

Impact analysis of the NRW.BANK.Green Bond #1-2025

Results of the evaluation of greenhouse gas
emissions avoided through the
NRW.BANK.Green Bond #1-2025
(ISIN: DE000NWBoAY4)

commissioned by



This report is based on the results of a study conducted on behalf of NRW.BANK.
The authors are responsible for the content.

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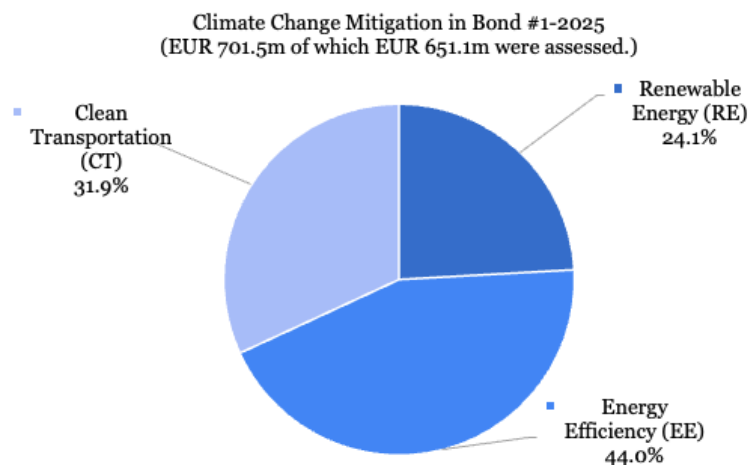
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On behalf of NRW.BANK, Wuppertal Institute has analysed the impact of the asset pools of the NRW.BANK.Green Bond #1-2025. The Bond has a volume of EUR 750m. The projects selected for this impact report fall into the category “Climate Change Mitigation” and have a volume of EUR 701.5 m (of which 92.8% could be assessed). These measures contributed to (financed) greenhouse gas emission savings of **171,000 tonnes¹ of CO₂-equivalents per year** (t CO₂e/a).

This analysis assesses the pro-rata contributions to climate protection made by the refinanced investments. The projects relate to:

- expansion of renewable energy (wind power, solar power, energy storage),
- increased energy efficiency (construction & modernisation of buildings; broadband expansion, heat storage),
- low carbon transportation (e-mobility, public/freight transport, construction machinery).



The impact analysis complies with the recent recommendations of the “Harmonized Framework for Impact Reporting²” in 2024. It has been calculated that these projects will avoid greenhouse gas emissions of 171,000 tonnes of CO₂-equivalents annually and 1.20 million tonnes over the 7-year term of the NRW.BANK.Green Bond #1-2025. Considering actual emissions in the State of North Rhine-Westphalia (NRW) of 179 million tonnes of CO₂-equivalents in 2024³, the financing of projects in the asset pool represents an annual reduction of about 0.67%. As the current Climate Action Plan of the State requires a reduction of GHG emissions by 65% until 2030⁴ (additional net reduction of 50 million tonnes), the 7-year reduction potential of projects in this Green Bond also represents circa 2.4% of the required reduction from 2024 onward.

Measured by the size of the analysed asset pool of EUR 651m for Climate Change Mitigation, 263 tonnes of CO₂-equivalents are saved per million EUR per year. For the total Bond volume of EUR 750m, annual GHG savings of 228 tonnes of CO₂-equivalents per million EUR and year are estimated. The following figure shows the effects of GHG savings for each project category per million EUR. In relation to the pro-rated financing, wind power (representing 97% of all induced GHG reductions), solar power and renewable energy storage (including batteries for photovoltaics) are the most efficient form of investment for the avoidance of greenhouse gas emissions in the NRW.BANK.Green Bond #1-2025.

