EBRD and Power Generation Efficiency in Russia; achievements and challenges ahead

EPG Conference, 19-20 September 2011, Moscow

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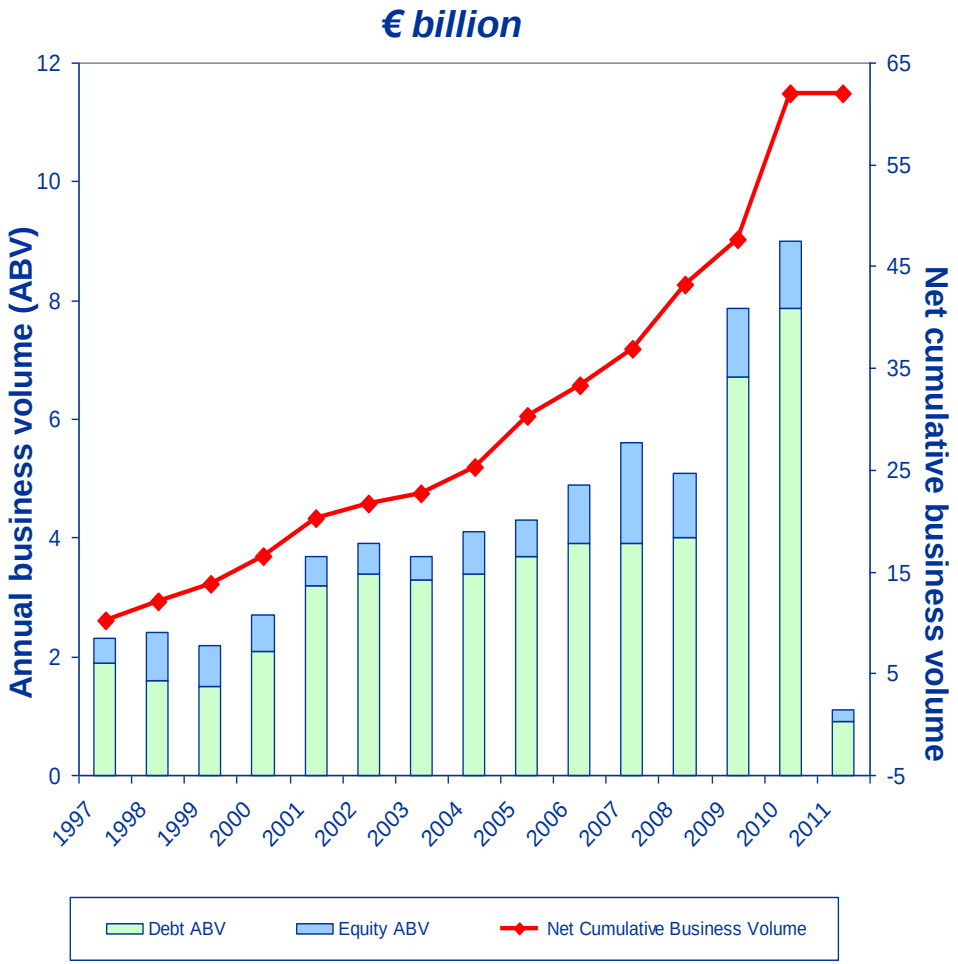
What is the EBRD?

- International financial institution, promotes transition to market economies in 29 countries from central Europe to central Asia
- Owned by 61 countries and two inter-governmental institutions
- Capital base of €30 billion



Reconciled as at 31 March 2011

EBRD and Energy Efficiency

The Sustainable Energy Initiative (SEI)

Launched in 2006. Results through to **Q1 2011**:

- EBRD's sustainable energy investments to **€6.6 billion**, for total project value of **€35 billion in 369 projects in 29 countries**;
- Annual GHG emissions savings of **39.6 million tonnes $CO_{2\text{-}eq}$ p.a.** (equivalent of more than Azerbaijan's emissions)

SEI 6 areas of investment are:

