groupe Société Générale (BRD) to be on-lent by BRD to municipalities, municipally-owned companies and private companies providing municipal services in Romania.

85. Government Directive 1661/2008 initiated the *national program for improving energy efficiency and use of renewable energy resources in the public sector*, for 2009-2010. It provided non-reimbursable co-financing (30-59%) from the Ministry of Economy through ARCE/ANRE. Eligible projects included DH modernization/change of fuel type; EE rehabilitation and use of RE in public buildings; and modernization of indoor/outdoor public lighting. Building energy audits were also co-financed. Seven projects received grant funding of RON 2 million.

86. Thermal rehabilitation of 35 public health buildings was completed between 2005 and 2010 with total allocated funding of EUR 8.7 million from MDRT and the Swiss Government.

87. The national program *District Heating - Heat and Comfort, 2006-2015*: Rehabilitation of DH systems, including internal installations in connected buildings provided a total of roughly EUR 30 million during 2011/2012. Some of the funds allocated by the national budget went unused in 2011 since municipalities could not finance their originally budgeted share.

88. Under the EU 2007-2013 program, total financing of EUR 657 million (including EUR 101 million national co-financing) was allocated for public building renovation and for the environmental upgrading of several DH production facilities (SOP Environment, PA 3). Schools especially benefited from the program, receiving 54% of the total EUR 608.5 million for 342 projects contracted until 2011 (Table 9). Investment per building is fairly high, since most projects not only aim at increasing the energy performance of the buildings, but also include structure works, extension of existing buildings and provision of miscellaneous equipment. Investments in DH production and network facilities received EUR 128 million funding.

**Table 10: Public building renovation projects co-financed with EU funds, 2007-2013**

| Sector | Contracted projects, # | Financing, EUR | Cost per project, EUR |
|---|---|---|---|
| **Health** | 47 | 200,647,875 | 4,269,104 |
| **Social*** | 112 | 79,759,685 | 712,140 |
| **School** | 183 | 328,136,014 | 1,793,093 |
| **TOTAL** | 342 | 608,543,574 | 1,779,367 |

* Including social housing
Source: NEEAP 2012

89. *Based on the above information, the total financing available for EE investments in public sector (covering public buildings and district heating systems) between 2007 and 2013 amounted to about EUR 788 million*.

90. Future financing mechanisms to support EE investments in the public sector have to take into account the following barriers: (i) the limited number of creditworthy municipalities and borrowing capacity of local governments and other public sector agencies; (ii) restrictive budgeting, accounting and procurement regulations; (iii) relatively high interest rates charged by commercial banks; (iv) small project sizes, leading to high project development and transaction costs; and (v) potentially lower than expected savings in cases where an increase in energy

service is realized instead of actual energy savings compared with pre-investment conditions. Financing mechanisms that could mitigate those barriers will be examined in Chapter 6.

91. **Summarizing**: The amount of EE investments in Romania in the past is only partially known. Rough estimates indicate that about EUR 2,000 million were available explicitly for EE investments between 2007 and 2013 (Table 10). Not all was spent, an indication of insufficient implementation capacity. The amount is substantial but falls short of addressing the potential needs (see Chapter 5). EU funding has made a big difference (covering about 37% of the funding), especially for public building projects, but it cannot fill the entire gap. Other financial instruments that leverage public money with private financing need to be developed. This will be explored in more detail in Chapter 6. Grants should be used only for those projects that provide social benefits in excess of private benefits or where barriers exist that prevent more commercial financing, with large investment and energy saving potentials. Additional incentive schemes, such as tax reductions or credits, or non-monetary incentives, such as accelerated licensing or permitting, may be explored to bring about more private financing of EE investments.

**Table 11: Estimated available financing for energy efficiency investments during 2007-2013**

| Sector | EUR Million | Of which EU Funds |
|---|---|---|
| **Industry** | 543 | 96 |
| **Residential Buildings** | 827 | 130 |
| **Public Sector** | 788 | 582 |
| **TOTAL** | 2,158 | 808 |

Source: Authors

## 3.5 Gaps in implementation capacity [26]

92. Energy efficiency programs and projects are often difficult to implement. Even if funding is available, there are numerous problems that could occur: designing a program, including criteria for participation and eligibility; developing a pipeline of projects to be financed which involves identifying and prioritizing projects; determining the baseline; persuading potential beneficiaries to make decisions to actually apply for funding; availability of co-financing; implementing procurement; ensuring quality of works and services; guaranteeing repayment; and if applicable, monitoring of results.

93. In the following section, the responsibilities and potential weaknesses of actors in the EE field are briefly examined:

94. **Central Government/Administration.** The main institutions responsible for EE at the national level are:

- Ministry of Economy, Trade and Business Environment - with responsibilities for and focus on energy supply and industrial sector policies
- Ministry of Environment and Climate Change – with responsibilities for and focus on environmental and climate change policies
- Ministry of Regional Development and Public Administration – with responsibilities for and focus on the building sector and the legislative and institutional framework of the local public

[26] Implementation cut across factors in institutions, technical capacity and information depicted in Figure 20.

administration authorities. Its subordinated regulatory agency ANCSR regulates the public utility services including DH systems

- Romanian Energy Regulatory Authority (ANRE), including its EE department (the formerly quasi-independent EE agency ARCE)

95. **Local Governments** are responsible for public service infrastructure and oversight of real estate within their territory. Local energy planning is required for all municipalities with more than 20,000 inhabitants; some municipalities are very interested and active in EE/GHG issues, e.g., those that signed the Covenant of Mayors (COM) and committed to reduce $CO_2$ emissions by at least 20% by 2020 by implementing a Sustainable Energy Action Plan.

96. **Energy Efficiency Agency**: ARCE was dissolved in 2009, including its regional offices, and incorporated into ANRE, the energy regulatory agency. ANRE's EE department suffers from similar governance issues as ARCE did before. It is not autonomous, properly resourced and accountable, and lacks good data, all of which are factors that undermine its ability to design, implement, evaluate, and redesign programs. Energy efficiency and renewable agencies have been established at the local level, particularly in cities participating in the COM and EnergieCites.

97. As a result, coordination between many ministries and levels of government is needed for a seamless implementation of EE measures required by existing laws and regulations. This coordination is frequently missing due to the lack of staff in general and with experience in EE issues in particular. The need to implement the EU OPs with their huge resources exacerbates the problems: procedures need to be established but are frequently not streamlined; prioritization is missing or based on too little information; procurement is complicated and time consuming.

98. **Energy Supply Entities** are not involved or interested in demand side EE issues; this could change if Romania implements an EE obligation scheme, following the 2012 EED.

99. **Energy Service Providers**: very few ESCOs[27] have a track record of implementing EPC projects.

100. **EE Products and EE Capacity of Industries and Trades**: the availability of EE products is improving and does not seem to be much different from that in other EU countries; capacity building for energy managers and auditors for the industrial and building sectors has been scaled up; the construction industry needs EE skills upgrade (architects, engineers, developers, builders and personnel).

101. **Monitoring &Verification (M&V) Agencies**: no agencies seem to exist.

102. **Financial Institutions**: Major banks have some interest and gained experience in EE lending, especially since EBRD started its EE credit lines in 2009; however, they are still limited to a narrow range of sectors, mostly industry, and slowly expanding into the municipal and residential sectors as well as the financing of ESCOs; FREE has been largely inactive since 2009.

[27] One for electricity, one for thermal services and one working with CHP projects; Econoler 2011.

103. **Energy Users**:

- Households and HOAs: limited knowledge of EE options and benefits as well as how to access financing. Individual billing of consumers supplied by public DH systems on the basis of heat meters or heat cost allocators was to be implemented by 2009, but has not been completed
- Industry: larger industries have potential EE knowledge through mandatory energy managers and energy audits. SMEs are being engaged through EBRD credit lines that incorporate technical support and grant elements
- Public sector: basic information on building stock is missing and prioritization therefore difficult
- Commercial sector: limited knowledge of EE options and benefits. Some interest in green buildings is due to corporate sustainability policies and to enhance public image

104. **Other contributing factors to implementation problems**. So far, a database for the Romanian building stock and its energy consumption characteristics and savings potential does not exist. It is planned to establish an inventory of public buildings to ensure the definition of a coherent plan for the renovation of the existing public building stock. It would help to develop audit templates to ensure consistent data collection and minimize costs. A similar effort should be completed for residential buildings by localities. The UNDP project (UNDP 2011) attempts to provide some initial information on building types and designs of block buildings that would facilitate energy audits and design of EE measures. In selected municipalities the project will assemble building registries[28] that would serve to prioritize areas for building renovation.

105. In principle, ANRE's EE department has the overall responsibility to formulate, implement, evaluate and report on EE programs. De facto, the ministries responsible for sector policies assume several of these roles. Frequently, they lack the resources and capabilities to do this. As a result, especially the evaluation and monitoring of results of programs is deficient. Gathering this information (financing and results), including monitoring, should be mandatory for publicly financed projects.

106. Resources for sustained information campaigns about EE benefits and financing are very limited with the result that participation is limited. Most information and capacity building programs continue to be financed by IFIs and donors within their projects.

107. Summarizing: The support structure for delivering EE investments is not adequate. This results in too little planning, data gathering and analysis, ability to prioritize, information about funding opportunities and requirements, preparation of project pipelines, slow and complex procurement, no M&V capacity, lack of preparing and disseminating information about results and benefits of EE interventions.

[28] Information in the registry is expected to include: technical information about the building (useful area, completion date, number of floors, number and size of rooms, etc.), information on the ownership structure, type of building users, number of building users, heating/cooling source, theoretical energy demand (according to any audits carried out), actual energy use (according to previous records), pictures of the building (including areas that need improvement), potential EE measures, including estimated investment costs, energy to be saved, and GHG emissions reduction at the primary energy source (UNDP 2011).

## 3.6 Conclusions of the gap analysis

108. Romania has major opportunities and challenges to narrow the EE/intensity gap with more advanced EU countries and thereby to further reduce GHG emissions.

109. Many of the legal and regulatory requirements to enable improved EE are dealt with on paper. The major exception is energy price reform, with an unfinished agenda in removing the large subsidies for natural gas and DH. These general subsidies are major disincentives for energy consumers to engage in EE actions and divert public funds from more productive uses. They should be replaced with increased targeted support for low-income families.

110. Access to financing remains a constraint in certain EE market segments, such as residential building retrofit and SMEs. Nevertheless, substantial amounts of dedicated financing for EE investments have been made available in recent years, at about EUR 300 million per year during 2007-2013.

111. There is insufficient institutional support and technical capacity to deliver EE investments which will only grow in the next seven years. This is caused by a lack of incentives and information as well as necessary skills upgrades and administrative improvements, such as strategic planning, prioritization, systematic evaluations and coordination between the different levels of government.

112. Table 12 provides a summary of gaps that impede the achievement of a higher level of EE that would provide a wide range of benefits for the Romanian economy and economic actors.