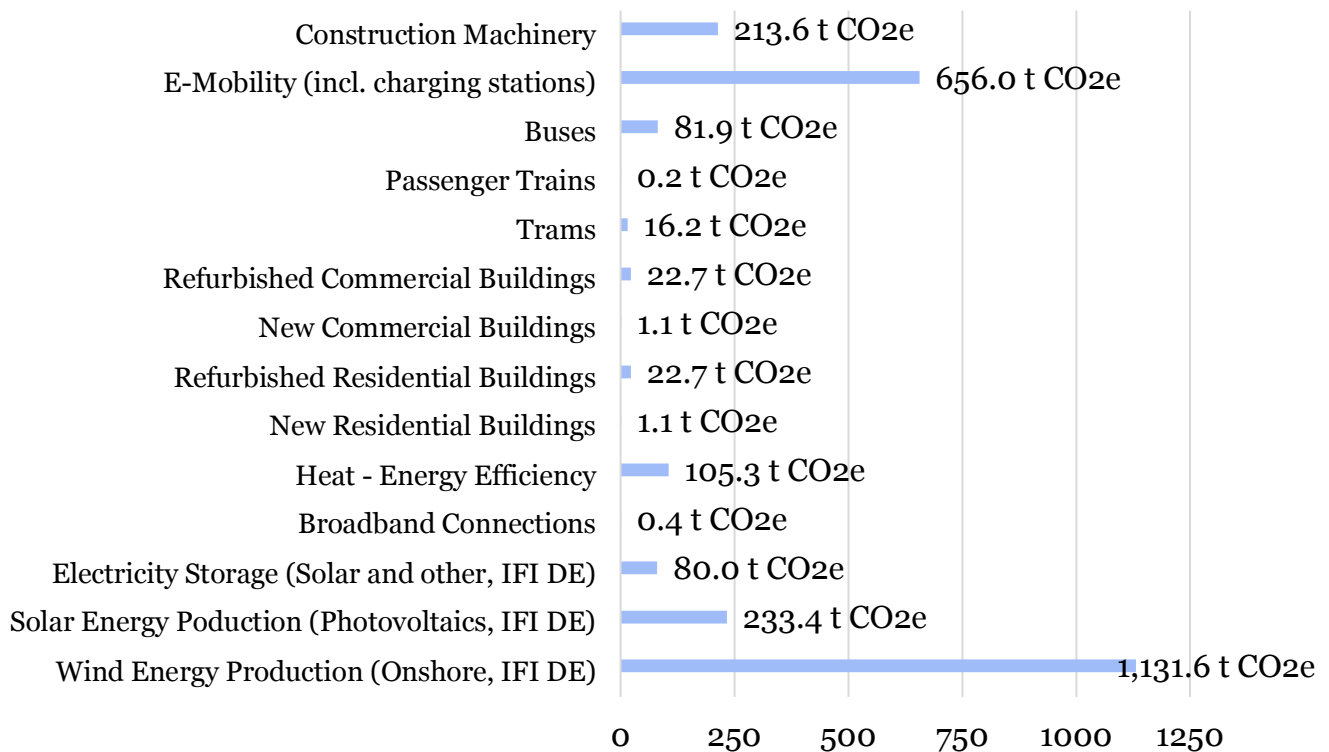
¹ All values for greenhouse gas (GHG) emissions refer to metric tonnes of CO₂-equivalents (GWP 100a).

² see also <https://www.icmagroup.org/assets/documents/Sustainable-finance/2024-updates/Handbook-Harmonised-Framework-for-Impact-Reporting-June-2024.pdf>

³ see also <https://umweltindikatoren.nrw.de/klima-energie-effizienz/treibhausgasemissionen> (preliminary results for 2024)

⁴ „Gesetz zur Neufassung des Klimaschutzgesetzes Nordrhein-Westfalen“ (Act to amend the North Rhine-Westphalia Climate Protection Act) from the 8th of July 2021

GHG Savings per Million EUR and year (263 tonnes on average)



All investments will continue to avoid greenhouse gases beyond the maturity of the Bond. New buildings for example are associated with very long service times of 50 years and more.

Update of Methodology

We continued to update our methodology in alignment with the best-practices in the market and updated also the underlying emission intensities and costs-factors when available and feasible. The full methodology is described in an additional report that will be published at <https://wupperinst.org/en/p/wi/p/s/pd/2356>. Compared to our last impact report, the following changes or additions were made.

Storage capacity, in particular for renewable energy production, has increased in importance for both the German electricity grid and the financing by NRW.BANK. Although there are some additional GHG savings effects from the energy buffer provided by these systems, this relationship is not a direct substitution on the annual timescale. The new methodology accounts for these facts by (i) reducing the amount of direct GHG savings from renewable energy production, (ii) assuming that a portion of this production directly feeds into storage and then (iii) shifting some of the savings from replacing fossil fuels to the output of energy storage systems in Germany over the course of a year.