1. Industrial Energy Efficiency

2. Sustainable Energy Financing Facilities

3. Power Sector Energy Efficiency

4. Renewable Energy Scale-up

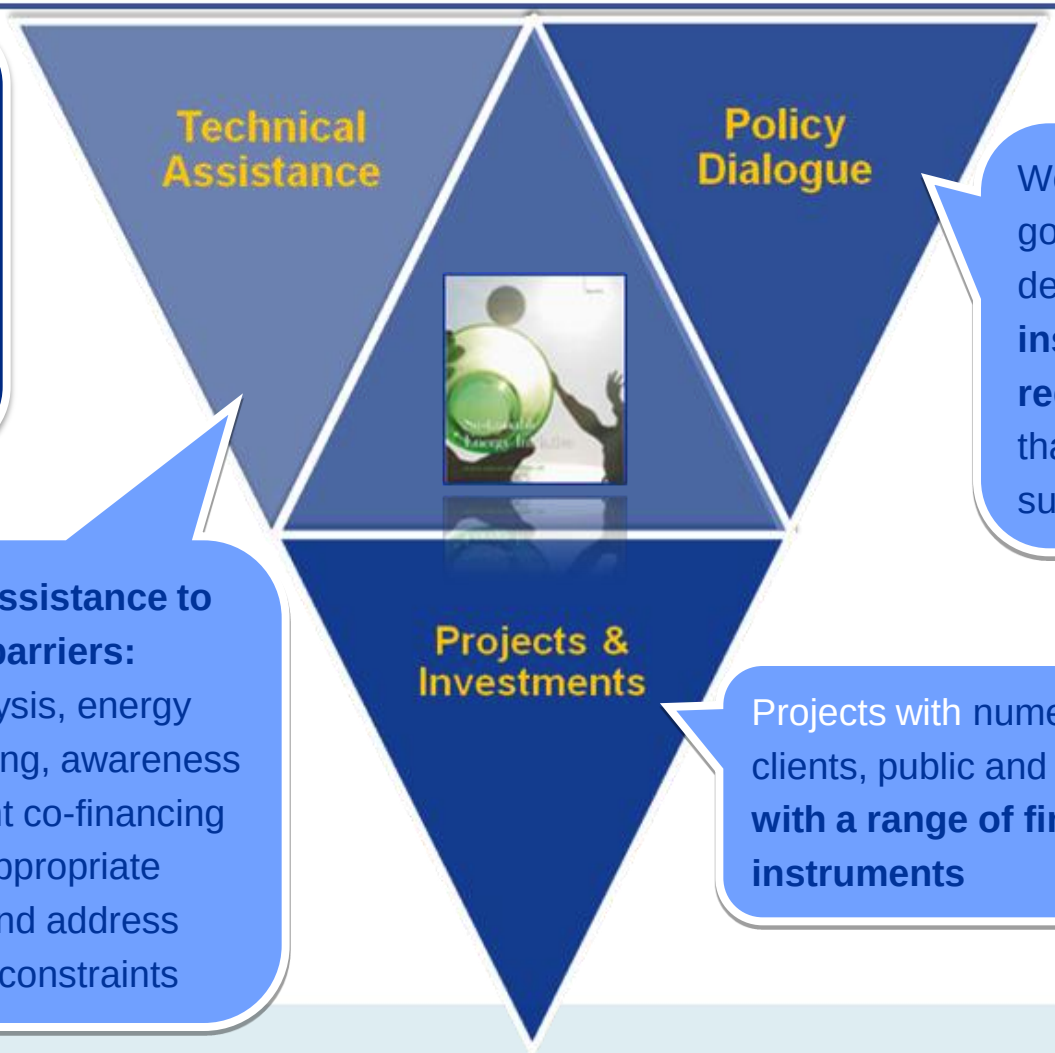
5. Municipal Infrastructure Energy Efficiency

6. Carbon Markets Development

EBRD and Energy Efficiency

The SEI Operational Approach

Via these three parallel activities **SEI accounted for 24% of EBRD's total and 75% of power sector portfolio in 2010**