**Table 12: Summary of Gap Analysis**

| | EE gap | Policy/ Regulatory Gap | Financing gap | Implementation capacity gap | Issues which need to be addressed during 2014-2020 |
|---|---|---|---|---|---|
| **Manufacturing** | | | | | |
| General | | | Probably quite large, but most EE investments quite cost-effective | | Possibly information programs, case studies |
| SME | Depends on sub-sector, export share etc | | Large, but commercial financing with some grant elements in place | Information deficit, few resources, high transaction costs | Support for energy audits |
| Energy-intensive | Large for some sectors | Preferential energy pricing for some energy-intensive SOEs | | | LTA design and implementation<br>End of preferential energy pricing |
| **Buildings** | | | | | |
| Residential | 40% energy savings achievable | Gas prices not cost reflective, huge subsidies for DH | Huge, so far only grant funding, covering about 1% of stock in | Large gap: information on building stock and EE performance | • Energy pricing and targeted income support<br>• Market assessment |

| | | | | | |
|---|---|---|---|---|---|
| | | | four years | missing<br>HOA issues<br>Awareness low | and strategy for EE in residential buildings<br>• Sustainable financial mechanisms |
| Public sector | 40% energy savings achievable in buildings, more in DH | Procurement, accounting and budgeting rules not supportive of EE, especially EPCs | Large, especially for buildings and DH<br>Budgetary resources small compared to need | Large gap at national level (skills, EE knowledge, lack of coordination)<br>Progress at local level, e.g. in cities that signed Covenant of Mayors | • Market assessment and strategy for EE in public buildings<br>• Sustainable financial mechanisms<br>• Strategic Review of DH systems |
| Commercial sector | Similar to public sector | | Not analyzed | Landlord-tenant issues<br>Low awareness | Information programs, case studies |

Source: Authors

# 4 Preliminary Assessment of District Heating

## 4.1 Key sector issues

113. Centralized heating (or District Heating – DH) in Romania is beset by serious problems that have been known for many years (see, for example, the 2004 National DH Strategy[29]). But since no serious changes were made in how the sector functions, DH has become a serious drain on public finances without providing a satisfactory service to its customers. It is estimated that the amount of (cross-) subsidies for DH has increased from EUR 88 million in 2003 to about EUR 500 million in 2010,[30] while serving about 1/3 less customers (see below). If the sector is to receive financing from EU structural and cohesion funds during the 2014-20 period, substantial reforms need to be made during this period to set DH on a path to become an economic and financially viable modern service or the funds could be wasted.

114. This assessment only highlights the key issues which the DH sector faces. Further investigations will be needed to analyze the options for improving and economizing urban heating in general and DH in particular. The following is a list of issues that has to be dealt with urgently:

- **Economic viability of many DH systems**. Decline in the number of DH systems from more than 300 in 1995/96 to 100 in 2010/11, of which 83 are in urban areas. An assessment is needed to determine which of these remaining ones are economically viable and should be assisted to restore service quality, improve efficiency, and achieve long-term financial sustainability. For those that have declined beyond the point of economic viability, alternative heating service strategies need to be developed.
- **Continued decline in the number of customers**. The residential DH customer base was reduced from 2.2 million apartments in 1990 to 1.4 million in 2012. In 16 of the 31 DH systems with initially more than 10,000 customers, the number of customers declined by more than 50%. Disconnections occurred (and are still occurring though at a much reduced pace) due to an inability to pay, but more importantly due to competition with subsidized natural gas prices. In addition to addressing the artificial price distortions, options to stem disconnections and establish criteria for obligatory DH connections need to be carefully assessed.
- **Inefficiencies and high losses in the DH systems**:
  - Production: In 2010 cogeneration had a share of 10.7% in total electricity generation and 69.4% in total heat supply (ANRE estimate). 51% of the heat supplied is generated from natural gas and 38.5% from coal, mainly lignite. Most of the old inefficient CHPs[31] and heat-only boilers are still not upgraded or replaced with

[29] The Strategy estimates that investment in the rehabilitation and renovation of heat generation, transmission and distribution systems would total US$ 6.8 billion (EUR 5.5 billion), requiring annual investment of US$ 453 million (EUR 364 million) over a period of 15 years.

[30] According to PWC 2011 analysis.

[31] With very few exceptions, none of the existing plants in Romania comply with the EU definition of high-efficiency cogeneration. ANRE's regulation qualifies a CHP facility as high efficiency cogeneration if it realizes 10% fuel savings compared to separate generation of electricity and heat by equivalent 'reference' power plants.

modern generation equipment, nor are they equipped with adequate burning equipment. Therefore, the $SO_2$ and $NO_X$ emissions exceed EU norms. With an average of 275 tons of $CO_2$ per Gcal, Romania's DH producers rank among the most polluting DH service suppliers in the EU.

- Transportation and distribution networks suffer high heat and water losses. The distribution networks incur almost 30% losses on average (PwC2011, based on ANRSC data), compared to 5-10% in the case of fairly new or modernized networks.
- As a result of those inefficiencies, the cost of DH is about 18-20% higher than in some other EU countries (see Figure 10).

- **Distortion in residential heat and gas tariffs**. Tariffs for residential consumers are highly subsidized, on average about 50%, through a complex system of support for high-efficiency cogeneration (paid by electricity consumers, thus reducing the cost of produced heat)[32] and subsidies for local heating companies (provided by municipalities). The subsidy system is complemented by a heat social assistance system that offers targeted benefits to poor households.[33] It covers less than 15% of the total DH support and is based and differentiated on a social eligibility criterion, including monthly income. If DH tariffs were not subsidized, heat costs would amount to about 12% of average annual incomes. With the subsidies, the burden goes down to 7% on average.[34] This is about the same level as in other CEE countries, such as Poland, Czech Republic, Hungary and Estonia. See Figure 10. The unit cost of heat sold at the subsidized tariff is slightly

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Based on the Romanian reference plants, all existing CHP equipment using steam boilers fulfills the criterion despite its obsolescence and modest heat efficiency. The share of real highly efficient technology (CCGT, GTs with heat recovery, and modern dispersed cogeneration units) in total DH supply is still insignificant. The 'rehabilitation' projects so far were driven by environmental objectives, including mandatory desulphurization and $NO_X$ emission limitation, while preserving the basic old equipment.

[32] The current support scheme applied by ANRE as a **cogeneration bonus** to all existing cogeneration suppliers does not promote high efficient technology and may be unsustainable in the long run. Such inefficient and typically oversized plants should be replaced with dispersed CHP and local peak load boilers. "High efficiency cogeneration" is defined as when there is 10% primary energy savings as against separate generation of electricity and heat by reference power plants (and minimum 70% overall heat efficiency for the units larger than 25 MW). The official reason of the simplified solution to declare a high efficiency cogeneration facility makes reference to the Art. 12 alin. (2) of the 2004/8/CE Directive. It claims for missing the heat efficiency data of the Annex II in the EU Directive, the ratio C between supplied electricity and heat, in particular. The necessary bonus funds are collected on a monthly basis as a cogeneration contribution from all electricity customers as well as exporting electricity suppliers and transferred to Transelectrica, the scheme administrator. The amount of contribution is established by ANRE on an annual basis and reviewed each semester. ANRE's Order No. 50/2012 has set it to 23.1 lei/MWh for the year 2013. Cogeneration bonus is a scheme that establishes a financial support in favor of non-depreciated cogeneration power plants with a view to maintaining them viable on the competitive electricity market. The scheme is planned for a maximum power capacity of 4000 MWe for the period 2011-2023. Each cogeneration producer can receive the support for a maximum period of 11 consecutive years. For the entire period, ANRE has estimated a total budget of EUR 4.1 billion.

[33] Heating aid during the cold season is provided on the basis of GEO 70/2011 on social protection measures during the cold season. This is available to families who use thermal energy in a centralized house heating system, persons who use natural gas, or wood, coal and oil, are eligible to these measures. The GEO stipulates the maximum income of a person or a family for being eligible for the heating allowance, and it stipulates allowance amounts for heating with natural gas, wood, coal, oil, and thermal energy in a centralized system. The fiscal revenues to support this social measure originate from the "windfall revenue tax" in the gas sector, introduced in early 2013, which allows the Government to withhold above 60% of the additional revenues of (state- and private) companies in gas resulting from higher domestic gas prices.

[34] The problem is exacerbated by billing for heat only during the heating season. During these months even subsidized costs of heating can become unsustainably high for a large part of the population.

lower than the levelized costs of an individual heating system based on the (subsidized) price of natural gas (ATKearney, 2009).

- **Complex system of regulation with two regulators**. ANRE oversees electricity producers, including CHPs. ANRSC oversees public services at the municipal level, including heat only boilers and DH suppliers. Prices are set, adjusted and changed on the basis of ANRE- and ANRSC-approved methodologies. The local heat price is the aggregation of the generation price with the transportation, distribution and supply tariffs, which are approved by local authorities (APLs) and ANRSC for each utility. The current 'cost – plus' methodologies take into consideration *justified* operational, capital and environmental costs, and a profit margin that should be less than 5%.
- **One-part heat tariff**. In most other EU countries two-part heat tariffs with a fixed and a variable part are the norm and follow the cost structure with the high fixed costs of delivering heat. The variable one-part tariff exacerbates the financial problems of heat suppliers in an environment where consumers save energy and/or disconnect.
- **Incomplete implementation of consumption-based billing**. While almost all customers (HOAs in the case of block buildings) are now individually metered[35] and billed based on their heat and hot water consumption, this does not universally extend to individual dwellings. Only about 50% of dwellings with DH supply are equipped with heat/hot water meters or heat cost allocators (and thermostatic valves to regulate heat consumption).
- **Insufficient investment in DH infrastructure**. The national program *District Heating - Heat and Comfort: Rehabilitation of centralized DH systems* provides cofinancing from the central government for investments in DH transportation and distribution networks which are under the control and financial responsibility of local authorities. In 2011 and 2012, EUR13 and 15 million, respectively, were invested with slightly more than 50% of the total coming from the national government.[36]

115. Some of the reforms that need to be implemented to stem the further deterioration of DH in Romania include:

- Strategic reviews of local DH systems to establish the most efficient and cost-effective heat supply options, taking into account economic levels of fuel prices and environmental costs of burning fuels, as well as modern heat and cogeneration technologies, efficient and cost-effective distributed systems. The reviews should also consider how to establish PPPs for those DH systems that are deemed viable to bring in private sector funds and expertise in modernizing and efficiently operating DH systems;
- Acceleration of electricity and natural gas price liberalization to maximize the role of the market in resources allocation;
- Abolishment of all price subsidies and targeting only low-income families for subsidies in the form of cash payments within the social protection system;

[35] 97% for heat and 96% for hot water consumption (Source: ANRSC July 2013)

[36] 2012: RON 60 million (EUR 13 million), of which Lei 31.2 million from the national budget and Lei 28.98 million from local budgets. 2011: 42.8 million lei were allocated from the 2011 state budget to 27 administrative - territorial units of which only 35.46 million were spent by 22 units. The own contribution of local authorities was 28.7 million lei. This totals RON 64 million (EUR 15 million).

- Investment support for truly high-efficiency cogeneration;
- Unification of DH regulation under one regulator (ANRE);[37]
- Introduction of a two-part heat tariff system;
- Consumption-based billing at dwelling level for heat and hot water;
- Consideration of additional policies to "protect" DH in areas where it is already supplied and cost-effective, such as requiring that new buildings are connected to DH or that existing buildings cannot disconnect and choose an alternative heat source. According to the Heat Law, the latter can already be implemented in municipalities where investments in DH rehabilitation/modernization have taken place.[38]

## 4.2 Sources of financing for modernization

116. Funding from public sources is clearly insufficient, compared to the EUR 4.2 billion estimated investment requirements in modernizing the DH systems in 33 cities.[39] Municipalities are already contributing a large share of the annual subsidies and it is unlikely that they will be able to contribute much more than they have in recent years.

117. This leaves the private sector and the EU as the only alternatives. Several municipalities have concluded concession contracts for their DH systems with private sector operators who assume investment and performance improvement obligations. Some municipalities (or private operators in those municipalities) have taken or are considering taking loans from commercial banks or IFIs for improvement of the DH systems, for example, Oradea (from FREE) and Bucharest, Timisoara, Iasi and Brasov (from EBRD).

118. In the 2007-2013 period, several DH projects were financed under SOP Environment, mainly to comply with EU environmental regulations in heat production facilities, but also to improve EE of the DH networks. The cities of Oradea, Iasi, Timisoara and Bacau received EU funding of EUR 128 million in total, roughly 50% of total project costs.

119. Under certain conditions, DH network modernization should be eligible for funding in the 2014-2020 program period. Efficient and competitive DH systems can substantially reduce GHG emissions compared to providing heat with individual heating systems based on natural gas. It has to be analyzed, however, which of the existing systems in Romanian cities can be modernized to the point of being efficient and competitive compared to distributed alternatives based on economic costs and benefits. Many DH systems probably will have to be reduced in scope since they have lost so many customers already. As an alternative to large centralized systems, decentralized systems should be investigated where appropriate. An initial indicator of the potential competitiveness of DH – number of households per km of network - is provided for

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[37] This change is stipulated in the 2012 law on public services, but the heat law was not changed accordingly; personal communication C. Cremenescu, Dalkia.

