Impact Report #2 of the Green Bond Baden-Württemberg

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Impact Report commissioned by the Ministry of Finance Baden-Württemberg

Results for Climate Change Mitigation, Climate Change Adaptation, Water & Marine Resources, Circular Economy, Pollution Prevention, Biodiversity & Ecosystems

Wuppertal Institut

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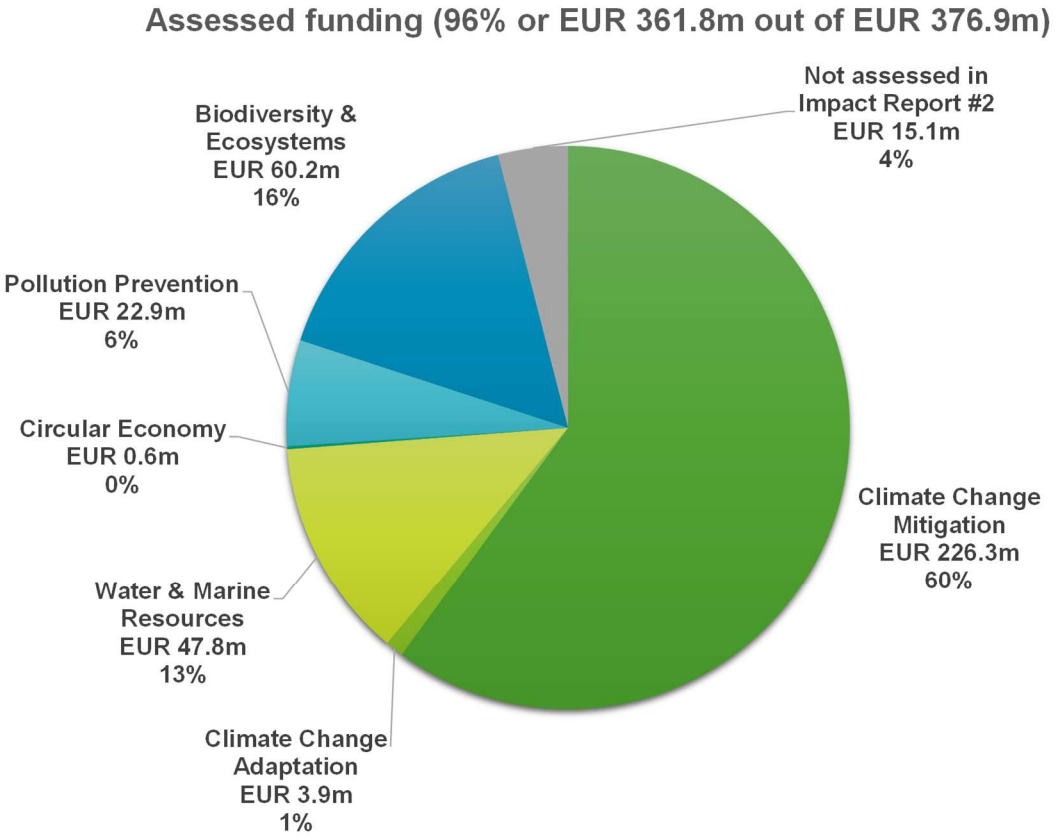
Executive Summary

The State of Baden-Württemberg issued its second Green Bond in May 2022 (#2) with a volume of 350 million Euro and referring to the state's expenditure in 2021 (EUR 376.9m). Wuppertal Institut has been commissioned with the impact reporting (#2) and evaluation of its compliance with the do-no-significant-harm (DNSH) criteria of the EU taxonomy regulation. The report describes the results of this assessment in line with the ICMA's *Harmonised Framework for Impact Reporting (ICMA 2022)* as well as the current proposal for a European Green Bond Standard.

The Green Bond's impact orientation is aligned with the UN Sustainable Development Goals (SDGs), the state's sustainability strategy as well as the environmental objectives of the taxonomy regulation. The issuer has published an updated Green Bond Framework in May 2022, a second-party-opinion (SPO) and an allocation report (Ministerium für Finanzen Baden-Württemberg 2022; Ministry of Finance Baden-Württemberg 2022; MOODY´S ESG Solutions 2022). The bond comprises 58 eligible projects, covering all six environmental objectives.



The report investigates positive changes from 52 projects, representing 96% of the total financing. The majority of the assessed projects can be attributed to the objectives *Climate Change Mitigation* (26 projects, EUR 226m) and *Biodiversity & Ecosystems* (11 projects, EUR 60m). Another large portion is allocated to the objective *Pollution Prevention* with expenditures of EUR 23m for 7 projects. In total, 141 indicators were selected, qualified and quantified (see "Results"). The indicator-quality can be considered *best-practice* (quality C) for 26 projects, representing a "high likelihood of substantial contribution" to the taxonomy objectives. Moreover, an intermediate-outcome could be found in 10 of these 26 projects. We consider such desired outcomes (quality B) as "strong evidence for a substantial contribution" to the taxonomy objectives.

Risk Assessment for potential violations of DNSH criteria

None of the assessed projects in the Green Bond pose a high or even medium risk for significant damage to any of the objectives. It is therefore unlikely that any of the projects violates the DNSH criteria. Low or minimal risks could be identified for 14 out of all 58 projects, of which 7 projects require individual assessments to ensure compliance with the generic criteria on climate change adaptation. The issuer is currently investigating whether additional information, or additional third-party assessments can be employed to ensure full conformity for these projects (almost all of which relate to the construction, refurbishment, or ownership of buildings).

Climate Change Mitigation

Expenditures of 241 million Euro or 60% of the eligible funding contributes to the objective of climate change mitigation. Out of these funding, 26 projects with an eligible amount of EUR 226m were assessed for the impact report (94% of EUR 241m). These expenditures can be associated with total investments of at least 1,560m for all actors (e.g., if a project is financed with a share of 40% then another 60% of the costs needed to be invested).

The project with the largest contribution is the expansion of broadband connections in the State of Baden-Württemberg (28% of eligible amounts for climate change mitigation). It is estimated that 20,000 new connections were potentially realized with the help of the financing alone. This relates to approximately 140,000 connections overall for 2021. Considering the increased energy-efficiency of these connections, we estimate that 700 tons of GHG emissions are saved per year in total, with an annual "financed" effect of 150 tons CO_2-equivalents.

The next two larger contributions are related to newly constructed public buildings (EUR 54m) and the refurbishment of the existing building stock (EUR 20m). In total, 24 building investments were part of the Bond that contribute to GHG savings of 3,700 tons per year (the "financed" effect is estimated at circa 300 tons). The new buildings have 86% lower GHG emissions compared to the emissions of the state's building stock in the 1990s. For the refurbishment, an effect of 82% lower emissions could be estimated.

Other assessed measures in this category also contribute to the reduction of GHG emissions or enable other stakeholders do so with the help of scientific research (e.g. by the Karlsruhe Reallabor for Sustainable Climate Protection), loans to SMEs (e.g. from the Enhanced Resource Efficiency Programme) or funding for local communities (e.g. for energy-efficient heat networks).

Climate Change Adaptation

Two projects contributing to climate change adaptation were selected by the issuer of which both projects were assessed in the report. The expenditures in this category make up for 1% of the total EUR 377m. The "Timber Construction Initiative" promotes timber buildings, of which more than 6,700 could be approved in 2021. The actual activity itself is reported with 45 events with stakeholders held in this year. However, the main contribution in this category stems from "subsidies for the development of climate-resilient forests". The re- or afforested area amounts to 1,500 ha in total in 2021, of which 600 ha can be directly attributed to the financing. These forests help to store 149,000 tons of carbon (60,000 tons attributed to the funding alone) and absorb more than 1,700 tons of carbon every year (700 tons attributed to the funding).

Water & Marine Resources

Two projects were selected by the issuer in this category and both of them were quantified on the level of activities. In regard to the bond, 126 measures related to sewerage infrastructures were funded in 2021 with circa EUR 34m (100% financial share). In addition, another 58 measures can be related to the supply of clean water (with a funding of EUR 14m). In total, 166 communities in the State of BW profited from the programmes.

Circular Economy

All projects were assessed in this category. Although these projects represent only a small portion of the Green Bond (EUR 0.6m), a clear contribution to the overall objective can be shown. Four nuclear power plants are currently under investigation for material recovery (from the project "RecTecKA") and seven theses were finished as a consequence of the new hybrid Professorship for "Sustainability Research and Transformative Research". In addition, future potentials for phosphorus recovery from sewage sludge is estimated at 1.4 tons per year and the new research facility INATECH will house more than 100 employees in the future.

Pollution Prevention

The majority of projects could be assessed for the report at hand. Out of total expenditures of EUR 23.0m, seven projects with EUR 22.9m (or 99%) could be associated with positive changes towards the environmental objective. The largest contribution can be attributed to the project "low-emission bus transportation" (EUR 12m), where 224 out of 358 approvals are explicitly dedicated to purchasing low- or even zero-emission public vehicles. Additional mobility-projects relate to the purchase of pedelecs for the state police (93 vehicles with total expenditures of EUR 0.2m in 2021) as well as the establishment of additional express bus lines (with a length of more than 60 km in the region of Stuttgart).

Other projects contribute to direct pollution control such as the installation of air filter cubes (reducing local air emissions by circa 10%) and the remediation of contaminated sites (40 implemented measures in 2021 with total expenditures of EUR 6m).

Biodiversity & Ecosystems

Eleven projects with expenditures of EUR 60m were assessed that contribute to the "protection and restoration of biodiversity and ecosystems". This represents all expenditures in this category and 16% of the total expenditures in the Bond. Five desired outcomes ("best-in-class" indicators) could be identified and quantified, all of which are associated with additional protected areas (15,800 ha as well as 7,500 biotopes) or areas dedicated to sustainable farming (circa 46,000 ha). These projects with total expenditures of EUR 27m can be considered "strong evidence for a substantial contribution" to the EU taxonomy objective.

Other projects in this category promote activities (e.g. 16 funded communities as part of the "exemplary regions for organic farming") or research related to organic farming (e.g. three scientific publications from the research programme "Organic Farming").

Outlook

A number of projects assessed here will also be part of future Green Bonds. The reporting will integrate these annual effects into an accumulated presentation. It is also intended to investigate whether additional evidence for desired outcomes can be found that indicate long-term improvements towards the overarching environmental objectives.

Results

The following tables list all indicators identified for the impact report of the second Green Bond Baden-Württemberg. The projects themselves as well as an evaluation of the robustness of the indicators can be found in section 4.

