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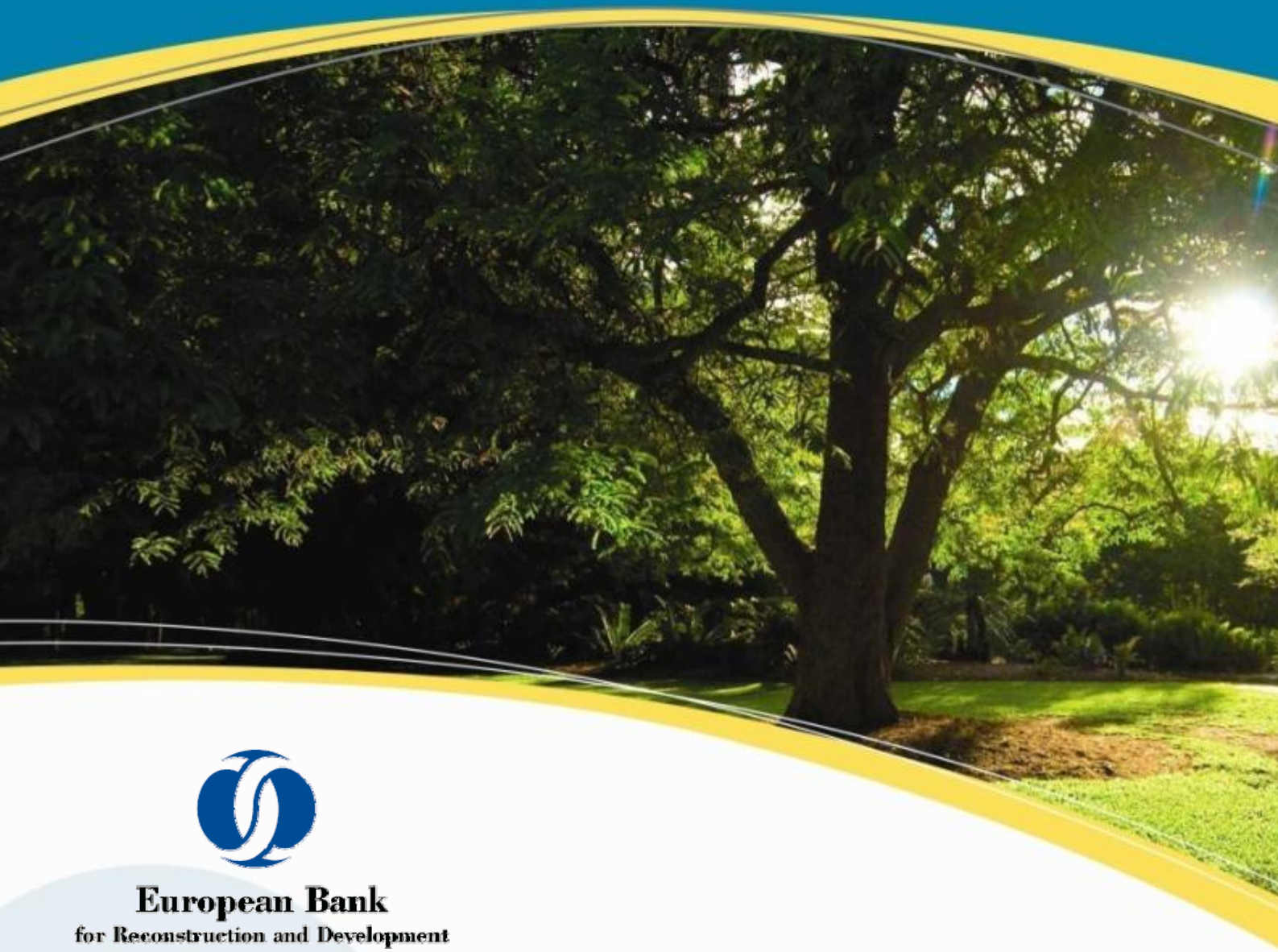