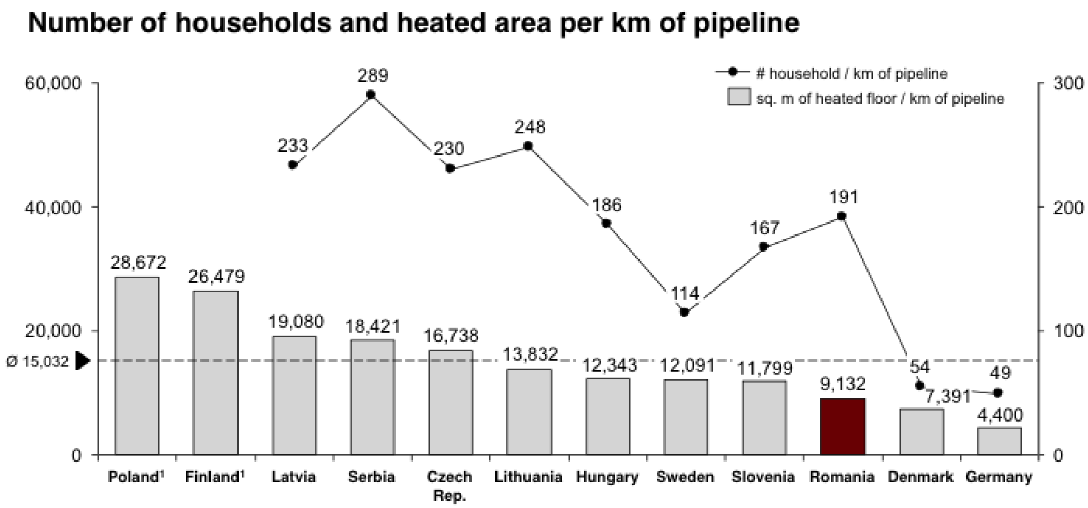
[38] This is similar to the "Anschlusszwang", the requirement to connect to DH that German municipalities can apply. In a just released study for the German Competition Agency DH prices (which are not regulated in Germany) were found to be substantially higher in municipalities with an "Anschlusszwang" ; Bundeskartellamt 2012

[39] Romanian Cogeneration Association

several Romanian cities in Box 2. In several cities this indicator is very low—probably too low to make the modernization of the DH system an economically viable option.

**Box 2: Is District Heating Competitive - Connected households per km of DH network**

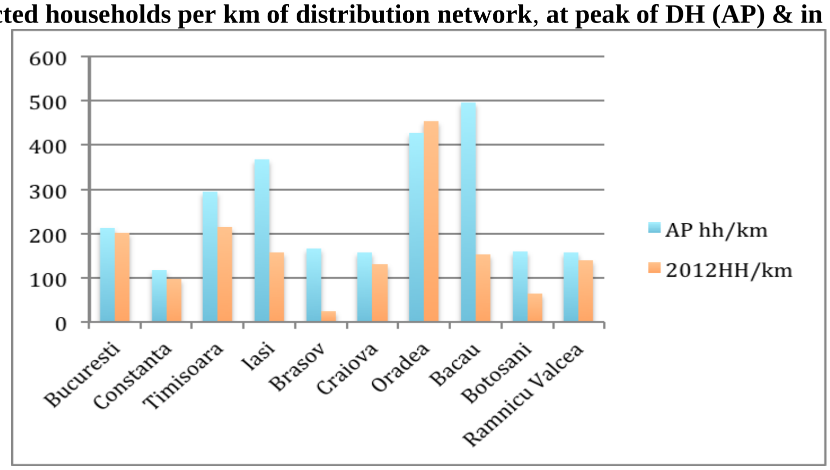
Viability and competitiveness of a DH system is correlated to its heat load per km of network (heat density). High heat density reduces losses and the cost of heat transport. For example, in the case of Kiev, it was found that below a heat density of 2 MW/km individual building boilers and above 5 MW/km centralized DH would be more cost-effective, respectively. Between these values, heating options would have to be evaluated in more detail (World Bank 1998). Heat density data of Romanian DH systems are not readily available. Therefore, the number of connected households is used for comparison. The Romanian average is 191 households/km of pipe, which puts it in the middle of a range of several EU countries.[40]




Source: AT Kearney 2009

Seven out of ten cities for which data were available show a 2012 value that is below the Romanian average. In Brasov and Botosani current DH heat density is probably too low to make modernizing the DH system an economically viable option (Figure below).

**Number of connected households per km of distribution network, at peak of DH (AP) & in 2012**




Source: ANRSC data and ISPE 2013

[40] There are some doubts about the underlying data. A recalculation of the German indicators with 2011 data from AGFW yields the following results: *Households per km of pipeline*: 109 (219 if km is measured by km of trench), and $m^2$ *of heated floor area per km of pipeline*: 10878 (21756 for km of trench). The pipeline/trench length is for both transport and distribution networks.

# 5 Priorities for Energy Efficiency Investment and Government Support

## 5.1 Cataloging energy efficiency investments

112. For the purpose of this rapid assessment, key demand-side EE interventions are listed for manufacturing industries, residential buildings, public and commercial buildings, and municipal services (Table 13). EE interventions in the transport and agriculture sectors are not covered.

**Table 13: Demand-side energy efficiency interventions by sector**

| Sector | Area of intervention | Note |
|---|---|---|
| **Manufacturing industries** | Industrial motors | Upgrading and optimization of pumping, compressed air and fan systems |
| | Industrial combined heat and power (CHP) | Utilization of excess heat or other forms of excess energy in manufacturing processes |
| | Process- or equipment-specific improvements | Upgrading and optimization of energy-using equipment or processes; may overlap with the two generic interventions above |
| **Residential buildings** | Thermal retrofit of existing buildings | Improvement of building envelope thermal performance |
| | New buildings | Improvement of whole building energy performance, including construction of nearly zero energy (nZE)[41] buildings |
| | Main appliances | High efficiency refrigerators, freezers, cloth washers, TV sets, etc. |
| | Other electric and electronic equipment | Energy efficient computers, small appliances and various gadgets which use power |
| | Lighting | Energy efficient lighting source: CFLs or LED |
| | Air conditioning | High efficiency split units |
| | Service hot water | High efficiency water heaters and solar hot water heaters |
| **Public and commercial buildings** | Thermal retrofit of existing buildings | Improvement of building envelope thermal performance |
| | New buildings | Improvement of whole building energy performance, including construction of nZE buildings |
| | Heating, ventilation and air conditioning (HVAC) systems | Upgrading and optimization of HVAC systems |
| | Lighting | Energy efficient lighting sources: CFLs, high efficiency T8, T5, or LED, as well as lighting controls |
| | Refrigeration | Commercial refrigeration efficiency |
| | Electric and electronic equipment | Efficiency of office equipment and other power-consuming equipment |
| | Service hot water | High efficiency water heaters and solar hot water heaters |

41 "Nearly zero-energy (nZE) building means a building that has a very high energy performance, determined in accordance with Annex I [of the recast EPBD]. The nearly zero or very low amount of energy required should to a very significant level be covered by energy from renewable sources, including renewable energy produced on-site or nearby"; Directive 2010/31/EU 2010

| | | |
|---|---|---|
| **Municipal services** | District heating systems | Modernization and rehabilitation of heat production units and networks |
| | Public lighting | Energy-efficient light sources: sodium or LED lamps, as well as lighting controls |
| | Water and wastewater | Upgrading and optimization of pumping systems and networks |

113. In each area of intervention, there may be multiple specific measures or measure packages with different investment levels and energy savings results. For example, residential thermal retrofit can be done to achieve 30-40 percent energy demand reduction, usually referred to as a regular retrofit package, or to achieve 60-70 percent energy demand reduction, usually referred to as a deep retrofit package. Residential lighting efficiency may involve switching to CFLs or LEDs. Based on available investment data and actual project information from Romania (unless noted otherwise) the costs of saved energy (CSE)[42] of some of the above interventions are estimated and summarized in Table 14. A uniform real discount rate of 10% is applied to compare the CSE on an equal basis with conventional energy supply options (although for some reported investments it is difficult to determine whether electricity and/or fuel is saved). Using a discount rate of 3% would reduce the CSE by 43 percent.

**Table 14: Estimated cost of saved energy of selected EE interventions in Romania**

| End-use Sector | Measure | Type of Energy Saved | Number of projects | Cost of Saved Energy (EUR/MWh) | | Average simple payback period* (years) |
|---|---|---|---|---|---|---|
| | | | | Median | Weighted Average | |
| Manufacture industries | Industrial motors /1 | Electricity | NA | 61 | 84 | 9 |
| | Industrial CHP | Fuel and electricity | 3 | 43 | 22 | 10 |
| | Process or equipment specific improvements | Fuel and electricity | 100 | 43 | 15 | 2-7 |
| Residential buildings | Regular thermal retrofit of pre-2000 apartment blocks | Fuel/heat | NA | | 90 | 20 |
| | New nZE apartment buildings /2 | Fuel/heat (primary) and electricity | NA | | 70 | 16 |
| | Refrigerator upgrade /3 | Electricity | NA | | 86 | 9 |
| | Lighting (CFL) | Electricity | NA | | 18 | 1 |
| Public and commercial buildings | Regular thermal retrofit for schools | Fuel/heat | 3 | 46 | 48 | 11 |
| | Lighting /4 | Electricity | NA | | 40 | 4 |
| Municipal services | District heating system modernization /5 | Fuel/heat (primary) and electricity | NA | NA | 45 | 20 |
| | Public lighting (Sodium lamps) | Electricity | 5 | 27 | 32 | 3 |

* At prevailing effective prices in Romania
/1: Based on EU-wide data from UNIDO, 2010
/2: Based on estimates for Poland

[42] The cost of saved energy is the levelized cost of energy efficiency investment during an EE measure's lifecycle. It enables direct comparison of energy savings (as an alternative energy supply) with conventional energy supplies (electricity, natural gas, etc.). In a simple form, CSE is defined as annualized (discounted) cost of EE measure divided by annual energy savings from the EE measure.

/3: Incremental cost of upgrading to A++ instead of A+ rated refrigerators
/4: Switching from T12 to T8, US data
/5: Based on analysis done for a comprehensive DH modernization project in Moldova
Source: World Bank staff

114. On average, industrial EE investments tend to have relatively short payback periods (2 to 7 years for about 100 projects financed by the EEFF). Lighting retrofits also are generally very cost-effective except in the case of switching to LED, which still is very costly. The financial attractiveness of investing in heat energy savings (building thermal retrofit and DH system modernization) is adversely affected by the relatively low effective prices for heat and natural gas (Table 15). If prices were at their economic levels, the average simple payback period for thermal retrofit measures would be cut in half for buildings supplied with district heat.

**Table 15: 2011 Energy prices for different consumer groups, incl. taxes, in EUR/MWh**

| | Electricity (2010) | Natural Gas (2010) | District Heat (2012) |
|---|---|---|---|
| **Industry, large** | €69.8/MWh | €19.2/MWh | NA |
| **Industry, small** | €131.4/MWh | €27.5/MWh | NA |
| **Residential** | €108.4 - €103.8/MWh | €28.0 - €27.2/MWh | €15.5 – 64.5/MWh |
| **Non-residential** | NA | NA | €15.5 – 110.9/MWh |

Source: Eurostat, ANRSC

## 5.2 Potential energy savings in key end-use areas

115. Indicative energy savings potentials were estimated for selected end-use sectors or interventions based on the stock or activity levels in 2011 and using physical or monetary energy intensity indicators for Romania. Such general estimates provide a basis for assessing the scalable potential for EE in particular sectors, subsectors, or major end-uses (Table 16).