Climate Change Mitigation

Climate Change Mitigation Indicators	Indicator quality	signed amount [1]	Share of financing [2]	Eligibility for green bonds	allocated amount	Indicator name (all indicators refer to 1 year of funding from the State's budget)	Indicator unit	Annual Effects [3]	
Project Name [4]	[A-G]	million EUR	%	% of signed amount	million EUR			full effect	financed
Notably energy-efficient new buildings in the public building construction (No 2) [5]	B	53.96	8%	100%	50.09	GHG emission reduction compared to 1990	[Δ%]	- 86	- 7
	C*	53.96	8%	100%	50.09	GHG emissions avoided per year	[t CO2e / a]	3,334	252
	D*	53.96	8%	100%	50.09	energy-efficient net floor area added	[squ-m]	136,688	10,337
	E*	53.96	8%	100%	50.09	funding for public buildings	[mEUR]	713.6	54.0
	G	G1: concordance with climate change adaptation criteria has not been ensured (yet)							
Notably energy-efficient restructuring measures in the public building construction (No 3) [5]	B	20.39	13%	100%	18.92	GHG emission reduction compared to 1990	[Δ%]	- 82	- 11
	C*	20.39	13%	100%	18.92	GHG emissions avoided per year	[t CO2e / a]	355	46
	D*	20.39	13%	100%	18.92	energy-efficient net floor area added	[squ-m]	36,916	4,832
	E*	20.39	13%	100%	18.92	funding for public buildings	[mEUR]	155.7	20.4
	F	F1: minimal risk of violating specific criteria for water and marine resources | F2: minimal risk of violationg specific criteria for a circular economy							
	G	G1: concordance with climate change adaptation criteria has not been ensured (yet)							
Strategy for sustainable bio-economy (No 10)	D	2.54	100%	100%	2.36	number of events held	[1]	14	14
	E	2.54	100%	100%	2.36	funding for bio-economy	[mEUR]	2.5	2.5
State funding of broadband (No 12)	B	68.35	14%	100%	63.45	GHG reductions of broadband systems compared to conventional connections	[t CO2e / a]	1,060	150
	C	68.35	14%	100%	63.45	energy savings from network access compared to conventional connections	[MWh / a]	697.3	100
	D	68.35	14%	100%	63.45	additional broadband connections	[1]	142,000	20,000
	E	68.35	14%	100%	63.45	funding for broadband	[mEUR]	480.3	68
GVFG Electrification Projects (No 20)	D	0.75	45%	100%	0.69	additional electricified railway	[km]	12	5
	E	0.75	45%	100%	0.69	funding for electrification of rail traffic	[mEUR]	1.66	0.75
	F	F1: minimal risk of violating generic climate change adaptation criteria | F2: minimal risk of violating generic water and marine resources criteria | F3: minimal risk of violating regulatory criteria for a circular economy | F4: minimal risk of violating generic criteria for biodiversity and ecosystems							
Cycling Culture Initiative (No 21)	E	2.48	100%	100%	2.30	communities funded	[1]	17	17
Support program state initiative electromobility (No 23)	D	35.09	variable	100%	32.57	number of implementations by stakeholders (disbursements)	[1]	9,458	n.a.
	E*	35.09	100%	100%	32.57	number of approvals for electromobility measures	[1]	9,202	9202
	F	F1: minimal risk of violating generic climate change adaptation criteria | F2: minimal risk of violating regulatory criteria for a circular economy | F3: minimal risk of violating regulatory criteria for pollution prevention							
Support Program for Municipal Cycling and Pedestrian Infrastructure (No 24)	E	4.08	100%	100%	3.79	communities funded	[1]	36	36
Cycling Routes Network (No 25)	E	0.43	100%	100%	0.40	communities funded	[1]	721	721
Fast Cycling Routes (No 26)	C	2.20	100%	100%	2.04	km bicycle lanes	[km]	1	1
	E	2.20	100%	100%	2.04	funding for communities	[mEUR]	2.20	2.20
eLNG (e-Liquefied Natural Gas) from Air (No 28)	C	0.43	8%	100%	0.40	future absorbance rate of CO_2	[kg/h]	0.7	n.a.
	D	0.43	3%	100%	0.40	development of a demonstrator	[%]	100	3
	E	0.43	3%	100%	0.40	climate change mitigation funding	[mEUR]	15.48	0.43
High Efficiency Solar Cells (No 29)	C	3.80	11%	100%	3.53	no. of persons working at site in the future (approved)	[1]	68	8
	D	3.80	11%	100%	3.53	research building construction (and equipment)	[%]	100	11
	E	3.80	11%	100%	3.53	funding for research infrastructure	[mEUR]	34.00	3.80
	G	G1: concordance with climate change adaptation criteria has not been ensured (yet)							

HyFab BW - New Building (No 31)	C	6.55	n.a.	100%	6.08	no. of future employees (researchers)	[1]	10	n.a.
	D*	6.55	62%	100%	6.08	research building construction	[%]	100	62
	E*	6.55	62%	100%	6.08	funding for research infrastructure	[mEUR]	10.50	6.55
	G	G1: concordance with climate change adaptation criteria has not been ensured (yet)							
Energy-efficient heat networks (No 36)	E*	3.20	100%	100%	2.97	communities funded	[1]	4	4
	F	F1: minimal risk of violating generic climate change adaptation criteria | F2: minimal risk of violating generic water and marine resources criteria | F3: minimal risk of violating regulatory criteria for a pollution prevention | F4: minimal risk of violating generic criteria for biodiversity and ecosystems							
INPUT: Intelligent parking & underground garages (No. 37)	E*	3.76	100%	100%	3.49	projects funded	[1]	25	25
	F	F1: minimal risk of violating generic climate change adaptation criteria | F2: minimal risk of violating generic criteria for biodiversity and ecosystems							
Solar Battery Storage Systems (No 38)	C*	2.22	n.a.	100%	2.06	renewable storage capacity added (estimate)	[MWh]	n.a.	5.9
	E*	2.22	n.a.	100%	2.06	funding for renewable battery capacity	[1]	n.a.	2
Regional centers of excellence for energy efficiency (No 39)	C*	0.86	n.a.	100%	0.80	evaluated energy efficiency measures in companies	[1]	36	n.a.
	D*	0.86	n.a.	100%	0.80	energy consultations in companies	[1]	107	n.a.
	E*	0.86	100%	100%	0.80	number of arranged consultations	[1]	1,752	1,752
Enhanced Resource Efficiency Programme/ Combi loan for SMEs with climate premium (No 40)	D*	2.50	100%	100%	2.32	number of loans by housebanks	[1]	175	175
	E*	2.50	100%	100%	2.32	funding for resource efficiency in SMEs	[mEUR]	2.50	2.50
KARLA - Karlsruhe Reallabor for Sustainable Climate Protection (No 47)	C*	0.08	7%	100%	0.08	no of published peer-reviewed articles	[1]	1	0.07
	D*	0.08	7%	100%	0.08	no of activities (presentations, articles, etc.)	[1]	9	0.63
	E*	0.08	7%	100%	0.08	no of projects funded	[1]	4	0.28
CAMPUS high i - Intelligent and user-oriented planning processes for climate neutrality in buildings [...] (No 48)	B	0.17	n.a.	100%	0.15	future GHG reduction (estimated, building 1)	[t CO2e / a]	200	n.a.
	E*	0.17	17%	100%	0.15	no of funded projects	[1]	4	0.68
Climate Connect industrial area Donautal (KliConn) (No 49)	D*	0.08	5%	100%	0.08	no. of workshops conducted	[1]	3	0.15
	E*	0.08	5%	100%	0.08	funding for climate change mitigation strategies	[mEUR]	1.66	0.08
MobiQ - Sustainable mobility through sharing in the neighborhood (No 50)	D*	0.12	9%	100%	0.11	no of events with citizens	[1]	5	0.45
	E*	0.12	9%	100%	0.11	funding for real-world laboratories	[mEUR]	1.30	0.12
Reallabor for climate-neutral Reutlingen (Klima-RT-LAB) (No 51)	D*	0.19	17%	100%	0.18	no of projects (measure bundles)	[1]	11	1.87
	E*	0.19	17%	100%	0.18	funding for real-world laboratories	[mEUR]	1.14	0.19
Mobility Living Lab (MobiLab) Stuttgart (No 52)	C	0.40	n.a.	100%	0.37	no of jobs (mobility-authority)	[1]	1	n.a.
	D*	0.40	94%	100%	0.37	no of projects	[1]	5	4.70
	E*	0.40	94%	100%	0.37	funding for real-world laboratories	[mEUR]	0.42	0.40
Regional Innovation Centre for Energy Technology (No 55)	D*	0.02	0.2%	100%	0.02	research buildings constructed	[%]	100	0.2
	E*	0.02	0.2%	100%	0.02	funding for building construction	[mEUR]	9.90	0.02
	G	G1: concordance with climate change adaptation criteria has not been ensured (yet)							
Planning and construction of cycle routes on state roads (No 57)	C	11.69	100%	100%	10.85	constructed cycle-paths	[km]	19	19
	E*	11.69	100%	100%	10.85	funding of cycle route construction	[mEUR]	11.69	11.69
TOTAL FUNDING Climate Change Mitigation [6]	E	**226**	**15%**	**100%**	**210**	**induced project costs and capital [6]**	**[mEUR]**	**1,554**	**226**

* accumulative indicators (**annual financed effects** can be summed up over more than one impact report)

[1] Represents "allocated amount" in the ICMA (2021) Standard (p. 62, "c/"). For the issuer, this refers to the actual annual expenditure (net, only funds from the State's budget).

[2] These allocated costs refer to the total funding (e.g. when reporting number of projects) or total costs (e.g. when reporting effects), including perennial cost fractions when the overall share of the State is at 100%.

[3] "full effect" refers to the (annual) indicator value for the entire project, while the "financed effect" refers to the attribution of the State in the given year only.

[4] Projects can be listed more than once if more than one indicator is reported. The number in brackets refers to the number of the project in the project list of the issuer.

[5] The GHG effects (B and C) are estimated with the help of a simplified model. Due to the use of primary energy demands of the building, the effects are likely to be underestimated in terms of actual savings.

[6] The share of financing is not known for each project or cannot be quantified for this granularity. In these cases, the share of financing was approximated for the purpose of this indicator.