Moreover, improvements in data granularity by the issuer now allows a more accurate estimation of GHG effects from renewable energy production by accounting for the location, and the potential for energy production at these locations (higher full-load hours for locations with more wind or higher solar radiation compared to the German average and vice versa).

Further, and minor changes, include updates of emission factors and other relevant sources for calculation such as the assumed costs of residential and non-residential buildings.

Promotion of Wind Energy

The newly built wind farms, as shown in Figure 1) with a total capacity of 183 MW (onshore) were realized with a promotion portion of circa 90%⁵ (representing 165 MW). The wind turbines produce an estimated 505 GWh of electricity per year (of which 454 GWh/a is financed). Over one year, the wind farms in the Green Bond asset pool (EUR 145m) avoid 182,800 tonnes of CO₂-equivalents overall and 164,600 tonnes attributed to the financing alone.

Promotion of Solar Energy

Renewable electricity production from solar energy (as shown in Figure 1) was promoted with EUR 6.8m. The solar panels (photovoltaics) have a capacity of 4.9 MW_p from on-roof installations (with a share of financing of 90%⁵). These systems are expected to produce circa 4.9 GWh of renewable electricity annually (of which 4.4 GWh are financed). They help to avoid ca. 1,800 tonnes of CO₂-equivalents per year and 1,600 tonnes attributed to financing alone.

Wind power (left) and photovoltaic power (right) production of NRW.BANK Green Bond #1-2025 projects in North-Rhine Westphalia [indicated by their investment size in green and their location in relationship to the overall potential (darker colors indicate higher energy potentials)]

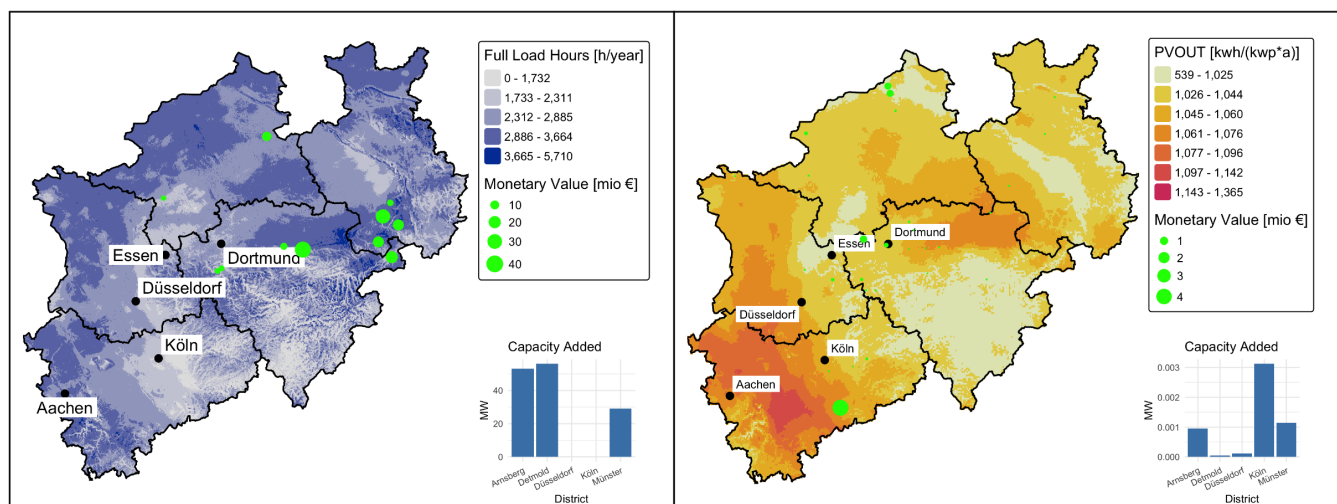


Figure 1: Locations of wind and solar power projects in NRW.BANK.Green Bond #1-2025

Promotion of Energy Storage

The promotion of energy storage (including the portion attributed for batteries in on-roof photovoltaics from the previous section) amounts to EUR 0.21m with a share of financing of 90%⁵. This represents an additional storage capacity of 0.31 MW and an energy buffer of 50 MWh over the course of a year (of which 0.29 MW are directly financed). This is equivalent to circa 20 tonnes of CO₂-equivalents that will be avoided due to this service.