**Table 16: Potential energy savings based on 2011 stock or activity levels**

| **Sector or end-use** | **Energy savings potential** at the end-use point **(GWh/yr)** | **Note** |
|---|---|---|
| Industrial motors | 2,199 | Down-scaled from EU27 level by manufacturing value added |
| Steel | 9,769 | Compared with EU average, physical intensity |
| Chemicals | 15, 467 * | Compared with EU average, value added intensity |
| Apartment building thermal retrofit | 10,533 | Regular retrofit for pre-2000 apartment blocks, average 40 percent heat demand reduction |
| Single family house thermal retrofit | 5,683 | Regular retrofit for pre-2000 single family houses heated by natural gas |
| Refrigerator upgrade | 987 | Replacing pre 2004 models with A++ rated new refrigerators |
| Residential lighting (CFL) | 797 | 50 percent of households upgrade 3 long duration lighting points to CFLs |
| Thermal retrofit for schools | 916 | Regular retrofit, average 40 percent heat demand reduction |
| Commercial lighting | 700 | Assuming commercial lighting efficiency is improved by 30 percent |
| District heating modernization | 3,184 | Based on 2011 heat supply to residential and commercial users and 20 percent loss reduction |
| Public lighting | 480 | For EUR 130 million investment in upgrading to sodium lamps |

* The energy intensity of Romania's chemical industry measured in value added is about 70 percent higher than the EU average and it has not changed significantly since 2006. This may indicate structural issues within the subsector (e.g., product mix is skewed toward energy-intensive basic chemicals). With privatization of remaining state-owned enterprises in the subsector production may be shifting away from energy-intensive products.
Source: World Bank staff

116. The largest energy savings potential at the current activity levels lies in industries and buildings. It is especially in basic materials manufacturing and the thermal retrofit of pre-2000 residential buildings. The modernization of district heating systems also presents a large savings potential[43] since production of heat is very inefficient by international industry standards and its transport and distribution suffers huge heat and water losses. However, the economic viability of DH in Romanian municipalities has to be clarified before deciding on any investments.

## 5.3 Prioritizing energy efficiency investments and policy support

117. As Table 15 revealed, the CSE for EE investments in different end-use sectors in Romania vary widely. In general, industrial EE investments have among the lowest CSE and are financially justifiable compared to industrial energy prices. Building thermal retrofits, especially for residential buildings, have high CSE, and with some exceptions, are generally difficult to justify based on heat cost savings alone, especially when the heat cost to households is distorted by subsidies. This is consistent with experiences from other EU countries. Comprehensive thermal retrofits which reduce heat load by 40% or so should generally increase the market value of buildings by a measureable amount. But this is an area where little empirical evidence is available. The market's under-valuation of thermal retrofit benefits is a major impediment to private financing of such investments.

118. Energy savings are the cleanest of any energy supplies and often are least costly as well. From a national perspective, EE investments should be prioritized based on the potential for scaling-up (large potential savings), the economic cost of saved energy (as a lower cost alternative energy supply[44]), and the certainty of delivering the desired energy savings (as a reliable alternative energy supply). The main purpose of government support for EE is to scale up energy savings by driving down the cost of saved energy and increasing the market's ability to deliver. This is particularly important for sectors or end-use activities where market barriers post challenges to realizing potentially large energy savings opportunities.

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[43] For example, a short-term investment program of about US$ 22 million (EUR 17 million) for the DH system in Chisinau/Moldova is expected to result in gas savings of 20%, electricity savings of 25% and water savings of 10% as well as O&M and other monetary savings, resulting in annual savings of US$ 7.5 million (EUR 6 million) (SWECO 2013). In Poland, a World Bank project with investments of a total of US$ 470 million between 1991 and 2001 in the DH systems of Warsaw, Krakow, Gdansk, Gdynia and Katowice produced 22% energy savings valued at US$ 60 million per year and various other benefits, resulting in economic rates of return of 25-53%, not counting substantial environmental benefits (Nuorkivi, 2001).

[44] (i) From a national/social perspective the CSE should be based not on effective end-user prices but on economic cost. (ii) If energy savings are treated as an alternative supply, avoided distribution and other losses would have to be taken into account. The reduction in building thermal energy use will also result in a reduction in heating capacity required from the existing or forecasted district heating plant or boiler houses for buildings connected to a city or municipality district heating network. For the case of Serbia, see Econoler (2013).

119. The main demand side EE interventions listed in Table 14 were mapped into a screening matrix to indicate the scalability (in terms of aggregate potential savings) and relative cost of saved energy (Table 17). Generally speaking, policy support should focus on those interventions with high scalability but are held back by high cost of delivery. The types of government support for EE investments in different sectors and end-uses need to match the specific barriers to implementation and delivery of scalable projects. In chapter 6 sector- and end-use specific options for delivery and financing mechanisms will be examined in detail and key government support measures for EE in Romania will be proposed.

**Table 17: Demand-side energy efficiency investment screening matrix: considering scalability and cost**

| | | Cost of saved energy | | |
|---|---|---|---|---|
| | | Low | Medium | High |
| Aggregate potential energy savings | High | • Energy efficiency measures in steel and chemicals manufacturing | • Energy efficiency of major consumer appliances<br>• Industrial motors energy efficiency | • Thermal retrofit of residential buildings |
| | Medium | • Energy efficiency measures in SMEs<br>• Residential lighting (CFL)<br>• Commercial lighting (CFL and high performanceT8) | • Modernization of district heating systems<br>• Thermal retrofit of public buildings, such as schools<br>• Retrofit or new commercial HVAC systems | • New nZE buildings<br>• Residential lighting (LED)<br>• Commercial lighting (LED) |
| | Low | | • Public lighting (sodium lamp)<br>• Energy efficiency in water supply and wastewater treatment | • Public lighting (LED)<br>• High efficiency residential air conditioners |

Source: World Bank staff

120. For both residential and public buildings the lack of a sectoral EE strategy is making it difficult to create interest and support for funding the implementation of EE investments that would create multiple benefits for society and individual economic actors. The development of a strategy should be based on a market assessment of the physical building stock and its energy performance and needed resources for various levels of EE improvements. The recent development of building EE studies for Western Balkan countries, examining the current market, cost and availability of EE technologies, barriers to implementing EE measures and financial instruments and other policy measures to eliminate those barriers, could provide an example for Romania.[45]

## 5.4 Investment needs and financing sources during 2014-2020

121. Not all savings indicated in Table 16 can be easily captured due to financing and implementation constraints. Table 19 provides estimated investment needs for the savings that

[45] See ENSI 2012 and World Bank reports on the Former Yugoslav Republic of Macedonia (Limaye/Meyer 2012) and Serbia (Econoler 2013).

are deemed feasible to deliver during 2014-2020 from selected interventions. Notably, DH modernization is not included and could add a substantial amount of investment to the list (see Chapter 4).

**Table 18: Investment needs for selected energy efficiency interventions, 2014-2020**

| Area of Intervention | Investment Need (million Euro) | Total annual savings achieved (GWh/yr) | Main Assumptions |
|---|---|---|---|
| Thermal retrofit of apt buildings | 2,535 | 3,318 | 5% of existing stock per year |
| Thermal retrofit of schools | 262 | 641 | 10% of existing stock per year |
| nZE apt buildings | 118 /1 | 196 | 5% of 2014 new construction, increasing 5 percentage points per year after |
| Upgrade refrigerators | 1,825 /2 | 987 | Replacing all pre 2004 residential stock with A++ rated by 2020 |
| Industrial energy efficiency | 1,400 | 12,600 | Assuming annual investment of EUR 200 million, based on EEFF project data |

/1: incremental cost of constructing nZE buildings compared with regular new buildings
/2: incremental cost of buying A++ instead of A rated refrigerators
Source: World Bank staff

122. For this incomplete list of selected EE investments, the estimated total financing needs already exceed EUR 6 billion, compared with the estimated available financing for EE of less than EUR 2.2 billion during 2007-2013 (Table 10). Major financing gaps are expected to occur in residential building thermal retrofit and potentially in DH modernization, both of which require more analyses. The need for partial grant support to scale up demonstration of nZE buildings will also be significant. The main portion of the incremental cost for refrigerator upgrading is expected to be financed by households themselves.

123. Only a combination of public and private funding could deliver the financing of these priority investments. Based on the assessment of the need for government support, an approximate determination was made about the share of public funding necessary to deliver the investments. Table 20 shows that some interventions would need 100% funding from public sources, such as the thermal retrofit of school buildings. For other areas, only small portions of public funding would be required, such as for demonstration projects of nZE buildings, initial rebates for highly efficient refrigerators and technical support for EE projects in the industrial SME segment. The biggest amount of public funding would be needed for the thermal retrofit of older apartment buildings. Experience from other countries in the region, such as the Baltics, shows that households can on average contribute about 80% of the cost of investments, if repayment terms of loans match savings in heat bills (see Chapter 6). Considering that incomes of Romanian households are lower and poverty levels higher than in most other recent EU member countries, it is assumed that private funding would amount to 60%, leaving 40% or about EUR 1 billion for public sources in the form of grant funding for poor home owners. This

includes support needed for project preparation, implementation and monitoring as well as for broad information campaigns and guidance to HOAs.

**Table 19: Financing Sources for selected energy efficiency investments, 2014-2020**

| **Area of Intervention** | **Investment Need (million EUR)** | **Financing Sources** | | |
|---|---|---|---|---|
| | | **Private** (equity and debt) | **Public** (grant) | **Public, EUR million** |
| Thermal retrofit of apt buildings | 2,535 | 60% | 40% | 1,014 |
| Thermal retrofit of schools | 262 | 0% | 100% | 262 |
| nZE Apt buildings | 118 | 70% | 30% | 35.4 |
| Upgrade refrigerators | 1,825 | 80% | 20% | 365 |
| Industrial energy efficiency | 1,400 | 95% | 5% | 70 |
| **Subtotal** | **6,140** | | | **1,746.4** |

Source: World Bank staff

124. It is proposed that EU structural and cohesion funds contribute a substantial share of the public funding identified above.

# 6 Delivering Energy Efficiency Investments During 2014-2020

## 6.1 Matching financing and delivery mechanisms with specific sector needs and constraints

127. Energy efficiency investments in Romania during the 2007-2013 years were well below levels suggested by the potential. This outcome is due to a combination of several factors:

- National financing levels are well below investment needs, both in terms of public funds and commercial funds. The national and local governments had to cut back on initially committed funding amounts due to austerity measures. Only some of the potential borrowers are actually creditworthy. This is the case in the residential sector, but also to some extent in the municipal and SME sector. Longer-term financial products that would match the longer payback periods of many EE measures have not been available in Romania until fairly recently.
- EU funds have been underutilized during the 2007-2013 period. The main reasons are that strategies for funding priorities and development of project pipelines had not been sufficiently put in place; procedures to apply for funding are complex and resource-intensive; public procurement is slow and inefficient; and management and control systems in general are weak.
- In addition, the public funds from national and local governments as well as the EU have leveraged only small amounts of private funding, since many projects received grant funding, sometimes for as much as 100% of the project costs. This severely limits the number of projects that can be realized and weakens beneficiary ownership.
- Several policy and regulatory hurdles are still hampering EE investments, foremost the subsidized energy prices, especially for natural gas and district heating.
- Information on the benefits of EE investments and the capacity to actually design and carry out such projects is limited. Technical assistance is available only to a small subset of programs, i.e., those implemented by donors.