Climate Change Adaptation

Climate Change Adaptation Indicators	Indicator quality	signed amount [1]	Share of financing [2]	Eligibility for green bonds	allocated amount	Indicator name (all indicators refer to 1 year of funding from the State's budget)	Indicator unit	Annual Effects [3]	
Project Name [4]	**[A-G]**	**million EUR**	**%**	**% of signed amount**	**million EUR**			**full effect**	**financed**
Timber Construction Initiative BW (No 7)	C*	2.15	n.a.	100%	2.00	no of approved timber buildings	[1]	6,780	n.a.
	D*	2.15	100%	100%	2.00	no of events	[1]	45	45
	E*	2.15	100%	100%	2.00	funding for sustainable construction	[mEUR]	2.2	2.2
Subsidies for the development of climate resilient forests and/or (re-)afforestation (No 11)	B*	1.77	40%	100%	1.64	annually absorbed carbon (carbon sink)	[t C/a]	1,737	695
	C*	1.77	40%	100%	1.64	stored carbon (biomass above and below ground) [5]	[t C]	149,011	59,605
	D*	1.77	40%	100%	1.64	promoted forest area	[ha]	1,497	599
	E*	1.77	40%	100%	1.64	funding for forest-related measures	[mEUR]	4.4	1.8
TOTAL Climate Change Adaptation	E	**3.9**	**60%**	**100%**	**4**	**induced project costs and capital [7]**	**[mEUR]**	**7**	**4**

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[2] These allocated costs refer to the total funding (e.g. when reporting number of projects) or total costs (e.g. when reporting effects).

[3] "full effect" refers to the (annual) indicator value for the entire project, while "financed" multiplies this effect with the share of total project financing.

[4] Projects can be listed more than once if more than one indicator is reported. The number in brackets refers to the number of the project in the project list of the issuer. Some project names were shortened for a better display.

[5] The stored carbon continues to be stored (and has been stored in the past) unless forest is removed or otherwise changed. Only additional protected areas can add to this indicator in the future.

Water and Marine Resources

Water and Marine Resources Indicators	Indicator quality	signed amount [1]	Share of financing [2]	Eligibility for green bonds	allocated amount	Indicator name (all indicators refer to 1 year of funding from the State's budget)	Indicator unit	Annual Effects [3]	
Project Name [4]	**[A-G]**	**million EUR**	**%**	**% of signed amount**	**million EUR**			**full effect**	**financed**
Sewerage infrastructure investments (No 42)	C*	33.74	100%	100%	31.32	no of implemented measures	[1]	126	126
	D*	33.74	100%	100%	31.32	no of funded communities	[1]	99	99
	E*	33.74	100%	100%	31.32	funding for remediation activities	[mEUR]	33.7	33.7
Water supply (No 43)	C*	14.11	100%	100%	13.09	no of implemented measures	[1]	58	58
	D*	14.11	100%	100%	13.09	no of funded communities	[1]	67	67
	E*	14.11	100%	100%	13.09	funding for remediation activities	[mEUR]	14.1	14.1
TOTAL Water and Marine Resources	E	**47.8**	**100%**	**100%**	**44**	**induced project costs and capital [7]**	**[mEUR]**	**48**	**48**

* accumulative indicators (**annual financed effects** can be summed up over more than one impact report)

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[2] These allocated costs refer to the total funding (e.g. when reporting number of projects) or total costs (e.g. when reporting effects).

[3] "full effect" refers to the (annual) indicator value for the entire project, while "financed" multiplies this effect with the share of total project financing.

[4] Projects can be listed more than once if more than one indicator is reported. The number in brackets refers to the number of the project in the project list of the issuer.

Circular Economy

Circular Economy Indicators	Indicator quality	signed amount [1]	Share of financing [2]	Eligibility for green bonds	allocated amount	Indicator name (all indicators refer to 1 year of funding from the State's budget)	Indicator unit	Annual Effects [3]	
Project Name [4]	[A-G]	million EUR	%	% of signed amount	million EUR			full effect	financed
New Research Building INATECH (No 30)	C	0.15	1%	100%	0.14	no of future employees	[1]	113	0.7
	D*	0.15	1%	100%	0.14	building construction (research)	[%]	100	0.6
	E*	0.15	1%	100%	0.14	funding for research buildings (circular economy)	[mEUR]	26.0	0.2
	G	G1: concordance with climate change adaptation criteria has not been ensured (yet)							
Phosphorus recovery from sewage sludge (No 41)	C	0.38	5%	100%	0.35	future potentials of recovered phosphorus	[t/a]	1.4	0.1
	D*	0.38	5%	100%	0.35	building construction (fertilizer recovery plant)	[%]	100	4.5
	E*	0.38	5%	100%	0.35	funding for research buildings (circular economy)	[mEUR]	8.3	0.4
Professorship for Sustainability Research and Transformative Research (No 45)	C*	0.06	100%	100%	0.06	finished theses	[1]	7	7
	E	0.06	20%	100%	0.06	funding for research (circular economy)	[mEUR]	0.3	0.1
RecTecKA - Recycling of technology metals from the dismantling of nuclear facilities (No 46)	D	0.02	100%	100%	0.02	no of nuclear plants to be dismantled	[1]	4	4
	E*	0.02	100%	100%	0.02	funding for material recovery research	[mEUR]	0.02	0.02
TOTAL Circular Economy	E	0.6	2%	100%	1	induced project costs and capital [7]	[mEUR]	35	1

* accumulative indicators (**annual financed effects** can be summed up over more than one impact report)

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[2] These allocated costs refer to the total funding (e.g. when reporting number of projects) or total costs (e.g. when reporting effects).

[3] "full effect" refers to the (annual) indicator value for the entire project, while "financed" multiplies this effect with the share of total project financing.

[4] Projects can be listed more than once if more than one indicator is reported. The number in brackets refers to the number of the project in the project list of the issuer.

Pollution Prevention

Pollution Prevention Indicators	Indicator quality	signed amount [1]	Share of financing [2]	Eligibility for green bonds	allocated amount	Indicator name (all indicators refer to 1 year of funding from the State's budget)	Indicator unit	Annual Effects [3]	
Project Name [4]	[A-G]	million EUR	%	% of signed amount	million EUR			full effect	financed
E-Mobility in the car pool of BW police - purchase of motorcycle with electric motor (No 13)	D*	0.04	100%	100%	0.04	purchase of electric vehicles	[1]	1	1
	E*	0.04	100%	100%	0.04	funding for low-emission mobility	[mEUR]	0.04	0.04
E-Mobility in the car pool of BW police - purchase of pedelecs (No 14)	D*	0.23	100%	100%	0.21	purchase of electric vehicles	[1]	93	93
	E*	0.23	100%	100%	0.21	funding for low-emission mobility	[mEUR]	0.23	0.23
	F	F1: minimal risks of violating the generic criteria for climate change adaptation							
Public Air Solutions - Filter Cubes (No 16)	C	1.95	100%	100%	1.81	site-specific reduction of air emissions (N20, PM) [5]	[Δ%]	10	10
	D*	1.95	100%	100%	1.81	additional air filter systems	[1]	15.00	15.00
	E*	1.95	100%	100%	1.81	funding for low-emission mobility	[mEUR]	1.95	1.95
Establishment of express bus lines in the Stuttgart region (No 17)	C	2.09	75%	100%	1.94	additional express bus line length	[km]	61	46
	E*	2.09	75%	100%	1.94	funding for low-emission mobility	[mEUR]	2.79	2.09
	F	F1: minimal risks of violating the generic criteria for climate change adaptation							
Low-emission bus transportation (No 19)	D*	11.47	100%	100%	11.23	approved purchases of low-emission vehicles [6]	[1]	224	224
	E*	12.10	100%	100%	11.23	funding for low-emission mobility	[mEUR]	12.10	12.10
Intelligent public transport in Baden-Württemberg (No 22)	E*	0.44	100%	100%	0.41	funding for low-emission mobility	[mEUR]	0.44	0.44
Remediation of contaminated sites (No 44)	C*	6.07	100%	100%	5.63	implemented measures of remediation	[1]	40	40
	D*	6.07	100%	100%	5.63	funded communities	[1]	24	24
	E*	6.07	100%	100%	5.63	funding for remediation activities	[mEUR]	6.07	6.07
TOTAL Pollution Prevention	E	22.9	97%	100%	21	induced project costs and capital [7]	[mEUR]	24	23

* accumulative indicators (**annual financed effects** can be summed up over more than one impact report)

[1] Represents "allocated amount" in the ICMA (2021) Standard (p. 62, "c/"). For the issuer, this refers to the actual annual expenditure (net, only funds from the State's budget).

[2] These allocated costs refer to the total funding (e.g. when reporting number of projects) or total costs (e.g. when reporting effects), including perennial cost fractions when the overall share of the State is at 100%.

[3] "full effect" refers to the (annual) indicator value for the entire project, while the "financed effect" refers to the attribution of the State in the given year only.

[4] Projects can be listed more than once if more than one indicator is reported. The number in brackets refers to the number of the project in the project list of the issuer.

[5] Estimated effect for different circumstances. The actual evaluated effects can be found at: https://vm.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/wirksamkeit-der-luftfiltersaeulen-bestaetigt/.

[6] 224 out of 358 vehicles are considered low-emission vehicles. The financial input was attributed accordingly at 63%.