⁵ The total share of financing for renewable energy production is not known, because some projects include financing for other purposes related to renewable energy plants. NRW.BANK estimates that 90% of the total costs for energy production and storage are provided via its loans.

Promotion of Broadband Connections

Circa 2,200 new broadband connections are promoted with EUR 9.6m (100% share of financing). These connections are estimated to reduce the annual energy demand by 10 MWh per year and to annual GHG savings of 4 tonnes CO₂ equivalents.

Promotion of Heating Efficiency⁶

The financing of projects aimed at reducing heat use in the economy amounts to EUR 1.4m with an assumed share of financing of 100%. This represents energy savings (heat) of 0.63 GWh/a and is estimated to avoid GHG emissions of 150 tonnes of CO₂-equivalents.

Promotion of Residential Buildings

The construction of new residential buildings (919) was promoted with EUR 204.7m. All buildings are considered green in line with the loan conditions of the issuer and thus achieve a maximum primary energy demand of circa 40 kWh/m²*a (KfW 40). This translates into energy savings of 0.93 GWh/a compared to the minimum German building standard and annual GHG emission reductions of 220 tonnes of CO₂-equivalents.

The renovation of buildings (141) in the residential sector was promoted with EUR 9.7m (100% share of financing). It is estimated that these renovations contribute to 0.55 GWh/a of savings in heat demand. By comparison with the heat production mix of buildings in stock, these savings potentially avoid annual GHG emissions of 130 tonnes of CO₂-equivalents.

Promotion of Non-Residential Buildings

New commercial energy-efficient buildings (34) are financed with EUR 71.4m with a promotion portion of 100%. These buildings are anticipated to save 0.24 GWh of heat annually when compared to current buildings standards (new buildings in Germany). This, in turn, contributes to potential GHG savings of 60 tonnes of CO₂-equivalents per year.

The renovation of non-residential buildings (24) was promoted with EUR 13.4m with a share of financing of 100%. It is estimated that these renovations contribute to 0.43 GWh/a of savings in heat demand and consequently to potentially avoided GHG emissions of 100 tonnes of CO₂-equivalents.

Promotion of Passenger-Trains and their infrastructures

The projects in the Bond promote the grid extension and the refurbishment of vehicles for local and regional passenger trains. EUR 130.3m were financed with a promotion portion of circa 6%. These measures likely lead to the replacement (modal shift) of 8.3 million car driven pkm (of which 0.5 million pkm are directly financed), which in turn induces GHG savings of 390 tonnes of CO₂-equivalents per year (20 tonnes financed).

⁶ The issuer attributed the underlying project to the category of "renewable energy systems", but we treat it as increased energy efficiency instead to ensure alignment with the GHG reduction methodology applied in this impact report.

Promotion of Public Tram Systems

Financing of EUR 29.5m with a promotion share of 38% leads to the replacement and refurbishment of old trams to increase the energy efficiency of the vehicles in use (with annual performance of 218 million pkm of which 83 million pkm are financed). It is estimated that this improvement leads to annual GHG savings of 1,260 tonnes of CO₂-equivalent (with a directly financed effect of 480 tonnes).

Promotion of Public Bus Systems

New buses are financed with EUR 26.6m and a promotion share of circa 33%, which in turn replace fossil-fuelled buses by hybrid or electric vehicles over 189.6 million pkm per year (of which 62.2 million pkm are directly financed). Compared to the base-case (overall fossil-fuelled Buses in Germany), these projects help to avoid 6,600 tonnes of CO₂-equivalents per year (of which 2,180 tonnes are directly financed).

Promotion of E-Mobility

The acquisition of climate-efficient vehicles and installation of charging stations is financed (EUR 1.7m) with a promotional share of 95%. It is estimated that this represents 11.3 million passenger-kilometres (10.8 million passenger-kilometres financed) and 0.154 million km in travelled distance for freight (of which 0.146 million km are financed)⁷. These improvements in the area of clean transportation contribute to annual GHG savings of approximately 1,120 tonnes (financed) and 1,190 tonnes (overall) of CO₂-equivalents.