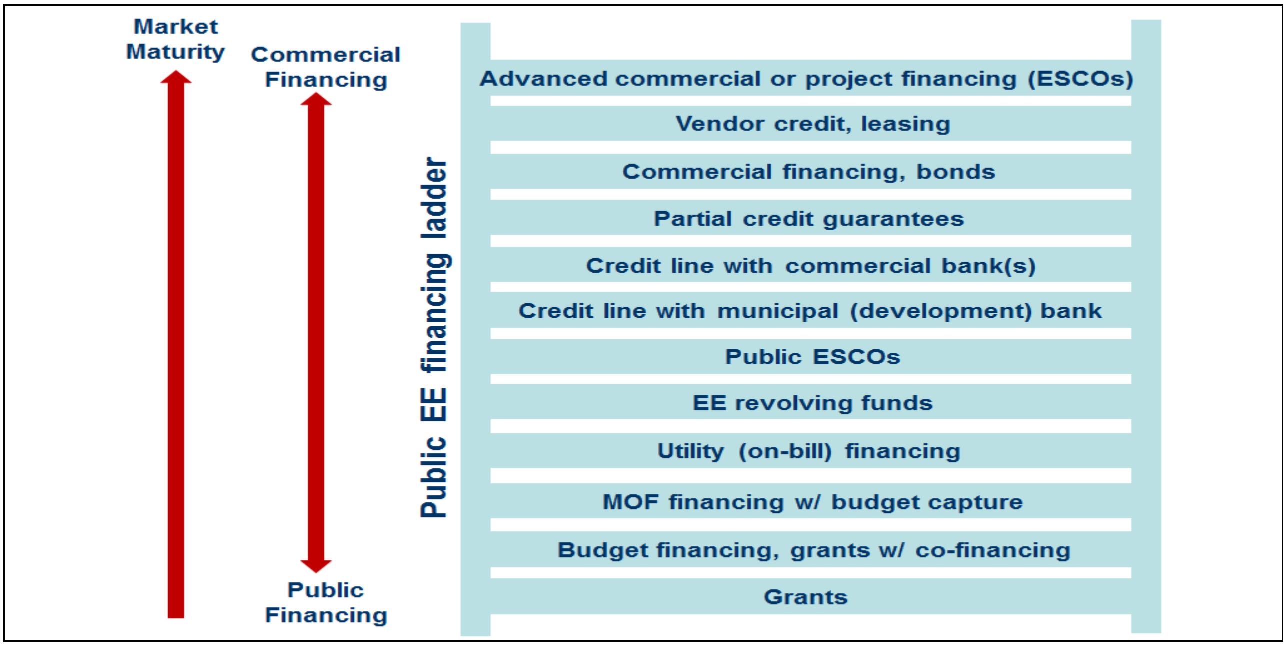
128. To scale up EE investments in the future, the quantity and quality of projects in all sectors need to increase. The necessary ingredients to achieve this are 1) an increase in the availability of funds and channeling them through appropriate funding mechanisms and 2) increased the role of repayable financial instruments. This involves taking a more strategic approach to prioritizing investments and increasing the level of capacity building so that projects can be better prepared, implemented and monitored.

129. ***Manufacturing sector***. Industrial EE investments in general are financially viable and do not need capital subsidies from public funds. Many financially viable EE investments are not undertaken due to a lack of awareness of the cost-savings opportunities by enterprises, competing needs for capital, and relatively high transaction costs of financing such projects. Dedicated industrial EE credit lines combined with grant support to implementation (such as energy audits and capacity building for banks) are now widely used to address such needs and constraints. During the past 10 years both industrial companies and financial institutions have

become familiar with such projects due to the experiences with IFI-funded projects. High efficiency cogeneration projects could still receive some investment grants but these should be channeled through commercial financial institutions. For other industrial projects, especially those carried out in the SME sector, some funds could be made available to provide support for project preparation as well as monitoring and dissemination of results after implementation.

130. ***Public sector***.[46] Despite attractive payback periods and energy savings potential in the public sector, EE is often plagued by a number of market failures and barriers (see paragraph 90). Global experience shows that there are a number of financing options for public buildings that can help address some of these barriers. This "financing ladder" (Figure 21) can help guide policymakers to select one or more options that can then be designed to provide accessible financing products.

**Figure 21: Public Energy Efficiency Financing Options Ladder**




Source: World Bank staff

131. The selection of appropriate mechanisms and their subsequent design will depend on factors such as: (i) current legislative and regulatory conditions; (ii) maturity of financial and public credit markets; (iii) current state of the local EE service markets, including ESCOs and energy auditors; and (iv) the technical and financial capabilities of public entities to undertake EE projects. Once the basic mechanisms are selected, these mechanisms must then be carefully designed to suit local market characteristics. During the design phase, one mechanism can be developed to offer more than one financial product, for example, guarantees in addition to loans. Multiple product offerings are generally recommended, as they allow different public clients with different capacities to be better served via one program.

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[46] Based on: Singh and Hofer, 2013

132. In the case of Romania, several financing options are already in place for the public sector, particularly municipalities. In addition to grant financing from the national budget and grants under the EU OP, several EE/renewable energy credit lines are available from commercial banks as well as from FREE, the Romanian EE Fund. The uptake is still limited, perhaps due to a lack of capacity to develop and package projects, limited borrowing capacity of local governments and inertia from a public sector accustomed to receiving grants. So far, it seems that the most frequently funded public projects are street lighting projects. ESCO financing is very limited, partially due to the limitation in the number and experience of ESCOs in Romania and their access to financing, as well as barriers to EPCs in the form of accounting, budgeting and procurement issues. In addition to the options already available in Romania, i.e., credit lines with commercial banks and EE fund (FREE), a potential mechanism that could be explored in the near term includes a full service EE revolving fund. Energy performance contracting and ESCO development should also receive more support to develop ESCO financing into a viable financing option for the public sector.

133. **EE revolving funds**. Romania already has experience with a revolving EE fund, FREE. It was established when the commercial banking sector exhibited major aversion to risk and did not provide mid to long-term loans that would match the payback periods of EE projects. Ultimately, it was not funded sufficiently and after disbursing its capital, FREE has been relying on the flow-back of funds to make additional loans. Experience of the EBRD shows that the use of grant funds as subordinated debt can help mobilize commercial co-financing. A fund would also be able to provide TA to disseminate information on EE subproject performance/financial data critical to sustainability. A fund is a fairly expensive mechanism, however, since a professional, well-incentivized Fund Manager/team is key. also It is necessary to be cautious designing a fund in a way that it does not crowd out sustainable private finance, but instead is able to leverage private funds.

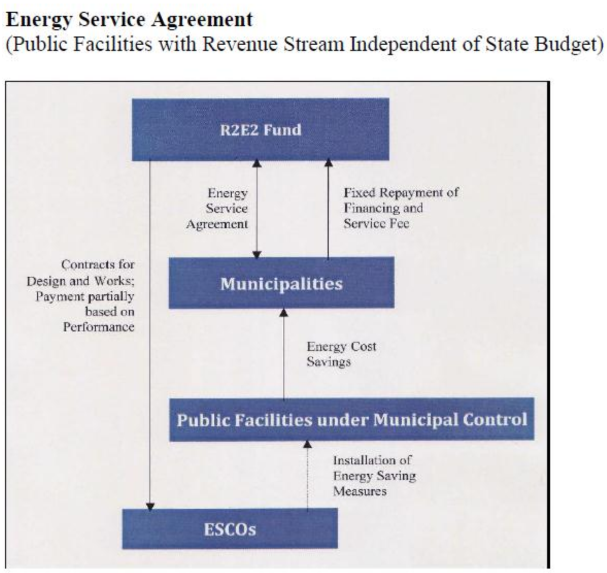
134. Following up on the FREE experience, it might be helpful to consider a slightly different EE revolving fund that would take a more active stance in supporting clients to design projects, implement them and monitor the results. It should provide different types of financial products for public clients with different needs. The Armenian Revolving EE fund (see Box 3) might provide a relevant example. It provides straight loans for creditworthy municipalities and energy service contracts for municipalities that are not creditworthy or have borrowing limits and for agencies/units that do not have their own budgets. Those service contracts are not considered public debt. It also uses a procurement approach with simplified ESCO contracts to shift some technical and performance risks to private construction firms. In this way it takes an important step towards building up an energy service industry.

**Box 3: ARMENIA: Energy efficiency revolving fund for public building retrofit**

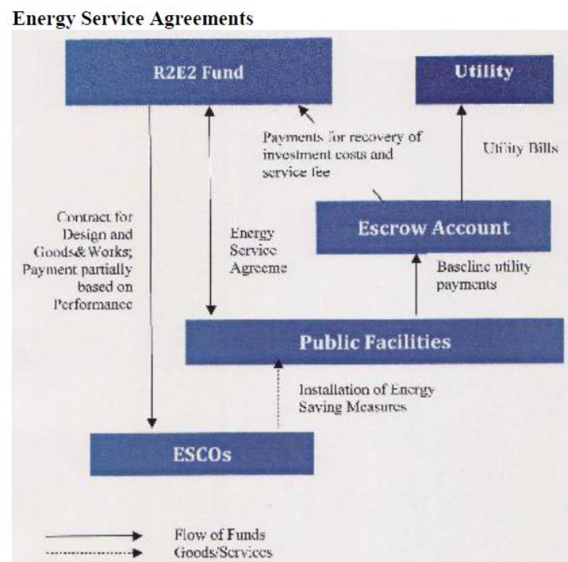
Since the public sector in general lacks the capacity to develop and deliver EE investment projects, successful operation of a revolving fund targeting the public sector often requires the fund to not only provide the financing but also provide project preparation, implementation and monitoring services. An on-going World Bank project in Armenia has set up a public sector EE revolving fund with the following characteristics:

1. Independent management by the R2E2 Fund, overseen by Board of Directors
2. Capitalized from IFI/donor funds or government budget
3. Full service: Financing plus project preparation/ implementation/monitoring services
4. Two fund windows (see flow charts below):
    a. Loans to creditworthy municipalities, collateral and own contribution required
    b. Energy services to other entities without their own budget, such as schools
5. Repayment from energy savings, allowing Fund to revolve
6. Repayment risk with the Fund
7. Uses simplified ESCO contracts to shift some technical and performance risks to private construction firms
8. Pricing of services depends on funding sources and condition of client

**Window A**




**Window B**




Source: World Bank 2012

135. **Commercial financing using ESCOs/performance contracts.** This approach is very attractive since it can address public sector EE implementation issues, such as a lack of capacity and information, and the reduction of transaction costs through bundling of projects as for example in the case of Berlin and several other Western-European cities and regions.[47] However, the ESCO approach has not taken off in many countries. It is fairly demanding in terms of an enabling environment. For example, it requires supportive policies, such as changes in public sector procurement and accounting/budgeting rules, standard requests for proposals and standard contracts, monitoring and verification protocols. Appropriate financing schemes need to be developed since the ESCO business model is unknown to many potential financiers. In several countries (USA, Canada, Germany), early market development has taken place through public

[47] Singh et al 2010.

sector projects. To kick start the market, PPP models should be developed with private sector involvement. The EBRD/GEF project is supposed to support many of the necessary changes in the public sector enabling environment, while EBRD credit lines are accessible to ESCOs. See Annex 1 for more details on energy performance contracting in the public sector.

136. ***Residential Sector.*** The financing options available to the residential sector are more limited than those available for the public sector and thus the ladder is "shorter". Four major financing options have been used in other countries to help overcome the barriers listed above (see paragraph 82) and support EE improvements in residential buildings. These include:

- EE funds;
- Commercial bank financing;
- Partial credit guarantees; and
- Utility EE programs.

137. A national revolving EE fund could be a valid alternative. If it is channeled through commercial banks, it could combine the more efficient commercial delivery of large numbers of financial contracts with the possibility of softening some of the commercial terms to make funding more attractive for projects that have fairly high costs of saved energy. If the creditworthiness of potential beneficiaries is a real concern, as it might be in the case of HOAs or municipalities, then an independent fund structure could be considered.