Biodiversity and Ecosystems

Biodiversity and Ecosystems Indicators	Indicator quality	signed amount [1]	Share of financing [2]	Eligibility for green bonds	allocated amount	Indicator name (all indicators refer to 1 year of funding from the State's budget)	Indicator unit	Annual Effects [3]	
Project Name [4]	[A-G]	million EUR	%	% of signed amount	million EUR			full effect	financed
Nationalpark Black Forest, new construction visitor and information center (No 1)	D*	2.60	6%	100%	2.42	building construction for environmental education	[%]	100	6.3
	E*	2.60	6%	100%	2.42	funding for environmental education	[mEUR]	41.5	2.6
	G	G1: concordance with climate change adaptation criteria has not been ensured (yet)							
Investing in properties with importance for environmental protection (No 3)	B	2.48	100%	100%	2.31	increase in natural protected area in the State of BW	[%]	1.1%	1.1%
	C*	2.48	100%	100%	2.31	additional protected area	[ha]	132	132
	E*	2.48	100%	100%	2.31	funding for nature conservation and biodiversity	[mEUR]	2.5	2.5
Aid for pruning of meadow orchards (No 5)	C*	3.17	100%	100%	2.95	number of pruned trees	[1]	211,500	211,500
	E*	3.17	100%	100%	2.95	funding for organic/sustainable farming	[mEUR]	3.2	3.2
Preserving steep-hill grassland (No 6)	C*	5.67	100%	100%	5.27	promoted area for organic/sustainable farming	[ha]	46,840	46,840
	D*	5.67	100%	100%	5.27	number of applicants	[1]	8,116	8,116
	E*	5.67	100%	100%	5.27	funding for organic/sustainable farming	[mEUR]	5.7	5.7
Exemplary regions for organic food (No 8)	D	0.74	100%	100%	0.69	number of funded communities	[1]	16	16
	E*	0.74	100%	100%	0.69	funding for organic/sustainable farming	[mEUR]	0.7	0.7
Preserving manually cultivable vineyards in steep slope and terraced areas (No 9)	B	0.96	100%	100%	0.89	increase in organically farmed area in the State of BW	[%]	18.6%	18.6%
	C*	0.96	100%	100%	0.89	additional organically farmed area	[ha]	50	50
	E*	0.96	100%	100%	0.89	funding for organic/sustainable farming	[mEUR]	1.0	1.0
Biotope mapping (No 32)	B	3.59	100%	100%	3.33	increase in biotopes	[%]	3.2%	3.2%
	D*	3.59	100%	100%	3.33	number of updated/new biotopes	[1]	7,480	7,480
	E*	3.59	100%	100%	3.33	funding for nature conservation and biodiversity	[mEUR]	3.6	3.6
Non-productive investments in conservation (No 33)	B	10.16	100%	100%	9.43	additional protected/enhanced eco-friendly area [5]	[ha]	11,445	11,445
	D*	13.92	100%	100%	12.92	funded projects for nature conservation and biodiversity	[1]	5,593	5,593
	E*	13.92	100%	100%	12.92	funding for nature conservation and biodiversity	[mEUR]	13.9	13.9
Special Programme for Biodiversity (No 34)	B	10.02	100%	100%	9.30	additional protected/enhanced eco-friendly area [5]	[ha]	4,208	4,208
	D*	11.01	100%	100%	10.22	funded projects for nature conservation and biodiversity	[1]	1,616	1,616
	E*	11.01	100%	100%	10.22	funding for nature conservation and biodiversity	[mEUR]	11.0	11.0
Nature conservation contracts (No 35)	D	15.76	50%	100%	14.63	no of projects	[1]	6,562	3,281
	E	15.76	50%	100%	14.63	funding for nature conservation and biodiversity [6]	[mEUR]	31.5	15.8
Research Programme Organic Farming (No 54)	C*	0.25	31%	100%	0.23	no of scientific publications	[1]	3	0.9
	D	0.25	31%	100%	0.23	no of held events	[1]	4	1.0
	E	0.25	31%	100%	0.23	funding for organic/sustainable farming	[mEUR]	1.0	0.3
TOTAL Biodiversity and Ecosystems	E	60.2	52%	100%	56	induced project costs and capital [7]	[mEUR]	117	60

* accumulative indicators (**annual financed effects** can be summed up over more than one impact report)

[1] Represents "allocated amount" in the ICMA (2021) Standard (p. 62, "c/"). For the issuer, this refers to the actual annual expenditure (net, only funds from the State's budget).

[2] These allocated costs refer to the total funding (e.g. when reporting number of projects) or total costs (e.g. when reporting effects), including perennial cost fractions when the overall share of the State is at 100%.

[3] "full effect" refers to the (annual) indicator value for the entire project, while the "financed effect" refers to the attribution of the State in the given year only.

[4] Projects can be listed more than once if more than one indicator is reported. The number in brackets refers to the number of the project in the project list of the issuer.

[5] Not all funded projects are monitored for changes of promoted/enhanced areas. The attribution of expenditures is estimated as a fraction of all measures (4,102 out of 5,593) and has therefore been adjusted accordingly.

[6] Share of financing unknown. Typical threshold for most contracts at 50% according to law (assumption here).

[7] The share of financing is not known for each project or cannot be quantified for this granularity. In these cases, the share of financing was approximated for the purpose of this indicator.

Zusammenfassung

Das Land Baden-Württemberg hat im Mai 2022 seinen zweiten Green Bond (#2) mit einem Volumen von 350 Mio. Euro aufgelegt, der sich auf die Ausgaben des Landes im Jahr 2021 (376,9 Mio. Euro) bezieht. Das Wuppertal Institut wurde mit der Wirkungsberichterstattung (#2) und der Bewertung der Einhaltung der Do-no-significant-harm-Kriterien (DNSH) der EU Taxonomie Verordnung beauftragt. Dieser Bericht beschreibt die Ergebnisse der Bewertung in Übereinstimmung mit den Leitlinien für die Wirkungsberichterstattung der ICMA (ICMA 2022) sowie dem aktuellen Vorschlag für einen europäischen Green Bond Standard.

Die Wirkungsorientierung des Green Bonds steht im Einklang mit den UN-Zielen für nachhaltige Entwicklung (SDGs), der Nachhaltigkeitsstrategie des Landes sowie den Umweltzielen der Taxonomie Verordnung. Der Emittent hat im Mai 2022 ein aktualisiertes Green Bond Framework, eine Second-Party-Opinion (SPO) und einen Allokationsbericht veröffentlicht (Ministerium für Finanzen Baden-Württemberg 2022; MOODY'S ESG Solutions 2022). Die Anleihe umfasst 58 förderfähige Projekte, die alle sechs Umweltziele abdecken.

Der Bericht untersucht die positiven Veränderungen bei 52 Projekten, die 96 % der Gesamtfinanzierung ausmachen. Der Großteil der bewerteten Projekte kann den Zielen "Klimaschutz" (26 Projekte, 226 Mio. EUR) sowie "Schutz und Wiederherstellung der Biodiversität" (11 Projekte, 60 Mio. EUR) zugeordnet werden. Ein weiterer großer Teil entfällt auf das Ziel "Vermeidung von Umweltverschmutzung" mit Ausgaben von 23 Mio. EUR für 7 Projekte. Insgesamt wurden 141 Indikatoren ausgewählt, qualifiziert und – größtenteils quantifiziert (siehe "Results"). Die Qualität der Indikatoren kann bei 26 Projekten als Best Practice (Qualität C) angesehen werden, was eine "hohe Wahrscheinlichkeit eines wesentlichen Beitrags" zu den Zielen der Taxonomie bedeutet. Darüber hinaus konnte bei 10 dieser 26 Projekte eine gesellschaftliche Wirkung attestiert werden. Wir betrachten solche gewünschten Auswirkungen oder "desired outcomes" (Qualität B) als "starke Belege für einen wesentlichen Beitrag" zu den Zielen der Taxonomie.

Risikobewertung für mögliche Verstöße gegen die DNSH-Kriterien

Keines der geprüften Projekte im Rahmen des Green Bond birgt ein hohes oder auch nur mittleres Risiko für eine erhebliche Beeinträchtigung eines der Ziele. Es ist daher unwahrscheinlich, dass eines der Projekte gegen die DNSH-Kriterien verstößt. Geringe oder minimale Risiken konnten bei 14 der insgesamt 58 Projekte festgestellt werden, von denen 7 Projekte einer individuellen Prüfung bedürfen, um die Einhaltung der allgemeinen Kriterien zur Anpassung an den Klimawandel sicherzustellen. Der Emittent prüft derzeit, ob zusätzliche Informationen oder zusätzliche Bewertungen durch Dritte erfasst werden können, um die vollständige Konformität dieser Projekte (von denen fast alle den Bau, Sanierung oder Besitz von Gebäuden betreffen) zu gewährleisten.

Klimaschutz

Ausgaben in Höhe von 241 Millionen Euro bzw. 60 % der förderfähigen Mittel tragen zum Ziel der Eindämmung des Klimawandels bei. Von diesen Mitteln wurden 26 Projekte mit einem förderfähigen Betrag von 226 Mio. Euro für den Wirkungsbericht bewertet (94 % der 241 Mio. Euro). Diese Ausgaben können mit Gesamtinvestitionen von mindestens 1.560 Mio. für alle Akteure in Verbindung gebracht werden.

Das Projekt mit dem größten Beitrag ist der Ausbau von Breitbandanschlüssen in Baden-Württemberg (28 % der förderfähigen Beträge für den Klimaschutz). Es wird geschätzt, dass allein mit Hilfe der Finanzierung 20.000 neue Anschlüsse realisiert werden konnten. Dies entspricht einer Gesamtzahl von ca. 140.000 Anschlüssen für das Jahr 2021. Unter Berücksichtigung der erhöhten Energieeffizienz dieser Anschlüsse schätzen wir, dass

insgesamt 700 Tonnen Treibhausgasemissionen pro Jahr eingespart werden, was einem jährlichen "finanzierten" Effekt von 150 Tonnen CO2-Äquivalenten entspricht.

Die beiden nächstgrößeren Beiträge beziehen sich auf neu errichtete öffentliche Gebäude (54 Mio. EUR) und auf die Sanierung des Baubestands (20 Mio. EUR). Insgesamt waren 24 Gebäudeinvestitionen Teil der Anleihe, die zu Treibhausgaseinsparungen von 3.700 Tonnen pro Jahr beitragen (der "finanzierte" Effekt wird auf ca. 300 Tonnen geschätzt). Die neuen Gebäude weisen im Vergleich zu den Emissionen des staatlichen Gebäudebestands in den 1990er Jahren 86 % geringere Treibhausgasemissionen auf. Für die Sanierung konnte ein Effekt von 82 % niedrigeren Emissionen geschätzt werden.

Andere bewertete Maßnahmen in dieser Kategorie tragen ebenfalls zur Verringerung der THG-Emissionen bei oder ermöglichen es anderen Akteuren. Dazu gehören beispielsweise wissenschaftliche Forschung (z. B. durch das Karlsruher Reallabor für nachhaltigen Klimaschutz), Darlehen für kleine und mittelständische Unternehmen (z. B. aus dem Programm für verbesserte Ressourceneffizienz) oder Finanzhilfen für lokale Gemeinden (z. B. für energieeffiziente Wärmenetze).

Anpassung an den Klimawandel

Zwei Projekte, die zur Anpassung an den Klimawandel beitragen, wurden vom Emittenten ausgewählt und in diesem Bericht bewertet. Die Ausgaben in dieser Kategorie machen 1 % der gesamten 377 Mio. EUR aus. Die "Holzbau-Initiative" fördert Holzbauten, von denen bis 2021 mehr als 6.700 genehmigt werden konnten. Die eigentliche Aktivität wird mit 45 Veranstaltungen mit Interessenvertretern in diesem Jahr angegeben. Der Hauptbeitrag in dieser Kategorie stammt jedoch aus den "Subventionen für die Entwicklung klimaresistenter Wälder". Die wiederaufgeforstete oder aufgeforstete Fläche beläuft sich 2021 auf insgesamt 1.500 ha, von denen 600 ha direkt auf die Finanzierung zurückzuführen sind. Diese Wälder tragen dazu bei, 149.000 Tonnen Kohlenstoff zu speichern (60.000 Tonnen sind allein auf die Finanzierung zurückzuführen) und jedes Jahr mehr als 1.700 Tonnen Kohlenstoff zu absorbieren (700 Tonnen sind auf die Finanzierung zurückzuführen).