European Bank
for Reconstruction and Development

Electricity Emission Factors Review

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		2008	2009	2010	2011	2012	Source
Albania	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.074	0.074	0.074	0.074	0.074	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.140	0.140	0.140	0.140	0.140	Grid loss = 47% (IEA, 2006)
Armenia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.437	0.437	0.437	0.437	0.437	PDD Argichi small hydroelectric CDM project, 2008[1]
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.508	0.508	0.508	0.508	0.508	Grid loss = 14% (IEA, 2006)
Azerbaijan	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.723	0.723	0.723	0.723	0.723	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.831	0.831	0.831	0.831	0.831	Grid loss = 13% (IEA, 2006)
Belarus	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.468	0.463	0.459	0.454	0.450	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.526	0.520	0.516	0.510	0.506	Grid loss = 11% (IEA, 2006)
Bosnia & Herzegovina	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.831	0.831	0.831	0.831	0.831	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	1.039	1.039	1.039	1.039	1.039	Grid loss = 20% (IEA, 2006)
Bulgaria	$EF_{grid,produced}$ (t_{CO2}/MWh)	1.059	0.947	0.908	0.884	0.833	PDD Sreden Iskar Cascade HPP Portfolio Project 2006[2]
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	1,217	1.088	1.040	1.016	0.957	Grid loss = 13% (IEA, 2006)
Croatia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.563	0.554	0.545	0.536	0.527	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.623	0.622	0.612	0.602	0.592	Grid loss = 11% (IEA, 2006)
Estonia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.703	0.687	0.672	0.657	0.642	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.799	0.781	0.764	0.747	0.730	Grid loss = 12% (IEA, 2006)
Georgia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.333	0.333	0.333	0.333	0.333	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.383	0.383	0.383	0.383	0.383	Grid loss = 13% (IEA, 2006)
Hungary	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.701	0.687	0.674	0.661	0.648	PDD Biomass retrofit at AES Borsod power plant 2008[3]
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.779	0.763	0.749	0.734	0.720	Grid loss = 10% (IEA, 2006)
Kazakhstan	$EF_{grid,produced}$ (t_{CO2}/MWh)	1.355	1.355	1.355	1.355	1.355	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	1.506	1.506	1.506	1.506	1.506	Grid loss = 10% (IEA, 2006)

[1] Source: Public Service Regulatory Commission of Armenia. State of the PDD: Approved.
[2] Source: "Baseline Study of Joint Implementation Projects in the Bulgarian energy sector", 2005. State of the PDD: Approved.
[3] Source: Ministry of Economic Affairs of the NL. State of the PDD: Approved.

Kyrgyz Republic	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.114	0.114	0.114	0.114	0.114	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.158	0.158	0.158	0.158	0.158	Grid loss = 28% (IEA, 2006)
Latvia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.354	0.354	0.354	0.354	0.354	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.400	0.400	0.400	0.400	0.400	Grid loss = 11% (IEA, 2006)
Lithuania	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.626	0.626	0.626	0.626	0.626	PDD Rudaiciai wind power park project 2006[4]
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.688	0.688	0.688	0.688	0.688	Grid loss = 9% (IEA, 2006)
FYR Macedonia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.873	0.873	0.873	0.873	0.873	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	1.078	1.078	1.078	1.078	1.078	Grid loss = 19% (IEA, 2006)
Moldova	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.521	0.521	0.521	0.521	0.521	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.660	0.660	0.660	0.660	0.660	Grid loss = 21% (IEA, 2006)
Mongolia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.800	0.800	0.800	0.800	0.800	PDD Taishir Hydropower Project, 2007[5]
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0,909	0,909	0,909	0,909	0,909	Grid loss = 12% (IEA, 2006)
Poland	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.699	0.684	0.669	0.653	0.638	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.768	0.752	0.735	0.718	0.701	Grid loss = 9% (IEA, 2006)
Romania	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.595	0.584	0.574	0.564	0.553	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.676	0.664	0.652	0.641	0.628	Grid loss = 12% (IEA, 2006)
Russia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.504	0.498	0.492	0.486	0.479	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.566	0.560	0.553	0.546	0.538	Grid loss = 11% (IEA, 2006)
Serbia & Montenegro	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.792	0.792	0.792	0.792	0.792	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.943	0.943	0.943	0.943	0.943	Grid loss = 16% (IEA, 2006)
Slovak Republic	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.547	0.539	0.531	0.523	0.514	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.582	0.573	0.560	0.556	0.547	Grid loss = 6% (IEA, 2006)
Slovenia	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.667	0.654	0.640	0.626	0.613	Ministry of Economic Affairs of the NL, 2004
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0,710	0,690	0,681	0,661	0,652	Grid loss = 6% (IEA, 2006)