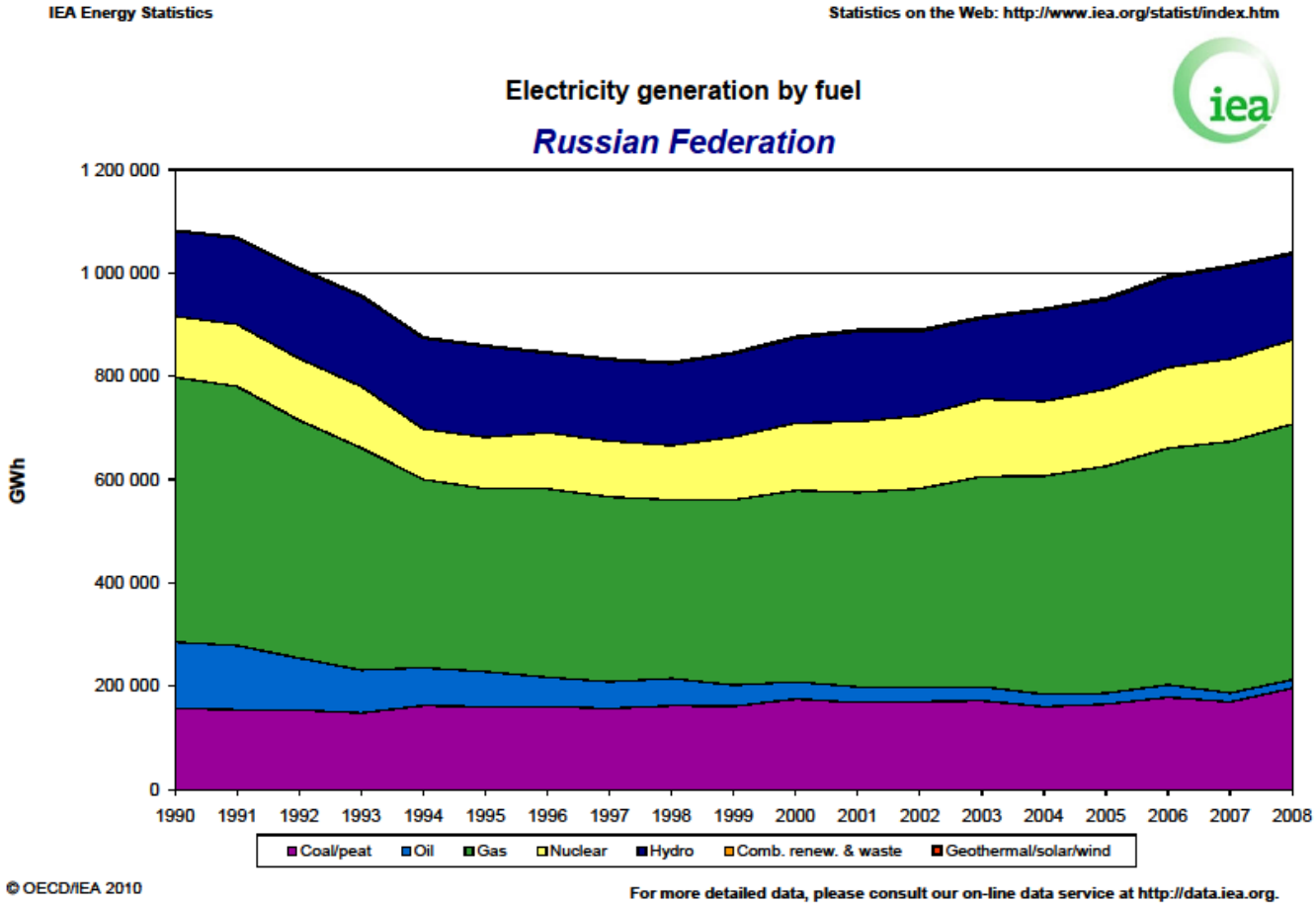


Working with governments to support development of **strong institutional and regulatory frameworks** that incentivise sustainable energy

Technical assistance to overcome barriers: market analysis, energy audits, training, awareness raising; grant co-financing to provide appropriate incentives and address affordability constraints

Projects with numerous clients, public and **private, with a range of financing instruments**

Some characteristics of the power system of Russia



The thermal power plants of Russia based on EBRD's study of 2009

- Many old coal fired units, with more than 220,000 hours, with limited Rehabilitation Plans under "Capitalna Remont"
  - Low achievable maximum load (~75% of nominal)
  - Low availability (~60%) and reliability
  - Low net efficiency (~ 32%) and high carbon (> 1.1 tonCO_2/MWh)
  - Poor Environmental performance (e.g. dust > 500 mg/Nm^3)
- Few new units have been installed in the last 25 years, and even these are not Best Available Techniques (BAT), with design and operational performance indicators of the 80's, so
  - Very few super-critical steam for coal fired plants
  - Some Combined Cycle Gas Turbines (CCGT) for gas fired plants