Nachhaltige Nutzung von Wasser- und Meeresressourcen

In dieser Kategorie wurden vom Emittenten zwei Projekte ausgewählt, die beide auf der Ebene der Aktivitäten quantifiziert wurden. Im Rahmen der Anleihe wurden 126 Maßnahmen im Zusammenhang mit der Abwasserinfrastruktur im Jahr 2021 mit rund 34 Mio. EUR (100%iger Finanzierungsanteil) finanziert. Darüber hinaus sind insgesamt 58 Maßnahmen im Zusammenhang mit der Versorgung mit sauberem Wasser zu nennen (mit einer Finanzierung von 14 Mio. EUR). Insgesamt profitierten 166 Gemeinden im Land BW von den Programmen.

Wandel zur Kreislaufwirtschaft

Alle in dieser Kategorie untersuchten Projekte wurden bewertet. Obwohl diese Projekte nur einen kleinen Teil des Green Bond ausmachen (0,6 Mio. EUR), kann ein deutlicher Beitrag zum Gesamtziel nachgewiesen werden. So werden derzeit vier Kernkraftwerke auf ihre stoffliche Verwertung hin untersucht (aus dem Projekt "RecTecKA"). Zudem wurden im Rahmen der neuen Hybridprofessur für "Nachhaltigkeitsforschung und Transformative Forschung" sieben Dissertationen abgeschlossen. Darüber hinaus wird das künftige Potenzial für die Rückgewinnung von Phosphor aus Klärschlamm auf 1,4 Tonnen pro Jahr geschätzt, und die neue Forschungseinrichtung INATECH wird in Zukunft mehr als 100 Mitarbeiterinnen und Mitarbeiter beherbergen.

Vermeidung von Umweltverschmutzung

Die Mehrzahl der Projekte konnte für den vorliegenden Bericht bewertet werden. Von den Gesamtausgaben in Höhe von 23,0 Mio. EUR konnten sieben Projekte mit 22,9 Mio. EUR (oder 99 %) mit positiven Veränderungen in Verbindung gebracht werden. Der größte Beitrag kann dem Projekt "Emissionsarmer Busverkehr" (12 Mio. EUR) zugeschrieben werden, bei dem 224 von 358 Genehmigungen explizit für die Anschaffung emissionsarmer oder sogar emissionsfreier öffentlicher Fahrzeuge bestimmt sind. Weitere Mobilitätsprojekte betreffen die Anschaffung von Pedelecs für die Landespolizei (93 Fahrzeuge mit Gesamtausgaben von 0,2 Mio. EUR im Jahr 2021) sowie die Einrichtung zusätzlicher Schnellbuslinien (mit einer Länge von mehr als 60 km in der Region Stuttgart).

Andere Projekte tragen zum direkten Umweltschutz bei, wie z. B. die Installation von Luftfilterwürfeln (Verringerung der lokalen Luftemissionen um ca. 10 %) und die Sanierung von Altlasten (40 durchgeführte Maßnahmen im Jahr 2021 mit Gesamtausgaben von 6 Mio. EUR).

Schutz und Wiederherstellung der Biodiversität

Es wurden elf Projekte mit Ausgaben von 60 Mio. EUR bewertet, die zum Schutz und zur Wiederherstellung der biologischen Vielfalt und der Ökosysteme beitragen. Dies entspricht allen Ausgaben in dieser Kategorie und 16 % der Gesamtausgaben in der Anleihe. Fünf gewünschte gesellschaftliche Auswirkungen („Best-in-Class"-Indikatoren) konnten identifiziert und quantifiziert werden, die alle mit zusätzlichen Schutzgebieten (15.800 ha sowie 7.500 Biotope) oder Flächen für nachhaltige Landwirtschaft (ca. 46.000 ha) verbunden sind. Diese Projekte mit Gesamtausgaben von 27 Mio. EUR können als "starker Beleg für einen wesentlichen Beitrag" zum Umweltziel angesehen werden.

Andere Projekte in dieser Kategorie fördern Aktivitäten (z. B. 16 geförderte Gemeinden im Rahmen der "Modellregionen für den ökologischen Landbau") oder forschen im Zusammenhang mit dem ökologischen Landbau (z. B. drei wissenschaftliche Veröffentlichungen aus dem Forschungsprogramm "Ökologischer Landbau").

Ausblick

Viele der hier bewerteten Projekte werden auch Teil zukünftiger Green Bonds sein. Die Berichterstattung wird diese jährlichen Effekte in eine kumulierte Darstellung integrieren. Zudem soll in zukünftigen Wirkungsanalysen untersucht werden, ob sich zusätzliche Belege für gesellschaftliche Auswirkungen finden lassen, die auf langfristige Beiträge zu den Umweltzielen hinweisen.

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No or no	Number or amount
BW	Baden-Württemberg
GHG	Greenhouse gas
GWP	Global warming potential
PEF	Primary energy factor
PED	Primary energy demand

1 Scope and Structure of the Report

The external reviewer (Wuppertal Institut) has conducted an impact assessment of the second Green Bond of the State of Baden-Württemberg (Impact Report #2) from 2022. All funding is related to the state's 2021 expenditure. Effects are usually restricted to the year 2021 but can, in some cases, refer to future effects as well (e.g., ex-ante from plants under construction). Most effects take place within the geographical borders of the state, although some projects can lead to benefits in other countries. The objectives of the report are defined by the issuer as listed below:

- Review of compliance with do-no-significant-harm principle
- Impact Assessment in line with ICMA framework and EU Green Bond Standard proposal
- Consideration of indicators proposed by issuer as well as suitable metrics found in the taxonomy regulation
- Quantification of indicators were possible, both for full and financed effects
- Transparent description of methods and data
- Continuous and further development of methodology, including the presentation of cumulative effects in future reports where possible
- Summary of results in form of an executive summary

The full report has 4 main sections, as listed below:

- Validation of Do-No-Significant-Harm
- Methodology
- Data and Results
- Discussion and Outlook

The Green Bond Framework of the issuer (Ministry of Finance Baden-Württemberg 2022) is in line with the EU taxonomy, which by itself is aligned to the environmental objectives of the EU environmental action program (EAP). Some of these objectives address slightly different targets at once such as the sustainable use of water bodies compared to the protection of marine resources. We use a matching table (see table 1-1), to condense and abbreviate the targets in the report at hand. Each abbreviation or short-term relates to all targets defined by each objective.

table 1-1: matching table for environmental objectives in the EU taxonomy regulation

Environmental objective	Short name	Abbreviation
Climate change mitigation	Climate Change Mitigation	CM
Climate change adaptation	Climate Change Adaptation	CA
The sustainable use and protection of water and marine resources	Water & Marine Resources	WM
The transition to a circular economy	Circular Economy	CE
Pollution prevention and control	Pollution Prevention	PP
Protection and restoration of biodiversity and ecosystems	Biodiversity & Ecosystems	BE

2 Validation of Do-No-Significant-Harm

The issuer's Green Bond Framework (Ministry of Finance Baden-Württemberg 2022) intends to address (if eligible programs and projects are available in a given year) all six environmental objectives in the European Union as defined by the EU Taxonomy regulation[1]. This is achieved by describing and assigning eligible projects to one of the objectives (termed "significant contribution" in the language of the regulation). A second-party opinion was published that corroborates this attribution (MOODY´S ESG Solutions 2022).

In line with Article 17 of that regulation, the issuer also discusses alignment with the "do no significant harm" criteria (abbreviated DNSH in the language of the regulation) to any of the other five objectives. The issuer's framework states in this regard:

"Fulfilment of "do-no-significant-harm" criteria as specified in the EU Taxonomy for sustainable activities in Article 17: Eligible green projects should, to a reasonable extent, be assessed to comply with the Do No Significant Harm ("DNSH") criteria. Such assessment is carried out by relevant experts within the ministries associated with the respective expenditures, to the best of their abilities. Demonstrating full alignment with the DNSH criteria may be challenging or unfeasible for certain public expenditure programmes, such as subsidy programmes and tax relief schemes. In such cases, any gaps in relation to alignment with the EU Taxonomy, e.g. due to lack of information, will be communicated transparently" (Ministry of Finance Baden-Württemberg 2022 p. 11)

The report at hand is part of this communication by investigating whether any of the projects in the bond poses a high risk of violating these criteria.

2.1 Validation method

The Taxonomy applies to economic activities that are mainly classified according to NACE[2] codes and focused on companies. The projects in the Green Bond on the other hand mostly refer to state programs. Although there are companies involved (e.g., when financially incentivized or profiting from free counselling services), the logic of the Taxonomy does not fully comply as some of the effects will occur outside of the funding and fiscal responsibility of the state. In addition, only parts of the entire economy are eligible to Taxonomy criteria (e.g., agricultural activities are currently not included).

It is therefore not feasible to review whether these programs are in line with specific do-no-harm criteria, unless

- there is a high probability for considerable damage ("high risk"),
- the project or program can be clearly matched to a NACE category where DNSH criteria are well-defined,
- and these DNSH criteria include requirements beyond national or European environmental regulation and laws[3].

The approach outlined here consists of a 4-step process. First (1), we evaluate whether there is either "no risk", "low risk" or "high risk" for violating the heuristic DNSH criteria in Article

[1] The environmental objectives of the EU taxonomy regulation are originally based on the 7th Environment Action Programme EAP (http://data.europa.eu/eli/dec/2013/1386/oj).

[2] NACE (Nomenclature statistique des activités économiques dans la Communauté européenne) is the most common classification system for economic activities in the EU. It is almost exclusively used for European Statistics or European Input-/Output-Tables.

[3] It can be safely assumed that companies and other actors only receive funding if they comply to national and European environmental laws.

17 of the Taxonomy regulation. Secondly (2), we check for the availability and feasibility of specific DNSH criteria in cases where a risk is anticipated (projects outside the taxonomy can still have a high risk but cannot be reviewed here). Thirdly (3), specific DNSH criteria are evaluated where applicable with the goal of conclusively identifying projects with a high risk. Fourthly (4), an individual risk assessment is conducted when a minimal risk of DNSH violations was identified in steps 1 to 3 or if both the risk evaluation in step 1 indicated a risk and such a risk could not be excluded due to being subject to generic DNSH criteria in the taxonomy.

2.2 Step 1: Heuristic risk assessment

Article 17 of the Taxonomy defines significant harm to environmental objectives in a more heuristic manner. Step 1 of the validation process is an expert review by the authors to check whether there is a high risk in any of the projects.

Two types of definitions are necessary for that process. Firstly, the term *high risk* needs to be defined. Secondly, the description of the harm criteria needs to be framed in the form of *control questions* that can be easily and, more importantly, clearly evaluated. The third and final step is applying these criteria to all projects in the Green Bond.

