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Impact report of the NRW.BANK.Green Bond

Findings of the analysis of greenhouse gas emissions avoided by the
NRW.BANK.Green Bond 2016

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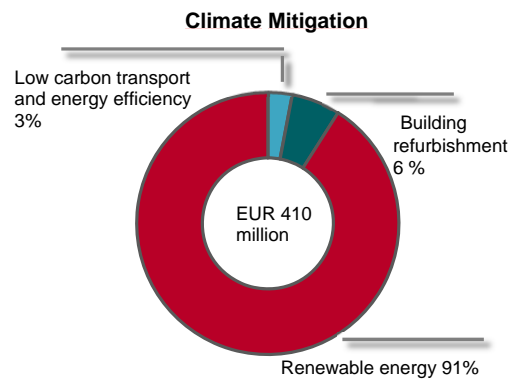
On behalf of



On behalf of NRW.BANK, Wuppertal Institut has analysed the impact of the asset pools of the NRW.BANK.Green Bond 2016. The analysed asset pool has a volume of EUR 523 million. The projects selected fall into the categories “Climate Mitigation” (EUR 410 million) and “Climate Adaptation” (EUR 113 million). From this pool, the Bank issued the EUR 500 million 10-year Green Bond. The asset pool provides additional room for private placements.

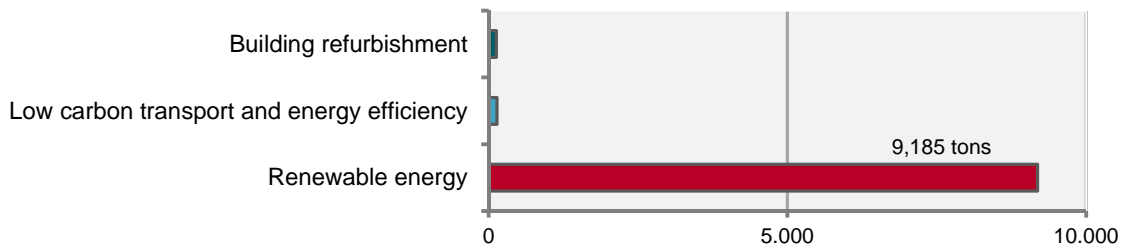
This analysis assesses the pro-rata contributions to climate protection by the refinanced EUR 410 million investments in the "Climate Mitigation" category. The projects relate to

- expansion of renewable energy (wind energy and photovoltaic),
- energy efficiency measures and low carbon transport as well as
- refurbishment of residential buildings.



It has been calculated that these projects will avoided greenhouse gas emissions of 3.4 million tons of CO₂ equivalents over the 10-year term of the Green Bond. Measured by the size of the analysed asset pool of EUR 523 million, 685 tons of CO₂ equivalents are annually saved per EUR 1 million.

CO₂ equivalents saved by investments of EUR 1 million over a term of 10 years (based on the investment volume of EUR 410 million)



In relation to the pro-rated financing, onshore wind turbine generators have proven to be the most efficient form of investment for the avoidance of greenhouse gas emissions in the Green Bond (960 tons per year and EUR 1 million). All investments will continue to avoid greenhouse gases also beyond the maturity of the Green Bond.

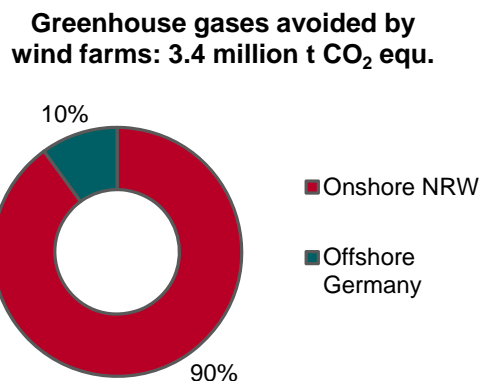
The impact analysis complies with the recommendations of the “Harmonized Framework for Impact Reporting¹“. The greenhouse gas emissions of wind turbine generators and photovoltaic systems as well as energy-efficient trams were calculated over their entire lifecycles. Due to the limited availability of data, the calculation for efficiency loans and efficient buildings covers only the upstream chains of the energy sources used.

¹ Green Bonds - Working Towards a Harmonized Framework for Impact Reporting

The energy supplied by conventional energy sources as well as the average thermal energy requirements of residential buildings have been used as the benchmark for the calculation of the potential savings (in NRW or Germany, depending on the context).

Promotion of wind energy

The newly built wind farms considered in the Green Bond asset pool with a total capacity of 1 GW (thereof 232 MW onshore in NRW) were realised with a promotion portion of 9% (82% for onshore). The WPGs produce an estimated 3,700 GWh of electricity per year. Over a period of ten years, the wind farms in the Green Bond asset pool (EUR 372 million) avoid 3.4 million tons of CO₂ equivalents. Onshore WPGs installed in NRW account for about 90% of the avoided greenhouse gas emissions.