Promotion of electric construction machines

The investment into electric construction machines is financed with circa EUR 0.3m (100% promotion). These acquisitions do not directly translate into travelled distances, but replace emission from direct fossil combustions with electricity use and its emissions over their lifetime. We estimate that this effect helps to avoid 60 tonnes of CO₂-equivalents.

Outlook

Many projects in the bond have lower GHG reduction or avoidance potentials than renewable energy production, either or both due to their costs and direct effects for GHG emission replacements. Moreover, there are also projects that might lead to GHG reductions in the long run but cannot be modelled to do so from a purely interventionist perspective (e.g. construction activities in electrical grids). Future impact reports will therefore investigate whether these projects can be associated with other quantifiable environmental or social co-benefits in a robust manner (e.g. on the additional benefits of broadband connections). This is likely to include categories that were previously not assessed for this series of impact reporting (such as water management or biodiversity measures).

⁷ The results in the tables in the annex add up these two distances to 11.5 million passenger/freight km (of which 10.9 million km are financed).

Appendix: Results

The basic rationale of the impact assessment as well as the reporting of the results is in line with current market practices as proposed in the ICMA Green Bond Principles and the Harmonized Framework for Impact Reporting. The main indicator for all projects is greenhouse gas (GHG) emissions avoided (ex-ante, potentials, contributed by financing, against a baseline) in the form of global warming potential savings (GWP 100a). A detailed description of the methods as well as additional assumptions and data points can be found in the supplementary method report and its annex (containing the R-script for calculation).

Projects related to renewable energy production refer to the IFI *combined margin* (CM) electricity mix for Germany (IFI Germany), that incorporates the generating capacity of the current system to be likely displayed by renewable energy projects (*build margin*) as well the cohort of power plants that are most likely affected by them (*operation margin*).

Renewable Energy (RE) A	Signed Amount	Share of Total Project Financing	Eligibility for green bonds	RE Component (estimate)	Allocated Amount	Portfolio Lifetime (average)	Annual generation		Renewable energy capacity added		Case	Reduced/Avoided annual GHG emissions			Absolute annual GHG emissions	
Energy Production	million €	%	%	%	million €	In years (7 year term GB)	GWh/a		MW		Emission factor	kt CO2-eq. / a		t CO2-eq. / (a*million €)	kt CO2-eq. / a	
							100%	financed	100%	financed		100%	financed	per unit of financing	100%	financed
Wind energy, onshore	145.4	90%	100%	100%	145.4	18.5	504.8	454.4	182.8	164.5	IFI Germany	182.8	164.6	1,131.6	0.42	0.38
Solar energy, roof ^{a)}	6.8	90%	100%	100%	6.8	14.5	4.9	4.4	4.9	4.4	IFI Germany	1.8	1.6	233.3	0.00	0.00
TOTAL RE-A	152	90%	100%	100%	152	18	510	459	188	169	IFI Germany	185	166	1,091	0.4	0.4
Renewable Energy (RE) B	Signed Amount	Share of Total Project Financing	Eligibility for green bonds	RE Component (estimate)	Allocated Amount	Portfolio Lifetime (average)	Energy buffered		Storing capacity added		Case	Reduced/Avoided annual GHG emissions			Absolute annual GHG emissions	
Energy Storage	million €	%	%	%	million €	In years (7 year term GB)	GWh/a		MW		Emission factor	kt CO2-eq. / a		t CO2-eq. / (a*million €)	kt CO2-eq. / a	
							100%	financed	100%	financed		100%	financed	per unit of financing	100%	financed
Energy Storage	0.21	90%	100%	100%	0.21	14.0	0.05	0.05	0.31	0.28	IFI Germany	0.02	0.02	80.0	0.00	0.00
TOTAL RE-B	0.2	90%	100%	100%	0.2	14	0.1	0.0	0.3	0.3	IFI Germany	0.02	0.02	80	0	0