138. Any financial mechanism targeted at the thermal retrofit of residential buildings will have to take into account that most of the beneficiaries/borrowers would likely be HOAs of multi-apartment buildings from the post-war period. In Romania, the formation of HOAs in owner-occupied apartment buildings is mandatory, if not always enforced, and they are registered as a legal entity. HOAs are required by law to establish a bank account and collect fees for building maintenance and other expenses on a monthly basis, but it is not clear that such funds are indeed collected by each HOA. If they are collected, their use has to be decided by all members of the HOA. Until the law was changed in 2007, a 50% majority was necessary, since then a two-thirds majority is required.[48]

139. In the past, the uptake of the thermal renovation program (see Chapter 3) has been slow, despite the fact that up to 66%, and after 2008 up to 100%, were grants from national and local governments. The reasons for the slow uptake seem to be the lack of coordination among owners, especially in buildings with large disparities in income, and lack of public awareness of the program. Lack of renovation funds that were initially the source of the beneficiaries' share in the thermal renovation program may have been another reason. Home-owners and HOAs may also have been reluctant to assume debt for an investment with a somewhat uncertain benefit. Finally, banks have little if any experience with HOAs as borrowers, and vice versa. Judging by the experience in other countries in the region, such as Lithuania, Estonia or Hungary, it takes serious investments in capacity building on both sides to establish a commercial relationship between banks and HOAs. For the first time, the ROSEFF credit line counts HOAs among the eligible borrowers.

[48] Rabenhorst 2012.

140. One challenge in the renovation of multi-family buildings is the diverse population in those buildings with respect to income. Poor families may not be ready to vote in favor of a renovation project if this adds to their monthly fees. In Lithuania, the government provided subsidies for poor families to enable them to participate in renovation projects.[49] In Romania, the UNDP (2011) project includes demonstration projects that will test the provision of additional grants to cover the share of renovation costs of apartments of poor families in buildings that undergo thermal rehabilitation.

141. Under these conditions, a dedicated financial mechanism, such as a housing renovation loan fund, appears to be a solution with several advantages. Funds are not given as grants, but mostly as loans that revolve, making the mechanism more sustainable. If channeled through the commercial financing sector, it could be scaled up fairly quickly. In addition to longer-term loans at preferential rates, the mechanism could provide some grant funding, subsidies to low-income families, technical assistance and capacity building.

142. *Experience with housing renovation loan funds.* In several countries EU funds have been used to support the retrofit of residential buildings by providing seed funding for the establishment of renovation loan funds. Examples are the Estonian renovation loan fund (RLF)[50] and the Jessica Holding Fund in Lithuania[51] for apartment building EE retrofits (see Table 21). Both are channeled through commercial banks and provide long-term preferential loans to housing associations and individual owners for apartment building retrofit. Loans are combined with some government-funded grant elements upon completion of the EE measures and with support for energy audits and technical inspection, provided the renovation achieves pre-defined energy performance goals. The Lithuanian Fund also incorporates government subsidies to low-income families. The Estonian Loan fund managed to renovate 6.7% of the total floor area of the country's apartment buildings between 2009 and 2012. Latvia is interested also in a Housing Renovation Loan Fund, possibly with ESCOs as additional eligible borrowers.[52]

**Table 20: Renovation Loan Funds in Estonia and Lithuania**

| | Estonia RLF | Lithuania |
|---|---|---|
| **Beneficiaries** | apartment associations, building associations and communities of apartment owners in buildings with at least 3 apartments, built before 1993 | Apartment owners |
| **Intermediaries** | 2 commercial banks for loans | 3 commercial banks |
| | Kredex (financial institution offering loans, credit insurance and guarantees) for the grant administration and TA | HUDA (Housing and Urban Development Agency) – reviews renovation plans, organizes/ provides TA |
| **Products/Services** | | |
| loans | 10 years with fixed preferential interest rate; up to 20 year maturity; for max. 85% of project costs; collateral: Pledge over the rights of the apartment or building association to claim against the apartment | 3% fixed interest rate, up to 20 year maturity |

[49] See Lithuania case study in Taylor et al 2008.
[50] Adler 2012.
[51] Irzikeviciute, 2012.
[52] JESSICA 2012.

| | | |
|---|---|---|
| | owners | |
| grants (works) | 15-35% depending on achieved energy savings (available also for clients of other banks) | 15% for 20% savings<br>30% for 40% savings |
| Grants for audits, building design documents, tech. expertise | 50% of costs up to max. amount | 50% of costs up to max. amount |
| Grants for low-income families | NA | 100% costs of preparation/ administration/supervision of the renovation project, credit insurance contribution, principal and interest |
| guarantees | Provided by Kredex | NA |
| **Sources of funds** | | |
| loans | EU ERDF: EUR 17 million<br>CEB* loan: EUR 29 million | Jessica Holding Fund (HF) managed by EIB<br>EU ERDF: EUR 127 million<br>State budget: EUR 100 million |
| Grants (works) | Funds allocated from trade in amount units assigned to Estonia under article 17 of Kyoto Protocol to the United Nations Framework Convention on Climate Change | State budget and funds of JESSICA HF, Climate Change Program |
| Grants (TA) | EU ERDF | State budget |
| Grants (Low-income) | NA | State budget |
| **Results** | (2009-2012) | (up to 10/2012) |
| Loans | 496 loans, EUR 48.1 million | 72 loans, EUR 7.7 million |
| investments | EUR 66.7 million<br>Average: EUR 104,000 | |
| savings | 36% (expected) | |
| grants | 550 with average 25% grant | |

*CEB: Council of Europe Development Bank
Source: http://www.kredex.ee; Adler 2012; Irzikeviciute 2012; JESSICA 2012

143. *Commercial bank financing and partial credit guarrantees*. Commercial bank lending for Romanian households is fairly short-term with high interest rates and thus does not match the longer-term funding needs for EE investments. A generous credit guarantee program is currently available for home owners, but its use has been very limited (see paragraph 78).

144. *Utility energy efficiency programs.*[53] A growing set of countries has developed regulations to encourage or oblige their utilities to implement EE programs given their technical capacity and their relationship with energy users. Demand-side management (DSM) programs in the U.S. demonstrated the successful efforts of utilities in implementing residential EE programs. Similar schemes have been implemented in Asia and Latin America with some success. A variation of utility EE programs are utility Energy Efficiency Obligations (EEOs), primarily used in the EU and now required under the recent Energy Efficiency Directive (see Table 8). Typically, EEOs are regulatory requirements on energy suppliers (or other obligated parties) to meet defined EE targets, with financial penalties for failure to achieve the targets. The costs of the EE investments required to achieve the target are usually recovered through the tariff

[53] Based on: Singh and Hofer, 2013

mechanisms. While utilities can be well-placed to undertake such programs, careful regulatory mechanisms need to be developed to address potential conflicts with their traditional business of energy sales. To meet the obligations, the utilities may: (i) directly implement EE measures in residential buildings; (ii) engage contractors to do the implementation; (iii) purchase energy savings achieved by others; or (iv) establish a fund that can be utilized for EE measure implementation. Formal measurement, reporting and verification of the savings are required. In the EU, EEOs have been implemented in Belgium, Denmark, France, Ireland, Italy, Netherland and the UK. In the UK EEO scheme, where the residential sector is a major target market, obligated parties are required to achieve a specified fraction of their energy savings among priority groups – mainly the elderly and those receiving certain means-tested benefits. The UNDP project is currently investigating whether/how EEO could contribute to reducing energy poverty in Romania.[54]

## 6.2 Policy support and implementation capacity-building

145. The availability of financing alone will not result in improved EE. Decision makers need to have proper incentives to participate in EE programs and knowledge/information about the costs and benefits of doing so. Eliminating distortions in the energy markets, particularly with respect to energy pricing, will generate a powerful incentive to pursue investments in EE, particularly for the residential building sector where decision makers face the most serious energy price distortions.

146. In addition to having an economic incentive to participate, decision makers need to be engaged and provided with the information necessary to make decisions. Program marketing and capacity building of the target sector entities need to be expanded to address the information and knowledge gaps related to EE, build demand for financing, and improve the sustainability of energy savings.

147. Many past and existing government programs have not included any monitoring and verification (M&V) of results. This is an essential part of any program though, since this is the only way to show whether funds were well spent and achieved the intended outcomes, as well as whether a program should be continued or if there is a need to adapt it. Support for the development and/or adaptation of methodologies for M&V and for the provision of M&V training to EE program staff, facility managers and engineers, and private sector service providers should therefore be included in EE programs.

## 6.3 Improving EE governance

148. In the wake of the financial crisis and resulting cutbacks in government spending, EE efficiency (as well as climate change issues) seems to have been relegated to the back burner despite a flurry of policy statements and legal changes triggered by EU requirements. One of the victims was the energy efficiency agency ARCE which was subsumed by the energy regulatory agency ANRE. A first step to elevate EE both within the government but also for external

[54] Househam/Musatescu 2012

stakeholders would be to improve the governance of the EE agency. Several options exist, requiring more analysis than is possible in this assessment, and among them are the following:

- ANRE's EE department could be strengthened. However, ANRE is a regulatory agency and only some responsibilities of an EE agency are of a regulatory nature
- ARCE could be revived as a separate agency with a strengthened mandate and its own independent budget. As a separate entity it would be able to establish regional offices which would be helpful in supporting local governments and other consumers. It should be considered whether responsibilities for buildings and EE in local governments should be moved from MDRAP to the EE Agency. At the very least, communication between the two entities needs to be improved.
- Some functions of either ANRE or ARCE could be outsourced to firms or NGOs under performance contracts (for example, regional offices).

It is proposed to investigate in detail how to improve EE governance. For cross-cutting issues such as establishment of national targets, EE incentives and so on, national leadership is indispensable, particularly in view of the importance that the EU is assigning to EE in the context of climate change.

149. In the future, cities should be engaged more, since they are critical in housing retrofit and district heating issues. The cities participating in the Covenant of Mayors, for example, would be natural champions for EE and RE initiatives. Local governments should be supported in the preparation of heating strategies and building stock data bases and the strengthening of support structures for HOAs.

## 6.4 Summary of main recommendations

150. To scale-up energy efficiency investments, the financing and delivery mechanisms need to match specific sector needs and constraints. Of particular interest in the long term is the use of financial instruments to increase the leverage of public funds in energy efficiency investments in the public and residential sectors, especially for the thermal retrofit of buildings. Increasing the role of ESCOs in delivery of energy efficiency projects also has the added benefit of bringing in third party commercial financing, especially for public sector energy efficiency investments. More specifically,

- Manufacturing sector energy efficiency investments should in general be financed through commercial means. Nevertheless, public funding in supporting information dissemination, awareness raising and capacity building among key stakeholders (enterprises, ESCOs and banks) have proven to be of catalytic value.
- A dedicated energy efficiency revolving fund for the public sector could be an effective way of addressing some of the critical financing and implementation constraints faced by municipal public entities while also helping to nurture and develop Romania's nascent ESCO market. Such a fund may be seeded by a combination of EU funds and government grants and could potentially attract private financing if proven successful.

- A financing mechanism/platform that matches the needs for long-term (up to 20 years) and low interest rate loans in residential thermal retrofit while also providing streamlined processing and necessary assistance to HOAs will help mitigate the challenges facing the thermal retrofit program in Romania. There have been some successful operations of housing renovation loan funds in other EU countries, which could inform the design of a similar program in Romania. As part of the transposition of the EE directive, the Romanian government should also consider the introduction of EEOs, perhaps first on a limited basis.
- As part of the transposition of the EE directive, the Romanian government should also consider the introduction of energy efficiency obligations (EEOs), perhaps first on a limited basis, requiring that a certain fraction of energy savings is achieved among vulnerable groups.

151. The characteristics of key government support that match the critical needs in energy-consuming subsectors and end-uses are summarized in the table below.