Promotion of photovoltaic systems

An amount of EUR 3.7 million of the Green Bond asset pool relates to the expansion of the largest PV site in Germany (Tagebau Hochland). Based on an output of 4 MW, 33,500 tons of CO₂ equivalents are avoided over a period of ten years.

Promotion of energy-efficient buildings

The refurbishment of residential buildings in NRW contained in the Green Bond asset pool totalling EUR 25.8 million has an estimated promotion portion of 90%. Compared to the existing building stock, this helps to avoid about 3,300 tons of CO₂ equivalents over a period of ten years.

Promotion of low carbon transport

In 2016, NRW.BANK provided EUR 10 million to purchase eight energy and climate-efficient trams (Variotrams) in Bochum. This helps to avoid about 1,100 tons of greenhouse gas emissions over a period of ten years. This measure is part of a larger order of a total of 42 Variotrams by 2020.

Efficiency loans for enterprises

The asset pool of the Green Bond also includes EUR 2.0 million for energy efficiency and resource efficiency measures in enterprises. This results in 600 tons of avoided greenhouse gases over a period of ten years.

The Annex lists the results in accordance with the Framework for Impact Reporting of Green Bonds.

Annex

The tables below show the results of the impact analysis in detail and according to the requirements of the Framework for Impact Reporting of Green Bonds.

Renewable Energy (RE)	Signed amount	Share	Eligibility for green bonds	RE component	Min. credit period	Annual energy generation		Renewable energy capacity added		Annual GHG emissions reduced/avoided	
Project name	million EUR	%	% of signed amount	% of signed amount	in years	GWh/a		MW		in 1,000 tonnes of CO2-equivalents	
						100%	financed	100%	financed	100%	financed
Wind energy, onshore NRW	317.0	82.3%	100%	100%	10	385.5	311.1	232.5	191.3	377.3	304.5
Wind energy, offshore Germany	51.4	1.4%	100%	100%	10	3,350.0	46.8	798.0	11.4	2,422.3	33.9
Solar power, photovoltaic	3.7	100%	100%	100%	10	3.7	3.7	4.0	4.0	3.4	3.4
Energy Efficiency (EE) and low carbon transport	Signed amount	Share	Eligibility for green bonds	EE component	Min. credit period	Annual energy savings				Annual GHG emissions reduced/avoided	
Project name	million EUR	%	% of signed amount	% of signed amount	in years	GWh/a				in 1,000 tonnes of CO2-equivalents	
						100%	financed			100%	financed
Refurbishment	25.8	90.0%	100%	74%	10	1.3	1.3			0.37	0.33
Low carbon transport	10.0	30.3%	100%	n/a	10	n/a	n/a			0.57	0.11
Efficiency loans	2.0	54.4%	100%	100%	10	0.3	0.2			0.11	0.06

The impact analysis is confined to the avoidance of greenhouse gas emissions on the basis of IPCC 2007 (GWP 100a).

The calculations for the renewable energy plants are based on five different plant types for wind energy as well as one PV site over the lifecycle (20 years each). 1,658 gross full load hours p.a. and a building cost flat rate of EUR 1,523/kW for onshore wind energy were taken as the basis². By contrast, the calculation of offshore and PV systems is based on the expected costs and operating performance of the Veja Mate and Merkur wind farms in the Green Bond as well as the PV system at Tagebau Hochland.

The conservative estimate of the greenhouse gas efficiency of the new Variotrams in Bochum is based on the results of an eco-balance of the tram manufacturer, generic data sets for the production of trams and the operating results for the entire network of Bochum-Gelsenkircher Straßenbahnen Aktiengesellschaft BOGESTRA in 2015.

The potential savings in the heat consumption of residential buildings are based on the average energy consumption of residential buildings in NRW and estimated costs for the partial and full refurbishment of multi-family homes³ as well as a full refurbishment efficiency of 35% (reduction in primary energy requirements), assuming a calculated promotion portion for the energy efficiency measures of 74%; this reflects the underlying assumption that 90% of the construction costs are covered by promotion funds and that one in ten buildings is not only maintained and energy-refurbished but is also made barrier-free. The avoidance of greenhouse gases through energy loans and residential buildings results from the specific greenhouse gas equivalents for heat generation from gas and heating oil in Germany as well as electricity generation and district heat supply in NRW⁴. All factors comprise the upstream chains of the energy sources but not the lifecycles of the infrastructure required for conversion.

² Fraunhofer IWES (2015). Wind Energy Report 2014

³ ARGE e.V. (2012). Typical energy consumption figures of German residential buildings, IWU-Tagung Darmstadt and ARGE e.V. (2016). Refurbishment or new building, GRE-Kongress Kassel

⁴ Energy balances of the federal states, as at 23 December 2015, <http://www.lak-energiebilanzen.de>