a) When no information was given, roof installation was assumed

Energy Efficiency (EE) A	Signed Amount	Share of Total Project Financing	Eligibility for green bonds	EE Component (estimate)	Allocated Amount	Portfolio Lifetime (average)	Annual Energy Savings		New connections added			Reduced/Avoided annual GHG emissions			Absolute annual GHG emissions	
non-buildings	million €	%	%	%	million €	in years	GWh/a					kt CO2-eq. / a	t CO2-eq. / (a*million €)	kt CO2-eq. / a		
							100%	financed	100%	financed		100%	financed	per unit of financing	100%	financed
Broadband	9.6	100%	100%	100%	9.6	27.5	0.01	0.01	2,218	2,218		0 ^{b)}	0 ^{b)}	0.39	0.00	0.00
Heat ^{c)}	1.4	100%	100%	100%	1.4	9.8	0.63	0.63				0.15	0.15	105.27	0.29	0.29
TOTAL EE-A	11	100%	100%	100%	11	25	1	1	2,218	2,218		0.15	0.15	14	0	0

b) The direct GHG savings from new broadband connections are too small to be directly depicted in this table in a meaningful manner. Thus, future impact reports will investigate co-benefits as well.

c) This refers to energy savings from electrification and is originally attributed to "Renewable Energy" by the issuer. We position it in the category of non-buildings energy efficiency instead and appropriate the "assessed" financed volume accordingly.

Energy Efficiency (EE) B	Signed Amount	Share of Total Project Financing	Eligibility for green bonds	EE Component (estimate)	Allocated Amount	Portfolio Lifetime (average)	Annual Energy Savings			Number of Buildings	Reduced/Avoided annual GHG emissions			Absolute annual GHG emissions		
buildings	million €	%	%	%	million €	in years	GWh/a				[1]	in 1,000 tonnes of CO2-equivalents		t CO2-eq. / (a*million €)	in 1,000 tonnes of CO2-equivalents	
							100%	financed				100%	financed	per unit of financing	100%	financed
Residential buildings (new built) ^{d)}	204.7	100%	100%	100%	204.7	30.8	0.93	0.93			919	0.22	0.22	1.07	0.55	0.55
Non-Residential buildings (new built)	71.4	100%	100%	100%	71.4	20.6	0.24	0.24			34	0.06	0.06	0.81	0.14	0.14
Residential buildings (refurbished)	9.7	100%	100%	100%	9.7	23.7	0.55	0.55	141	0.13	0.13	13.33	0.24	0.24		
Non-Residential buildings (refurbished)	13.4	100%	100%	100%	13.4	14.4	0.43	0.43	24	0.10	0.10	7.55	0.19	0.19		
TOTAL EE-B	299	100%	100%	n.a.	299	27	2.15	2.15		1,118	0.5	0.5	1.7	1.1	1.1	

d) Energy efficiency standard for each building is assumed to achieve at least KfW40 due to alignment mit KW loan conditions.

Clean Transportation (CT)	Signed Amount	Share of Total Project Financing (estimate)	Eligibility for green bonds	CT Component (estimate)	Allocated Amount	Portfolio Lifetime (average)	Passenger-kilometres Transport-kilometres			Case	Reduced/Avoided annual GHG emissions			Absolute annual GHG emissions	
	million €	%	%	%	million €	in years	million pkm/a million km/a (transports)			mode of reduction	in 1,000 tonnes of CO2-equivalents		t CO2-eq. / (a*million €)	in 1,000 tonnes of CO2-equivalents	
							100% financed				100% financed	per unit of financing		100% financed	
Trams	29.5	38%	100%	100%	29.51	17.9	218.3	82.8		improve	1.26	0.48	16.23	12.49	4.74
Passenger Trains	130.3	6%	100%	100%	130.30	31.9	8.3	0.5		shift	0.39	0.02	0.18	0.07	0.00
Buses	26.6	33%	100%	100%	26.61	9.9	189.6	62.6		improve	6.60	2.18	81.90	11.22	3.71
E-mobility & Charging Stations ^{iv}	1.7	95%	100%	100%	1.71	8.8	11.5	10.9	improve	1.19	1.12	656.02	0.88	0.84	
Construction Machinery ^v	0.3	100%	100%	100%	0.27	8.0			improve	0.06	0.06	213.57	0.27	0.27	
TOTAL CT	188	41%	100%	100%	188	26	428	157		n.a.	9.5	3.9	20.5	24.9	9.6

e) Small portions of "e-mobility" are attributed to charging stations for lorries. These additional distances in km/a are added to pkm/a for passengers.

f) For the acquisition of building machinery passenger-kilometres don't apply. Therefore lifecycle wide emissions were allocated annually on the machines lifetime.