**Table 22: Critical needs and government support to scale up EE investment**

| Key areas of intervention | Critical constraints to scaling-up EE investment | Means of government support |
|---|---|---|
| Basic policies | Subsidized energy prices | Cost reflective prices (remove general price subsidies) with targeted support for low-income families |
| | Metering and consumption-based billing | Requiring consumption-based billing as part of district heating modernization investments |
| | Lack of clear legal regulation of ESCO contracts, lack of deliberate policy support for ESCOs, and insufficient market recognition and credibility | Market development support efforts to improve the credibility of ESCOs (such as accreditation and certification) and access to project financing; changes in public sector budgeting, accounting and procurement regulations |
| | Reliance on grant financing | Expanded menu of support for energy efficiency: monetary and non-monetary incentives, financial instruments that leverage private financing |
| | Lack of EE program planning, policy implementation and supervision capacity | Improve the governance of the EE agency, for example, by strengthening ANRE or re-establishing an improved ARCE; consider outsourcing of functions to firms or NGOs |
| Selected energy-intensive manufacture | Competing demands on funds; preferential energy pricing for some SOEs; sector restructuring, SOE privatization in some industries | Abolish preferential energy pricing<br>Long-term agreements<br>Information dissemination, awareness raising and capacity building |
| Small and medium enterprises | Information, creditworthiness, credit terms | Support for audits and dedicated energy efficiency credit line<br>Information dissemination, awareness raising and capacity building |
| Residential thermal retrofit | HOA credit-worthiness/ decision making process, poverty/ affordability;<br>lack of information on building stock and energy performance | City-level market assessment, program design and implementation support<br>Dedicated financing mechanism with appropriate blending of long-term and low-interest loans and grants<br>Design of EEOs with social objective |

| | | |
|---|---|---|
| | | TA/grants for engaging and informing HOAs, preparing, supervising and monitoring projects |
| Public buildings thermal retrofit | Lack of EE information and implementation capacity, budgeting/accounting/ procurement restrictions; lack of information on building stock and energy performance | Market assessment, program design and implementation support for municipal public buildings<br>Changes in budgeting, accounting and procurement regulations<br>Dedicated financing mechanism with consideration of introducing a revolving fund |
| nZE buildings | Untested, new technologies | Grants for demonstrations |
| Large appliances upgrade | Up-front incremental cost | Consider utility EE programs: EEOs, on-bill financing, rebates |
| Residential and commercial lighting upgrade | Poverty, up-front capital costs | Consider utility EE programs: EEOs, on-bill financing, rebates;<br>regulation to phase out incandescent lamps |
| Other municipal services, such as public lighting and water supply | Access to financing | Enable PPPs, for example, ESCO arrangements<br>Energy assessment support to water utilities |

# Annexes

## Annex 1: Lessons learned on energy performance contracting in the public sector[55]

There are three basic types of ESCO contracts:

(i) *energy supply contracting (ESC)*, where an ESCO deals with all aspects of energy supply to a customer and gets paid through a margin on energy sales;

(ii) *energy operations contracting (EOC)*, where an ESCO optimizes an energy system and gets an operations fee; and

(iii) *energy performance contracting (EPC)*, where an ESCO finances an energy investment (new or rehabilitation) and is repaid from the energy savings. Because such a contract can be structured so that the financing and the risks are born by the ESCO, this form of contracting is ideal for the public sector as discussed below.

**EPC and the Public Sector**

The public sector is normally the most promising market segment for EPC because it is a major energy consumer; ownership/tenancy of the facilities is clear; the risk of bankruptcy is virtually nonexistent; and the risk of closure of a facility is low. However, there are barriers. The most important of these are the public sector's procurement rules, budget procedures and lack of savings incentives. Often there is also limited in-house competence related to energy management and the complexity of energy performance contracting.

***Procurement of EPC: maximize results rather than minimize cost***. Under traditional procurement the emphasis is on achieving the lowest price for known specifications. *Under EPC, however, the emphasis is on maximizing results rather than minimizing equipment cost*. Also, the main focus of the bid evaluation should be on the basic methodology for guaranteeing the savings, the proposed energy savings measures, and the benefit derived from working with that ESCO. Other key differences between performance contracting and traditional contracting are: (i) the provision of a package of EE services by a single company – the ESCO – as opposed to contracting with separate companies for the engineering design, supply and commissioning, and maintenance; and (ii) a contract with an ESCO usually covers 5-10 years or longer, which does not match the annual budget cycles of public sector institutions.

***Budget procedures: consider letting Agencies keep some of the savings***. Unless the Government sets mandatory targets (and penalties for not meeting them) for each government agency, incentives may have to be provided to the agencies for undertaking energy savings measures. Normally reduced energy bills that translate into equally reduced energy budgets in the next year will not motivate agencies to voluntarily undertake EE investments unless considerations of comfort, building appearance, etc., provide adequate incentives. In the US, federal agencies are in principle allowed to retain up to 50% of the energy savings resulting from

[55] See Singh et al 2010.

EPC (though in practice it is far less than that). In Germany and Hungary block budgets for some types of agencies provide built-in incentives to reduce operating costs, including energy costs.

Designing a scheme under which net savings are shared between the Ministry of Finance and the contracting Agency, perhaps on a declining basis, could be a win-win situation. It would also help Poland to reduce its energy intensity further and help it meet current and future EE, greenhouse gas and renewable energy commitments (the latter by reducing the denominator). Typically, most of the EE potential in the public sector is for heating (and increasingly cooling) and the remainder for lighting. Over the life cycle of EE investments, enormous savings to the Treasury and a very significant reduction in GHG emissions can be achieved.

***Debt ceilings: EPC payments as operating expenses***. In some countries, like Poland, EPC contracting is counted against the debt ceiling of public sector entities and therefore a non-starter. In Germany and the US, however, EPC contracting is allowed if the following conditions are met: *(i) the ESCO must contract the commercial debt and put it on its balance sheet; and (ii) the project should have guaranteed positive cash flow to the agency in any given year* of the contract period, backed up by strict performance guarantees, including performance and payments bonds, insurance certificates, or letters of guarantee. Dispute resolution procedures are also clearly specified and may involve third parties, but there have been very few such disputes in either country. *Provided the above conditions are met, payments to an EPC contractor or considered to be operating expenses (building maintenance), not debt repayments*.

***Developing industries and services of the future.*** Because of a lack of energy expertise in many government agencies, ESCOs are ideal to assist them in that area. Government is in a unique position to take the lead. By helping develop the demand for, and supply of, ESCOs and associated equipment and services, their use could then spread to other sectors of the economy. In this way the Polish economy could engage in applying and developing the cutting edge EE technologies and services of the future, becoming a leader in this important new field rather than lagging behind.

**Experience in the USA**

The ***Federal Energy Management Program*** was established in 1995 to help federal agencies reduce their energy consumption. The ***Energy Independence and Security Act*** (2007) set new mandatory goals: federal agencies are required by law to cut their energy use by 3% per year through 2015 (and to significantly increase their use of renewable energy and reduce water consumption by 2% per year, with 2003 as the base year). EPCs, or ESPCs as they are called in the US (Energy Savings Performance Contracts), have been a major vehicle to achieve this. Legislation giving federal agencies authority to enter into shared savings contracts with private sector ESCOs was enacted starting in 1985.

***Net savings sharing***. Over the past decade, more than 460 federal ESPC projects have been awarded. These projects will save the US Government US$7.1 billion in energy costs, US$5.7 billion of which will finance the facilities upgrade, *resulting in net savings to the government of US$1.4 billion*. Agencies can in principle retain 50% of net energy and water cost savings for additional energy saving projects, including employee incentive programs. However, given the pressure to limit federal budgets, any cost savings that remain after payment of the EPCs are often cut from the agencies' operating budget.

***Procurement: mandatory savings and multiyear contracts***. The authorization for federal agencies to enter into ESPCs specifies that *savings guarantees are mandatory* and that M&V protocols will be used to verify that the guaranteed savings are realized. *The savings to the agency must exceed payments to the ESCO in every year of the contract's term. The contract term for federal ESPCs, including the construction period, may be a maximum of 25 years though the average is about 15 years*. They can include a broad portfolio of energy savings measures, ranging from quick impact measures to ones with longer payback periods. With the aggressive US directives to reduce energy use, agencies have usually implemented many low-cost and no-cost measures themselves and use ESPC projects to replace old, inefficient equipment. Projects thus tend to be capital intensive and do not involve cream skimming.[56]

***Project financing on ESCOs balance sheet***. ESCOs commonly obtain financing from a third party. *They must solicit competitive financing offers for the energy project in commercial markets* to ensure that the agency will receive the best possible overall value. It is the responsibility of the ESCO to obtain competitive offers, evaluate them, and make a selection based on pre-established criteria for best value. The ESCO is required to document its selection. The financing of an EPC project is a contract between the ESCO and the financier, and is based on the ESCO's balance sheet, not the agencies'.

***Performance guarantee***. At the heart of the ESPC is a guarantee of specified levels of cost savings and performance. *The customer is not obligated to pay for an unmet guarantee and thus maintains a positive cash flow throughout the project period*. The allocation of responsibilities between the agency and the ESCO defines the specifics of the guarantee. The agency must receive acceptable performance and payment bonds as well as any required insurance certificates before construction begins.

The sharing of the savings between the agency and the ESCO is negotiated and defined in the contract, but the energy cost savings must be greater than the payments to the ESCO. The agency keeps any savings over the target. *If the savings fall short of the target, then the ESCO's guarantee takes effect and covers the shortfall*. The contracts include requirements for the ESCO to repair or replace any malfunctioning or burned-out equipment during the contract period.

**Project facilitators**. To help agencies enter into ESPCs, the Department of Energy has established a special team that can provide technical assistance and facilitate the process. These

[56] Under a new ***Super ESPC*** process, an ESCO is competitively selected by the US Department of Energy to *service a region or provide a specific type of technology*. Super-ESPCs use an "indefinite-delivery, indefinite-quantity" (IDIQ) contract method, introduced to make ESPCs a more practical and streamlined tool for agencies to use. These umbrella contracts are competitively awarded to ESCOs that demonstrated their capabilities to provide energy savings projects for federal facilities. The super-ESPC approach, with prequalified ESCOs, has been designed to accelerate the contracting process. A super-ESPC delivery order can be awarded in 4-12 months, while a typical stand-alone ESPC can take 2-3 years (or longer). The Department of Energy maintains a Qualified ESCO list (there is also a separate industry certification process by the National Association of Energy Service Companies). It is not uncommon for ESCOs on this list to work as subcontractors to one of the prime ESCOs awarded a super-ESPC.

project facilitators guide the agencies throughout the ESPC process and consult with agencies on contracting and financing issues, M&V, and technology and engineering issues. FEMP teams offer the assistance at no cost, starting with the kick-off meeting and extending through the review of an ESCO's initial proposal. Project facilitators are required for all super-ESPCs under the new, master IDIQ contract.

***General observations about the US ESCO market***. In 2006, about 82% of ESCO investments were with existing public sector building facilities (22% in the federal market 58% in state/local government, universities, schools and hospitals markets; and 2% with public housing authorities). Private sector investment was split between commercial (9%), industrial (6%) and residential (3%). Recently, some of the larger ESCOs have begun responding to interest in green buildings and are offering energy-related services that support green building certification processes.

ESCOs in the US have a track record of developing comprehensive projects that utilize EE, onsite generation and renewable energy technologies. The core market in which the ESCO business model has been most successful is in energy-efficiency retrofits of large buildings, primarily owned by institutional clients. Other types of energy service providers (e.g., lighting and HVAC contractors, engineering firms, and architects) are more active in residential and small commercial markets as they tend to work on a design/build basis, are compensated directly, and assume no ongoing performance risk. ESCOS are not generally involved in new construction.

**Experience in Germany**

Germany is generally considered to have the most mature ESCO industry in Europe. By 2005, ESCOs there had a total investment volume of about €5 billion. The vast majority, 85 percent, is for energy supply contracting (ESC), mostly for heat; about 10 percent for EPC; and the remainder for other forms such as energy operations contracting (EOC).

There are about 500 ESCOs in Germany, with annual revenues of over €3 billion. ESCOs range from subsidiaries of large utilities and former municipal utilities to equipment suppliers, construction companies, and engineering and consulting firms. There are two national ESCO Associations, with membership overlapping significantly.