2.2.1 Definition of high risk

Most of the DNSH criteria refer to environmental risks[4]. A full environmental risk assessment (ERA) is an extensive process, requires state-of-art methodologies and data and is usually conducted by a team of experts for different areas of protection (see Suter (2001) for a comparison between environmental monitoring and risk assessment). This type of assessment is outside of the scope of the report at hand. Instead, high risk is defined by comparing the consequences (damages) of the project with the current status quo or the most common alternative:

"Projects have a high risk of violating DNSH if the magnitude of the potential damage and the likelihood for its occurrence are unequivocally higher (above reasonable variation) than the current practice or economic activity (including absence of these activities)"

The restriction for "[...] reasonable variation [...]" refers to the comparison of systems that are very similar. This usually leads to small differences of effects also (e.g., of caused GHG emissions) that are mainly caused by variability of input parameters or their co-dependence on other systems. Both probability and potential damage should be higher not only in some, but in all cases ("unequivocally") or at least it cannot be ruled out by the reviewing expert.

The two parts of the definition (magnitude and likelihood) are evaluated separately, so there can also be a *high likelihood of some damage* and a *small likelihood of significant*[5] *damage*. We distinguish three cases:

1 | no risk: there is no high likelihood or significant damage anticipated
2 | low risk: there is either a high likelihood or significant damage anticipated
3 | high risk: both high likelihood and significant damage are anticipated

As a consequence, projects deemed to have "no risk" in any of the objectives are not further investigated. Only projects with "low risk" or "high risk" are further processed for step 2

[4] We refer to risks on the environment and not to risks from the environment for health. Another term that can be used instead is "ecological risks".

[5] We use the term "significant" in line with its use in the EU Taxonomy ("significant contribution") rather than its formal meaning in statistics. Synonyms for its use are "considerable" or "noteworthy".

(Applicability of Taxonomy), step 3 (Evaluation of DNSH criteria) and step 4 (Identification of indicators).

2.2.2 Control Questions

We distinguish four types of DNSH criteria:

- heuristic criteria (heu): the set of DNSH definitions described in Art. 17 of the regulation
- regulatory criteria (reg): criteria for DNSH violations that refer to adhering to European or national laws and regulations
- generic criteria (gen): criteria for DNSH violations (formulated in the annex of the regulation) that require an individual assessment but do not refer to specific economic activities
- specific criteria (spe): specific technical criteria for DNSH violations that refer to the economic activity they are associated with

The following figure shows the heuristic criteria for significant-harm in the EU Taxonomy regulation. These are used to develop control question for the first evaluation step.

figure 2-1: article 17 of the Taxonomy Regulation

Article 17

Significant harm to environmental objectives

1. For the purposes of point (b) of Article 3, taking into account the life cycle of the products and services provided by an economic activity, including evidence from existing life-cycle assessments, that economic activity shall be considered to significantly harm:

(a) climate change mitigation, where that activity leads to significant greenhouse gas emissions;

(b) climate change adaptation, where that activity leads to an increased adverse impact of the current climate and the expected future climate, on the activity itself or on people, nature or assets;

(c) the sustainable use and protection of water and marine resources, where that activity is detrimental:

(i) to the good status or the good ecological potential of bodies of water, including surface water and groundwater; or

(ii) to the good environmental status of marine waters;

(d) the circular economy, including waste prevention and recycling, where:

(i) that activity leads to significant inefficiencies in the use of materials or in the direct or indirect use of natural resources such as non-renewable energy sources, raw materials, water and land at one or more stages of the life cycle of products, including in terms of durability, reparability, upgradability, reusability or recyclability of products;

(ii) that activity leads to a significant increase in the generation, incineration or disposal of waste, with the exception of the incineration of non-recyclable hazardous waste; or

(iii) the long-term disposal of waste may cause significant and long-term harm to the environment;

(e) pollution prevention and control, where that activity leads to a significant increase in the emissions of pollutants into air, water or land, as compared with the situation before the activity started; or

(f) the protection and restoration of biodiversity and ecosystems, where that activity is:

(i) significantly detrimental to the good condition and resilience of ecosystems; or

(ii) detrimental to the conservation status of habitats and species, including those of Union interest.

2. When assessing an economic activity against the criteria set out in paragraph 1, both the environmental impact of the activity itself and the environmental impact of the products and services provided by that activity throughout their life cycle shall be taken into account, in particular by considering the production, use and end of life of those products and services.

Based on this description, the following control questions are used for evaluation:

"Is there a high risk that this project or program (taking the life cycle into account) [...]

(**Climate Change Mitigation**) [...] leads to additional greenhouse gas emissions?

(**Climate Change Adaptation**) [...] leads to adverse impacts of climate change on people, nature or assets?

(**Water & Marine Resources**) [...] harms the good environmental status of water bodies or marine waters?

(**Circular Economy**) [...] leads to inefficiencies in the use of materials and natural resources, increases the generation, incineration or disposal of waste or the long-term disposal of waste causes harm to the environment?

(**Pollution Prevention and Control**) [...] leads to an increase in the emission of pollutants into water, land or air?

(**Biodiversity and Ecosystems**) [...] harms the good condition of biodiversity and ecosystems (including the conservation status of habitats and species)?"

2.2.3 Systems for comparison

The control questions always refer to the activities financed and a system for comparison. These systems or reference systems are selected to represent a logic of intervention. They usually refer to the Status Quo of systems that are intentionally to be improved or even replaced. However, in some cases the absence of these activities is the best system of comparison (e.g., when referring to the construction of new buildings).

2.2.4 Assessment of heuristic risks

Applying the definition for risk and the control questions, an assessment of these heuristic risks was conducted. The full assessment for all 58 projects and programs can be found in the Annex, while the following table summarizes the results for all 19 projects that have a "low risk" (no "high risk" was identified). The assessment was conducted for all DNHS categories other than the category the project was mapped to by the issuer.

Most identified issues relate to the comparison with the absence of the activities (9 projects). Additional damages are anticipated in these projects (in particular lower climate change resilience and damage to ecosystems) but these damages are all deemed to be low. In addition, financing new buildings makes up the majority of these projects (6 out of 9), which means that later activities in and because of these buildings do not necessarily pose any risks of violating the DNHS criteria (e.g., research activities).

The remaining 10 projects with low risks (no projects were assumed to pose a high risk) focus on improvements of prevalent systems. This usually comes with a high likelihood of additional waste from new products and technologies (3 projects compared to 4 projects overall with CE risks) as well as additional pollutants to water, air and soil (3 projects compared to 4 projects overall with PP risks).

The next step is to assess which of these projects and programs can be associated with specific DNSH criteria in the EU Taxonomy.

table 2-1: results of the heuristic risk assessment with the help of control questions related to article 17
(CM: Climate Change Mitigation; CE: Transition to Circular Economy; PP: Pollution Prevention and Control; BE: Protection of Biodiversity and Ecosystems)

Project	**Obj.**	**risk**	**System for comparison**	**Reasoning**
Notably energy-efficient new buildings in the public building construction	CM	low	no new buildings	a) high likelihood for slightly lower climate resilience b) small likelihood for significant damage to ecosystems from construction
Notably energy-efficient restructuring measures in the public building construction	CM	low	stock of existing public buildings	a) high likelihood for slightly lower climate resilience
state funding of broadband	CM	low	no additional fiber optic connections	a) high likelihood for additional waste b) small likelihood for significant damage to ecosystems from civil engineering
Electrification Hochrheinbahn	CM	low	conventional rail transport	a) high likelihood for air emissions from fossil fuels in the electricity mix
GVFG Electrification Projects	CM	low	conventional rail transport	a) high likelihood for air emissions from fossil fuels in the electricity mix
Support program state initiative electromobility	CM	low	conventional vehicles (purchasing)	a) high likelihood for some damage to water systems from battery production b) high likelihood for slight increase of waste generation
High Efficiency Solar Cells	CM	low	no research building constructed	a) high likelihood for slightly lower climate resilience b) small likelihood for significant damage to ecosystems from construction
HyFab BW - New Building	CM	low	no research building constructed	a) high likelihood for slightly lower climate resilience b) small likelihood for significant damage to ecosystems from construction
Energy-efficient heat networks	CM	low	conventional heat production & distribution	a) high likelihood for some additional waste from upgrading heat networks
INPUT - Intelligent network link of parking garages and underground garages	CM	low	parking lots and garages without grid integration	a) high likelihood for some additional waste

Project	Obj.	risk	System for comparison	Reasoning
Regional centers of excellence for energy efficiency	CM	low	no energy-efficiency measures by companies	a) small likelihood of significant damage to water systems b) small likelihood of significant waste generation c) small likelihood of significant additional pollution
Regional Innovation Centre for Energy Technology	CM	low	no research building constructed	a) high likelihood for slightly lower climate resilience b) small likelihood for significant damage to ecosystems from construction
New Research Building INATECH	CE	low	no research building constructed	a) high likelihood for slightly higher GHG emissions b) high likelihood for slightly lower climate change resilience c) small likelihood for significant damage to ecosystems from construction
Phosphorus recovery from sewage sludge	CE	low	phosphate mining	a) higher likelihood of slightly higher GHG emissions b) higher likelihood of slightly higher pollution
E-Mobility in the car pool of BW police - purchase of pedelecs	PP	low	conventional bicycles	a) high likelihood of slightly higher GHG emissions
Establishment of express bus lines in the Stuttgart region	PP	low	other public or private means of mobility	a) small likelihood of significant higher GHG emissions (when replacing low-carbon options)
Nationalpark Black Forest, new construction visitor and information center	BE	low	no additional building	a) high likelihood of slightly higher GHG emissions b) high likelihood for slightly lower climate change resilience
Preserving steep-hill grassland	BE	low	no agriculture on slopes	a) high likelihood of slightly higher GHG emissions b) high likelihood of slightly lower climate change resilience c) high likelihood of small damages to water systems
Exemplary regions for organic food	BE	low	conventional farming	a) high likelihood of slightly higher GHG emissions (per unit of output)

2.3 Step 2: Applicability of EU Taxonomy

15 out of 19 projects with a "low risk" attribution are also covered by the Taxonomy. The following table lists all projects, their applicability and the objectives covered by either generic or specific DNSH criteria.