The thermal power plants of Russia based on EBRD's study of 2009

- Most of the Russian and Ukrainian equipment manufacturers have not fully passed transition to market conditions and there is great scope to improve in order to approach their European peers, especially in terms of:
  - Design and manufacturing technologies for overall achievable net efficiency
  - Quality of materials and machining processes
  - Customer service
- There is great need for new state-of-the-art units as well as rehabilitation and modernisation of existing units, especially for:
  - Coal preparation systems (conveyors, crushing, mixing etc.)
  - Boilers (burners, economisers, super-heaters etc.)
  - Reconstruction of turbine parts (cylinders, rotors, blades etc.)
  - Reconstruction of generators (rotors, stators, excitation, cooling etc.)
  - Installation of modern DCS systems

Technical Assistance to our clients

- Free of charge Technical Assistance (TA) through donors funds
- The overall aim of this advisory services is to assist both the Bank and its clients in the preparation of the most appropriate Rehabilitation or New Unit Programme

How EBRD can help

Two recent projects in Russia

- USD 150 million loan to TGK-8 for the installation of a new 410 MW CCGT at Krasnodar CHP
- Improve electricity operational efficiency from 32 to more than 55%
- Natural gas savings of around 390 million Nm^3 per year
- Carbon emission savings of around 750,000 ton CO_2 per year

- USD 75 million loan to TGK-13 for the completion of a 185 MW / 270 Gcal coal fired cogeneration unit at Krasnoyarsk CHP-3
- The unit will replace old and inefficient heat only boilers and electric boilers
- Improve overall resource efficiency by around 15%
- Carbon emission reduction of around 240,000 ton CO2 per year

New TA Framework for the Power Sector

- At this moment tendering for 3-4 framework contracts of total value EUR 1.5 million for Technical and Efficiency Audits / Projects Review / Projects Preparation for
  - Thermal Power Generation and Cogeneration plants of any technology and configuration;
  - Hydropower generation;
  - Grid connected renewable sources, i.e. wind, small hydro, biomass, solar, geothermal and waste to energy;
  - Power Transmission systems, including lines, substations, SCADA systems etc.
  - Gas and Power Distribution systems, including lines, substations, smart metering systems etc.

Typical Dilemma for coal fired TPP

	Investment Cost (EUR/kW)	Expected Lifetime (years)	Net Efficiency (%)	Availability (%)
New Unit	1,000 – 1,500	35	> 40	85
Rehabilitation of Old Unit	250 – 400	10 – 15	Improvement of 3 – 5 percentage points to 35%	Improvement of 10 – 15 percentage points to 75%

Resource Efficiency

Target Performance Indicators

Rehabilitation

- Extend lifetime for 15 years
- Improve availability by 10 pc points
- Improve efficiency by 3-5 pc points
- Improve environmental performance (what and how much?)

New Units

- Electricity only
  - Gas, CCGT only with efficiency > 52% (390 $kgCO_2$/MWh)
  - Coal, SC parameters with efficiency > 42% (860 $kgCO_2$ /MWh)
- CHP
  - cogeneration efficiency > combined efficiency for separate generation > 80%
  - Gas, GT open cycle or CCGT
  - Coal, SC steam parameters

Resource Efficiency

Typical Technical & Economic Characteristics

Type	Investment Cost (EUR/kW)	Net Efficiency (%)	Carbon $kgCO_2/MWh$
Coal SC and USC Steam Cycle	1,000 to 1,500	Electricity only: 40-45 CHP – el: 30-35 - heat: 40-50	750 – 900
Gas Turbine with HRSG (open cycle)	600 to 850	Electricity only: 32-36 CHP – el: 32-36 - heat: 40-50	560 – 630
Gas Turbine Combined Cycle	800 to 1,200	Electricity only: 50-55 CHP – el: 30-40 - heat: 40-50	370 – 410

Key challenges

- Need for improved performance requirements; resource efficiency pays back fast
- Need for relevant preparation actions at all levels for the introduction of Carbon Capture Storage (CCS) principles (CCS-ready units)
- Need for significant investments (many new units and many modernisations) in parallel with the privatisation and regulation improvements of the power generation sector
- Need for international know-how transfer to the major manufacturers of equipment