***EPC in the Public Sector.*** EPC was slow in gaining market share: uncertainty regarding procurement and budget procedures related to EPC; lack of information and awareness; lack of competence to deal with procurement complexity; and lack of staff incentives. However, EPC became an essential instrument to meet Germany's EE and climate change targets when the ***Energy Efficiency Contracting in Federal Properties Program*** was started in 2002. The basic procurement and public budgeting barriers were dealt with early on, both at the state and federal levels. EPCs are generally allowed, provided that procurement is competitive and that the comparison of offers includes self-implementation of projects by the agencies, i.e., without ESCO involvement.

***Clarification of budgetary issues***. All public properties in Germany, whether federal, state, or municipal, can in principle use EPC as an alternative to credit financing. As long as measures carried out under energy performance contracts are profitable— i.e., cost savings are greater than payments for contractor services—they are not taken into account for debt limits in most German states. Municipalities must have all credit transactions, and transactions similar to credits, authorized by their supervising authorities, except those for O&M. Energy performance contracts emphasize the service of the contractor, rather than the investment, and are considered to be an operating expense if their term does not exceed 10 years. If the contract includes a guarantee of the profitability of the measures to be taken, and if it has been awarded competitively, no preauthorization is required. Payments to the ESCO contractor are budgeted as building maintenance expenditures.

***Procurement***. Contracts have to be awarded through a competitive process, ranging from: (i) open public procurement; (ii) limited procurement; (iii) negotiated procurement; and (iv) competitive dialogue procurement. The second and third options can be used if the service to be rendered cannot be described unequivocally and exhaustively, such that a price for the service can be determined objectively. This applies to EPC projects, especially complex projects such as those covering many federal properties. Since the EPC contractor is expected to determine the specific measures, the objective of the contract is described in a functional way: percentage reduction of energy costs. Option (iv) is used for very complex projects after a EU-wide announcement. Contracts typically include both equipment and services (planning, installation, optimization, and maintenance of equipment; controlling; documentation, etc.).

***Energy audits***. An initial energy audit is usually not required or performed. Baseline data (technical, energy use, and cost) for the building(s) are provided by the agency, based on model data sheets provided in EPC guidelines. This is usually complemented by facility walkthroughs by bidders. In a two-stage contract the winning bidder carries out a detailed analysis, including an audit, the cost of which will be covered by the contract

Baseline data are typically collected by the agency, sometimes with help from specialists, such as a private consulting company. For the first demonstration projects in a program, the service is often provided free, but later the agency has to pay for such services. Federal and regional energy agencies have put together guides and data sheet templates for the process.

***Multiyear contracts***. Contract durations range from 7-12 years, depending on the savings potential, the level of investment, and cost savings participation of the client. For contracts of less than 10 years, few budgetary issues arise for state and municipal projects. Bigger, longer-term, and federal EPCs need to be approved and receive a commitment authorization for future payments to the ESCO.

***Project financing***. *For almost all public sector EPC projects in Germany, financing is provided by the ESCO.* Only for obligatory EE measures will an agency sometimes provide part of the financing. Although some ESCOs are able to use their own equity for financing, the usual source is long-term commercial bank loans. ESCOs can obtain lower-cost loans, comparable to what is available for public sector borrowing, if they sell their future payments from the client to the financing institution (factoring). The factoring share is usually restricted to 70-80% of the agreed payment to the contractor. This is roughly the value of the guaranteed investment, which could serve as a security.

***Performance guarantees***. The energy performance contract typically guarantees a minimum percentage energy cost savings over the term of the contract. This limits the payments from the public client to the ESCO. Frequently an immediate sharing of the benefits by the client is agreed upon. In case the contractor does not achieve the guaranteed cost savings in a period, he has to provide a compensation payment. The public client also has several other ways to reduce the risk of nonperformance. Typically, the installed equipment passes into the ownership of the client after commissioning. The ESCO can also be required to provide a bank letter of guarantee to the client.

***Monitoring and Verification***. Energy savings can be verified relatively easily through energy bills, metering of energy consumption, and correction of the baseline caused by any changes in energy prices, climate, and facility use. Model contracts provided by energy agencies oblige the contractor to install an energy management system that includes metering to control the energy consumption in relevant parts of the facilities. Remote monitoring enables the contractor to constantly optimize operation to achieve the targeted savings. It is customary for contractor and client staff to meet several times a year to discuss any issues, such as any changes in the use of the facility that affect energy consumption. So far, no disputes have been reported.

***Energy agencies as project facilitators***. In most cases, public sector clients use the services of an external adviser for support in managing the entire EPC process. Energy agencies, which exist on the federal, state, and communal levels, often provide those advisory services. In many states, they have been the first promoters of EPC in the public sector and have developed demonstration projects, guidelines, model contracts, and evaluations of EPC programs. During the first phases of EPC in a state or city, the energy agency typically receives funding from the government and provides its services free of charge. Subsequently, clients are supposed to pay for the services. However, project facilitation provided free of charge is still the norm.

### ***Lessons Learned and Key Steps***

Experience in other countries shows that factors facilitating more widespread use of EPC are:

- Existence of champions, especially in construction administrations.
- A reliable legal framework for procurement, contracting and budgeting.
- Standardized procedures and contracts reduce time and cost as well as increase the reliability of the process.
- Neutral process management through a trustworthy facilitator who provides technical and economic know-how, preferably free of charge.
- Creating pools of properties (within one agency or budget) to create economies of scale. Benefits are shared among all agencies involved, by assigning separate shares in the savings in the contract.

Some of the key steps for introducing EPC in the public sector are:

- *Conduct an upfront market survey of ESCOs*. Such a survey should be cast broadly to include all types of entities that could serve as ESCOs. It should gauge their level of interest and ability to take risk. The Government may wish to announce its intention to start using ESCOs for EPC well in advance, so that interested parties can start preparing.

- *Hold stakeholder consultations to analyze potential barriers* through the entire process, from the audit to the end of the contract period, to clearly define their nature. Rank the barriers in terms of those most critical to getting through the process.
- *Create lists of options to address each barrier*. Potentially viable solutions should be identified for each of the key barriers that the consultations identify, using successful international experience as a guide.
- *Learn from successful other countries*. Other countries, such as the US and Germany, have followed the EPC model successfully. The systems and procedures they have put in place to achieve this merit close examination and selective copying or adaptation.
- *Develop and test small procurements first*. One or more smaller procurements should be tested to learn whether the process works. Expand and replicate once the process appears to be working.
- *Institutionalize systems*. The design of model templates and documents, the introduction of changes to public procurement and budgeting systems to accommodate EPCs, the creation of nodal energy agencies and project facilitators, the launching of incentive schemes and financing programs, the development of public agency EE targets, the creation of M&V protocols, etc. can help ensure that (a) the process is continually encouraged, (b) EE gains are maintained, and (c) measures are put in place to realize greater potential energy savings.

**Table A1: Basic Types of ESCO Contracts**

| | Energy Supply Contracting (ESC) | Energy Performance Contracting (EPC) | Energy Operation Contracting (EOC) |
|---|---|---|---|
| Client | Energy consumer | User of existing units/equipment | User and owner of existing units/equipment |
| Target | Energy supply | Realization of potential energy savings | Economically optimized operation |
| Services by contractor | Planning, construction, operation, maintenance, financing | Asset renewal (financing included), operation & maintenance | Operation |
| Refinancing | Energy sales | Energy savings | Operations fee |
| Risks borne by contractor | Construction, operation, maintenance, finance and purchase | Actual energy savings, O&M | Maintenance and replacement investment |
| Economic advantages for client | Avoided investment, bulk buying advantages, reallocation of risks | Energy savings guaranteed by contract | Technical optimization and professional experience of contractor |

Source: Vollrad Kuhn, 2006. As quoted in Singh et al 2010

## Annex 2: Use of ETS in Romania to invest in energy sector climate change mitigation

Currently, in Romania, companies in the energy sector represent more than 60% of the ETS sector, and 9 out of the top 15 $CO_2$ emitters are electricity generation units (Table A2.1). One major opportunity for the refurbishment of the energy sector, which would also help the country contribute to meeting EU's 20-20-20 climate change targets, is the possibility to use available ETS-related instruments for investments in the power generation sector.

**Table A2.1: Top 15 largest $CO_2$ emitters in 2012 (in bold electricity generators)**

| | **Annual $CO_2$ emissions** (mn ton) | **Note** |
|---|---|---|
| **Turceni** | **6.07** | |
| **Rovinari** | **5.11** | |
| **Craiova** | **4.92** | |
| Mittal | 3.80 | steel producer |
| **Deva** | **2.43** | |
| **Drobeta** | **1.78** | |
| Holcim | 1.67 | cement producer |
| **Elcen** | **1.28** | |
| Petrobrazi | 1.17 | oil refinery |
| **Govora** | **1.10** | |
| **Paroseni** | **1.05** | |
| Azomures | 0.97 | fertilizer plant |
| **Oradea** | **0.96** | |
| Petrotel | 0.72 | oil refinery |
| Rompetrol | 0.67 | oil refinery |

In the EU-ETS Phase III (2013-2020), auctioning of allowances is the rule rather than the exception. However, poorer member states in dire need of investments in their power generation sector to reduce GHG emissions have the possibility to get free allowances. This is possible by making use of a derogation based on Article 10c of the Directive 2009/29/CE (temporary allocation of free certificates, for electricity generation only). 8 out of the 10 eligible member states made use of this option, and Romania applied for it in 2011.

Romania's application was approved in two stages by the end of 2012 and currently Romania benefits from 71.4 million free certificates for use during 2013-2020 (see Table A2.2 for the annual allocation; by comparison, during 2008-2012, Romania had 208 million free $CO_2$ allowances). The allowances in the EU-ETS III are calculated based on benchmark indicators, calculated to incentivize GHG emission reduction in the most polluting installations. In December 2012, the EC also approved the state aid scheme that allows Romania to use the available resources for projects that reduce emissions; the application included also a National Investment Plan (NIP) with proposed projects for which the proceeds from sales of free allowances would be used.

**Table A2.2: Free allowances of $CO_2$, 2013-2020**

| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|
| Total amount - tCO2 | 17,852,479 | 15,302,125 | 12,751,771 | 10,201,417 | 7,651,063 | 5,100,708 | 2,550,354 | 0 |
| % allocation | 70% | 60% | 50% | 40% | 30% | 20% | 10% | 0% |

As of the end of September 2013, the mechanism to use these amounts has been posted for public debate on the Ministry of Economy's website and is expected to be approved shortly. In brief, beneficiaries of free allowances (eligible electricity generators in operation before 2008) are required to pay the value of the free $CO_2$ certificates to a fund managed by the Department of Energy. The "free allowances" are traded by the Ministry of Finance on the ETS platform, like the other $CO_2$ certificates. The prices for $CO_2$ allowances considered for the fund are the market prices, or the reference values if the market prices deviate by more than 10% from the reference values (14.5 – 20 EUR/t). The Department of Energy manages the amounts in a dedicated account that is made available for the projects in the NIP. The Plan, approved already by the EC as part of Romania's application for the derogation on Article 10c, is a list of 39 projects that contribute to EU's 20-20-20 targets. Of these, 29 are electricity and cogeneration projects – 24 for new capacities and 5 for refurbishments. Of the new capacity projects, 3 are renewable projects and 14 are cogeneration units. Thus, some of the investments included in the NIP[57] concern the same electricity generators that benefit from free allowances; others are new capacities. The grants from the fund can cover 25% of eligible expenses for the proposed investments.

Investments in energy production are covered only by the proceeds from the sale of "free allowances". The other funds resulting from the ETS trading of $CO_2$ allowances[58] (proceeds from sales of "non-free" allowances) are used to finance projects in transport or environment.

[57] The list of 29 electricity and cogeneration projects from the NIP is available at: http://www.minind.ro/propuneri_legislative/2013/septembrie/Anexa_3_PNI_09092013.pdf. The NIP also includes units that are in the government's scenario A – e.g. rehabilitation of 5x330 MW coal-fired units.

[58] The relevant legislation consists of: Government Decision 780/2006 on the trading mechanism, subsequently amended; and Emergency Ordinance 115/2011 that authorizes the Ministry of Finance to auction allowances for Romania.

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