table 2-2: applicability of projects from risk assessment for EU Taxonomy

Project	Applicability	Activity in Taxonomy	Objectives with DNSH criteria (gen, spe)
Notably energy-efficient new buildings in the public building construction[1]	yes	7.07 - Acquisition and ownership of buildings	CA
Notably energy-efficient restructuring measures in the public building construction	yes	7.02 - Renovation of existing buildings	CA, WM, CE, PP
state funding of broadband	no	no activity	no activity
Electrification Hochrheinbahn	yes	6.14 - Infrastructure for rail transport	CA, WM, CE, PP, BE
GVFG Electrification Projects	yes	6.14 - Infrastructure for rail transport	CA, WM, CE, PP, BE
Support program state initiative electromobility	yes	6.05 - (financing) motorbikes, cars, LCV	CA, CE, PP
High Efficiency Solar Cells[1]	yes	7.07 - Acquisition and ownership of buildings	CA
HyFab BW - New Building[1]	yes	7.07 - Acquisition and ownership of buildings	CA
Energy-efficient heat networks	yes	4.15 - District heating/cooling distribution	CA, WM, PP, BE
INPUT - Intelligent network link of parking garages and underground garages	yes	4.10 - Storage of electricity	CA, CE, BE
Regional centers of excellence for energy efficiency	yes	9.03 - Professional services related to energy performance of buildings	CA
Regional Innovation Centre for Energy Technology[1]	yes	7.07 - Acquisition and ownership of buildings	CA

Project	Applicability	Activity in Taxonomy	Objectives with DNSH criteria (gen, spe)
New Research Building INATECH[1]	yes	7.07 - Acquisition and ownership of buildings	CM, CA
Phosphorus recovery from sewage sludge[2]	no	no activity	no activity
E-Mobility in the car pool of BW police - purchase of pedelecs	yes, no own contribution[3]	6.04 - personal mobility devices	CA, CE
Establishment of express bus lines in the Stuttgart region	yes, no own contribution[3]	6.03 - Urban and suburban transport	CA, CE
Nationalpark Black Forest, new construction visitor and information center[1]	yes, no own contribution[3]	7.07 - Acquisition and ownership of buildings	CM, CA
Preserving steep-hill grassland	no	no activity	no activity
Exemplary regions for organic food	no	no activity	no activity

[1] The financing of new public buildings can either be covered by activity 7.1 (construction of new buildings) or by activity 7.7 (acquisition and ownership of buildings). The issuer opted for option 2. Many projects covered by 7.1 in the risk assessment to the first impact report are, as a result, now covered by 7.7 instead (with less restrictive DNSH criteria).

[2] This project was originally attributed to activity 5.9 in the EU Taxonomy. However, the recovery plant employs a chemical process not covered by mechanical material recovery (5.9) or anaerobic digestion from sewage sludge (5.6). It is therefore unlikely that DNHS criteria address the actual risks to environmental objectives.

[3] There are currently only full data sheets for substantial contributions to CM and CA.

2.4 Step 3: Evaluation of DNSH criteria

The next step is to identify whether any of these criteria require efforts beyond existing laws or regulation in Germany. We distinguish three types of DNSH criteria for that purpose:

- (1) Specific technical criteria in the context of activities
- (2) Regulatory criteria in the context of activities
- (3) Generic criteria requiring project-specific assessments

Criteria of type (1) are assessed individually as shown in table 2-3.

For criteria of type (2), a "minimal risk" is assumed. All projects in the risk assessment adhere to national regulations and it is very likely that these regulations are in accordance with the minimal European requirements described in the Taxonomy.

For criteria of type (3), individual risk assessments would be necessary to fully comply with the taxonomy. This is not possible due to lack of data and methodology. Instead, we distinguish three additional cases. First, "minimal risk" is assigned, if the original heuristic risk assessment from step 1 did not reveal a higher probability or a higher damage potential. Secondly, we assign "significant harm cannot be excluded" if these objectives were indeed considered to have "low risk" in the original assessment. Thirdly, "no risk" is assigned if the generic requirements of the Taxonomy are in line with German law and regulation.

As a result, 7 out of a total of 58 projects in the Green Bond can be associated with a noteworthy risk (other than "minimal") of DNSH violations. All identified issues refer to building construction or (in one case) building refurbishment. In each of these cases, it cannot be ensured that material climate change risks, specific to each building site, are accounted for by the responsible stakeholders. In addition, there is also a low risk that some of the buildings constructed would exceed the specific requirements for water use according to the Taxonomy.

In all other cases, including other objectives affected for buildings, only minimal risks are present. For the most part, these minimal risks are not very likely to materialize, if one assumes that German laws and regulations are adhered to and that these laws are themselves in line with European requirements cited in the Taxonomy regulation.

table 2-3: DNSH evaluation of projects from risk assessment that are applicable to the Taxonomy Regulation
(att: highlighted in 1st evaluation | reg: regulatory requirements | gen: generic requirements | spe: specific requirements in Taxonomy regulation)

Project	DNSH Risk	DNSH Type	Assessment of specific risks
Notably energy-efficient new buildings in the public building construction	**CA: cannot be excluded**	CA: att, gen	none
Notably energy-efficient restructuring measures in the public building construction	**CA: cannot be excluded** WM: minimal risk CE: minimal risk PP: no risk	CA: att, gen WM: spe CE: reg, spe PP: reg	WM: it is unlikely that public buildings exceed water usage in accordance with Appendix E of Taxonomy CE: required rates in accordance with national targets/regulations (e.g., KrWG); only requirements for backfilling poses a very small risk
Electrification Hochrheinbahn	CA: minimal risk WM: minimal risk CE: minimal risk PP: minimal risk BE: minimal risk	CA: gen WM: gen CE: reg PP: att, reg, spe BE: gen	PP: generic principle & risk attributed in first evaluation step; it can be safely assumed that measures are in place to reduce noise and other emissions during construction (specific criteria)
GVFG Electrification Projects	CA: minimal risk WM: minimal risk CE: minimal risk PP: minimal risk BE: minimal risk	CA: gen WM: gen CE: reg PP: att, reg, spe BE: gen	PP: generic principle & risk attributed in first evaluation step; it can be safely assumed that measures are in place to reduce noise and other emissions during construction (specific criteria)

Support program state initiative electromobility	CA: minimal risk WM: no risk CE: minimal risk PP: minimal risk	CA: gen WM: att, no CE: reg PP: reg	none
High Efficiency Solar Cells	**CA: cannot be excluded**	CA: att, gen	none
HyFab BW - New Building	**CA: cannot be excluded**	CA: att, gen	none
Energy-efficient heat networks	CA: minimal risk WM: minimal risk CE: no risk PP: minimal risk BE: minimal risk	CA: gen WM: gen CE: att, no PP: reg BE: gen	none
INPUT - Intelligent network link of parking garages and underground garages	CA: minimal risk CE: minimal risk BE: minimal risk	CA: gen CE: att, spe BE: gen	CE: given the fact that the systems are installed in parking garages with the help of public funds, it is unlikely that no waste management plan is in place that ensures compliance with the waste hierarchy
Regional centers of excellence for energy efficiency	CA: minimal risk	CA: gen	none
Regional Innovation Centre for Energy Technology	**CA: cannot be excluded**	CA: att, gen	none
New Research Building INATECH	CM: no risk **CA: cannot be excluded**	CM: att, reg CA: att, gen	CM: any publicly funded building should comply with the generic requirements on energy performance and this particular building is not dedicated to fossil fuel extraction, use or transport
E-Mobility in the car pool of BW police - purchase of pedelecs	CM: no risk CA: minimal risk CE: minimal risk	CM: att, no CA: gen CE: spe	CE: given the fact that these are publicly purchased e-bikes, it is very likely that batteries and/or electronics are treated according to the waste hierarchy and German regulations for potentially hazardous waste
Establishment of express bus lines in the Stuttgart region	CM: no risk CA: minimal risk CE: minimal risk	CM: att, no CA: gen CE: spe	CE: In cases where electric or H-fueled vehicles are used on the express lines, it is very likely that batteries and/or electronics are treated according to the waste hierarchy and German regulations for potentially hazardous waste
Nationalpark Black Forest, new construction […]	CM: no risk **CA: cannot be excluded**	CM: att, reg CA: att, gen	CM: public buildings or public funded buildings in the State of BW do not exceed national NZEB requirements

In the next and final step of the validation, it is evaluated whether additional hazard-indicators are necessary to manage the remaining risks.

2.5 Step 4: Individual risk assessment

Hazards or rebounds in the impact report indicate the risk for target conflicts and in particular potential violations of the DNSH criteria of the EU taxonomy. They are subject to an individual assessment if significant harm to other objectives cannot be ruled out or poses at least a minimal risk (bold assessments in table 2-3).

The validation of the issuer's DNSH assessment in the report at hand identified 7 projects where this type of risks can occur. 6 out of 7 projects refer to the ownership of buildings as defined by activity 7.7 (Acquisition and ownership of buildings) and 1 project to renovation or modernisation measures for public buildings by activity 7.2 (Renovation of existing buildings). The main objective potentially affected is "Climate Change Adaptation". However, no specific DNSH criteria apply here but only the more generic criteria set out in Appendix A in Annex I of the Taxonomy Regulation.

The most current climate impact assessment for Germany (UBA 2021) identifies three main climate risks related to construction activities and buildings. By the middle of the century and under pessimistic rather than optimistic conditions, there is a high risk for "damage to buildings due to river flooding", a high risk for more "urban climate/ heat islands" and a high risk for worse "indoor climate". In addition, the risks of "damage to buildings due to heavy rain" and damage to "vegetation in settlements" is considered medium under the same scenario. Even when considering adaptation measures under the Adaptation Action Plan III (APA III) (UBA 2021 p. 70), these high and medium risks can only be reduced to "medium-high" or "medium".

The State of Baden-Württemberg (as issuer) is aware of these (and other building-related) risks and has not only developed a climate-adaptation strategy but also monitors its progress (Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg and LUBW Landesanstalt für Umwelt Baden-Württemberg 2021; Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg and LUBW Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg 2015). In our opinion, these measures ensure (at least for now) that no additional climate risks are caused by these projects that constitute a "significant harm".

2.6 Summary of DNSH risks

We concur with the assessment of the issuer that none of the projects in the Green Bond pose a high or even medium risk for significant damage to any of the environmental objectives. Low or minimal risks could be identified for 15 out of 58 projects, of which 7 projects in the area of building ownership, renovation and funding require full compliance with additional requirements in order to avoid harm. We have currently no evidence that any of these violations occur and assume that future amendments of the taxonomy regulation will address these issues as soon as the first actors in the finance industry have to fully comply with them.

Since all these projects, and their potential issues, relate to potential material climate change adaptation risks, the issuer already has made plans to request additional information for the upcoming bond issues.

3 Methodology

The following sections first present the methodology (indicator classification, robustness criteria, adaptation of ICMA framework), followed by a description of the selection and quantification of indicators in each of the six environmental objectives.