[4] Source: AB Lietuvos Electrine Dataset, PDD approved.
[5] Source: Mongolian Government, PDD approved.

Tajikistan	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.064	0.064	0.064	0.064	0.064	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.075	0.075	0.075	0.075	0.075	Grid loss = 15% (IEA, 2006)
Turkey	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.605	0.605	0.605	0.605	0.605	US Energy Information Administration, 2007
	$EF_{grid,reduced}$(t_{CO2}/MWh)	0.703	0.703	0.703	0.703	0.703	Grid loss = 14% (IEA, 2006)
Turkmenistan	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.521	0.521	0.521	0.521	0.521	US Energy Information Administration, 2007
	$EF_{grid,reduced}$(t_{CO2}/MWh)	0.620	0.620	0.620	0.620	0.620	Grid loss = 16% (IEA, 2006)
Ukraine	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.807	0.807	0.807	0.807	0.807	Standardized Emission Factors for the Ukranian Electricity Grid (Global Carbon, 2007)
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.896	0.896	0.896	0.896	0.896	Standardized Emission Factors for the Ukranian Electricity Grid (Global Carbon, 2007)
Uzbekistan	$EF_{grid,produced}$ (t_{CO2}/MWh)	0.558	0.558	0.558	0.558	0.558	US Energy Information Administration, 2007
	$EF_{grid,reduced}$ (t_{CO2}/MWh)	0.613	0.613	0.613	0.613	0.613	Grid loss = 9% (IEA, 2006)

Objective of the assignment

MWH was retained to carry out a review of carbon emission factors and of primary energy factor electricity for different countries. The main purpose of the activity is to provide updated and reliable values for the elaboration of PDDs (Project Design Documents).

Terminology

- EF (Emission Factor)$_{grid,produced}$ is used to calculate emissions for projects supplying additional electricity to the grid (t_{CO2}/MWh);
- EF (Emission Factor)$_{grid,reduced}$ is used for projects reducing electricity consumption from grid (t_{CO2}/MWh);

Examined sources

The review of the Emission Factors has been firstly based on the analysis of the approved Project Design Documents registered on the official website of UNFCCC. The documents found have provided reliable values of Emission Factors (grid, produced) for Armenia, Bulgaria, Hungary, Latvia, Lithuania, Mongolia and Ukraine.

For the countries where registered project design documents are not available, an accurate research has been conducted on various official websites and documents.

We retain that the most reliable of these sources is the “Operational Guidelines for PDDs of JI Projects, May 2004”, elaborated from the Ministry of Economic Affairs of the Netherlands in order to facilitate the development of project design documents. This publication has provided data for Belarus, Croatia, Estonia, Hungary, Latvia, Poland, Romania, Russia, Slovak Republic and Slovenia.

For Ukraine the document “Standardized Emission Factors for the Ukranian Electricity Grid, 2007” elaborated by the Global Carbon B.V. (made possible by funding of EBRD and the Netherlands’ Ministry of Economic Affairs) has been referred to.

For the remaining countries, data has been gathered from the document “US Energy Information Administration, based on data from the following sources: International Energy Agency (IEA), Electricity Information Database 2007 and CO_2 Emissions from Fuel Combustion Database 2006, http://www.iea.org, October 2007”.

In order to calculate the emission factors for projects reducing electricity consumption from grid ($EF_{grid,reduced}$) the following definition has been applied.

$$EF_{grid,reduced} = \frac{EF_{grid,produced}}{1 - losses}$$

The grid losses for each country have been calculated on the basis of the data quoted in the IEA Statistics updated to 2006.