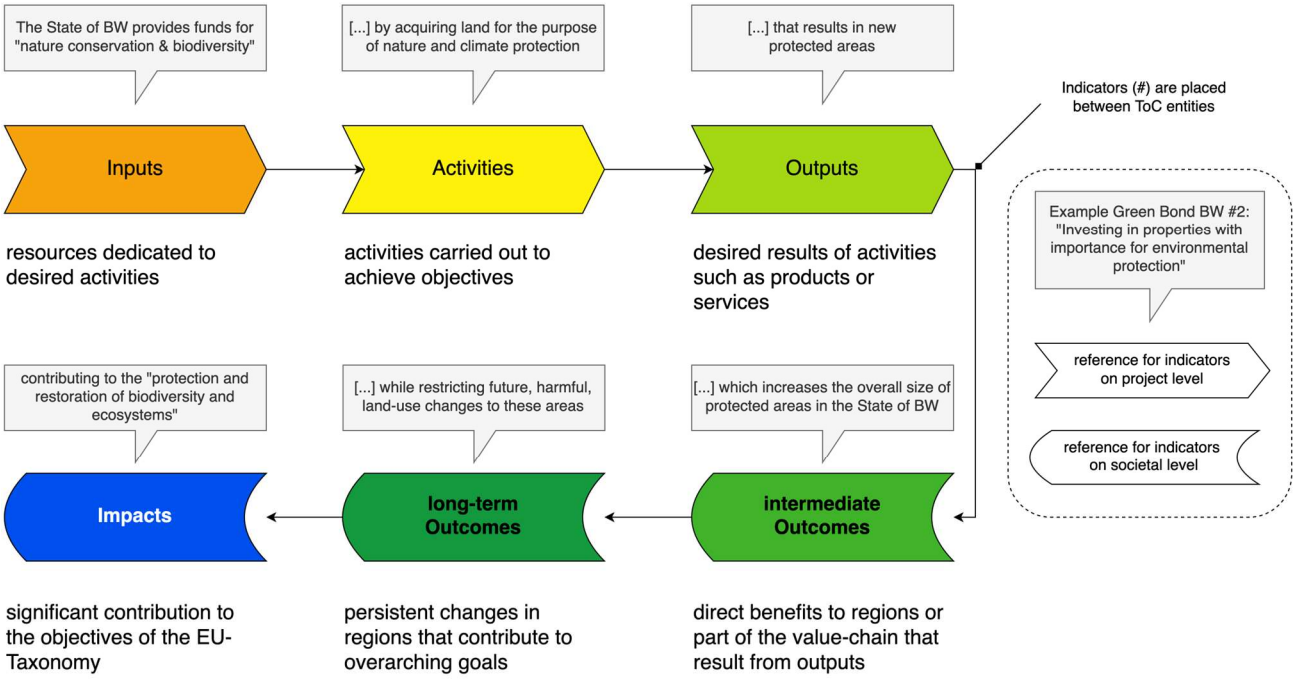
3.1 Indicator Quality

The impact assessment at hand not only identifies and selects key performance indicators of the projects financed, but also qualifies them in relation to their societal or ecological relevance. Any quantifiable metric can be assessed in its ability to contribute to targets or to measure success.

We apply a theory-of-change (ToC) logic for that purpose which is in line with other assessments by the authors (Teubler 2021) as well as current practices for SDG mapping (Dangelmaier 2019). At its core, a ToC allows the distinction of different types of indicators depending on their position on a cause-effect chain. The following figure shows our terminology and examples for them.

The current figure was updated according to the progress in the project. It now shows where indicators are located in the ToC and how indicator quality not only depends on its location but also on the level of attribution by different actors along the value chain. For example, the funding of communities, so they can implement measures to improve cycling and pedestrian mobility, is considered an indicator with quality E (*by State of BW or its agencies*), while the number of implemented measures by these communities (*by project stakeholders*) would be considered a D indicator.

figure 3-1: terminology and logic for indicator quality in Green Bond Baden-Württemberg
(own compilation based on Teubler, 2022)



Any project, program or measure in the Green Bond can achieve every type of indicator quality (one project can have more than one indicator). However, providing evidence for changes on a societal level and tracking these changes back to financing is very difficult. In most cases, inputs and activities are the only indicators that can be reported without the use of models and assumptions on the additionality of these measures. As a rule of thumb, data

and method requirements increase with higher indicator quality (up to a point where most projects cannot be robustly related to societal outcomes).

In addition, the Green Bond BW is unique in the way that it aims to contribute to all six environmental objectives of the EU Taxonomy regulation while also adhering to the regulation's do-no-significant-harm criteria. This is a potential for target-conflicts that the methodology needs to address. We therefore introduce two additional types of indicators that should be reported if these target conflicts are likely: hazard-indicators and rebound-indicators. Both are measures of probability and damage, intended to be control variables when re-financing green projects. Hazards indicate the risk for significant-harm to the five other objectives and rebounds the compensation or even over-compensation of target contribution. An example for such a direct rebound would be the financing of energy-efficiency measures in companies that in turn lead to additional energy use from expanding the economic activity.

Hazard-indicators are, for the purpose of reporting, specified as a qualitative indicator (quality F) for a certain project, if this project is associated with any risks according to the risk assessment in section 2. Rebound-indicators are described if a violation of DNHS criteria cannot be excluded or is considered to be a low risk or higher (see section 2.5).

All indicators are color-coded and classified from A to G based on the logic of European energy-efficiency classifications (see table 3-1). In theory, indicators could also measure and track impacts which represent the persistent improvement of overarching goals. We did not include the possibility in the table shown here. If needed, such an indicator could be classified as A+, but we currently see no option how the impact assessment of a Green Bond could provide evidence for that.

table 3-1: color-coded indicator quality for indicators in the report at hand

Color Code	Indicator Quality	Interpretation for Reader
long-term outcomes	A	**best-needed** (unequivocal evidence for substantial contribution)
intermediate outcomes	B	**best-in-class** (strong evidence for substantial contribution)
outputs	C	**best practice** (high likelihood of substantial contribution)
activities	D	**high standard** (indication of substantial contribution)
inputs	E	**minimum requirement** (aligned with EU Taxonomy objectives)
hazards	F	minimal risks for DNSH
potential rebounds	G	to be investigated in order to ensure DNSH compability

3.2 Criteria for Robustness of Reporting

Each reported value depends on the robustness of the input data for indicator quantification. We differentiate five types of robustness ranging from 1 (best) to 5 (lowest) as shown in table 3-2. The main criterion is the necessity of calculation or models (robustness of 2, 3 or 4) and the availability of primary data (robustness of 1 or 2). Primary data in this context are actual reported values (e.g., in monitoring reports), official statistics as well as any direct data input by the issuer or the related state agencies (e.g., eligible expenditures from the state's budget). Secondary data mainly consists of scientific findings and reports as well as press releases by state ministries and agencies. Auxiliary variables are data that are needed to convert or estimate results. They can be of high quality (e.g., global warming potentials in IPCC reports) but are independent of the systems assessed in each category. The final and lowest robustness is attributed to data that required calculation by 3rd parties but cannot be replicated due to lack of data or reporting on the method used. The lowest robustness is also attributed to effects that relate to future planning (e.g. the number of researchers in a facility under construction).

Most indicators of high quality are expected to show a lower robustness, because they are usually not measured directly and require the use of models and additional secondary data. On the other hand, most low-quality indicators usually exhibit a high robustness. Only few data points and calculations are needed or they are even directly part of the underlying framework (such as agreed funding in a regulation).

table 3-2: robustness criteria for data collection and quantification

Robustness	Criteria	Examples
1	primary data (directly reported or monitored)	number of approved grants for broadband expansion
2	directly calculated from primary data	energy use of buildings based on energy demand per floor area and year
3	calculated with the help of secondary data, auxiliary variables, share of financing assumptions	GHG savings from direct input on the energy demand of buildings before and after renovation
4	estimated on the basis of models or relations that simplify the cause-effect-relationships	promoted organic farming area based on funding per hectare in a regulation
5	results from 3rd party reporting without the possibility for validation or future effects	number of families benefiting from funding for agroforestry projects

3.3 Adaptation of ICMA reporting template

We use the templates provided by the International Capital Market Association (ICMA) as a basis for our own reporting (ICMA 2022) but adapted them to the needs of a Green Bond issued by a federal state in Germany. Apart from providing information on the quality of indicators, we set-up the following conventions.

- In our first convention, we assume that the eligibility for Green Bonds is 100% in all cases, as corroborated by a SPO and the issuer's framework (see summary).
- In our second convention, we omit the information on the lifetime of projects. All parts of the impact reporting refer to the expenditures in the state's budget for one year. Some projects (usually state programs) exceed the lifetime of one year and some related systems are anticipated to show benefits well beyond the scope of state financing. In addition, not all funds in the state's yearly expenditure cover direct investments or costs from the same budget year but can also include allocations from previous budget years (as approved grants could be funded later on). We think that providing a value for the project lifetime would obscure these effects rather than increase transparency.
- Thirdly, all effects are reported on an annual basis. The reason for that is partially based on the reasoning for our second convention (omittance of project lifetime). However, reporting annual effects also allows to accumulate effects over several bonds later on in the project.
- Our fourth convention is an extension of the reporting template. We distinguish between "full effects" and "financed" effects. Not all established full effects can also be attributed to financed effects and vice versa. For the most part though, financed effects are a direct result from the "share of financing" provided in the results tables in the annex.
- Our final convention relates to the reporting of total values. Here, only the number of projects/measures or funding (input-indicators with quality E) is aggregated because most of the indicators are not compatible or summable.

4 Data and Results

The following sections describe the results for projects that could be associated with inputs (E), activities (D), outputs (C), intermediate-outcomes (B) or long-term outcomes (A) (see also section 3.1) in each of the six environmental objectives:

- Climate Change Mitigation
- Climate Change Adaptation
- Water and Marine Resources
- Circular Economy
- Pollution Prevention
- Biodiversity and Ecosystems

For 6 out of 58 projects, no such assessment could be made due to lack of data or lack of a plausible Theory-of-Change. All of these projects are considered to be "eligible" and there is no reason to assume that these projects do not contribute to the overarching objectives.

4.1 Climate Change Mitigation

26 projects were assessed that contribute to 85 indicators, of which 33 indicators achieve an indicator quality of D or higher. The total volume of expenditures amounted to EUR 226m, which is 94% of all expenditures contributing to this objective.

For 4 projects, so-called desired outcomes (indicator quality B) could be identified that represent “strong evidence for a substantial contribution” to the environmental objective of “climate change mitigation” (another 9 projects are associated with quality C and thus a “high likelihood of substantial contribution”). The following table lists these four projects and their desired outcomes. It also shows how long-term benefits as “unequivocal evidence for substantial contributions” could be potentially ensured. These criteria are going to be investigated for any project in this list that is also part of the next Green Bond.

table 4-1: Best-in-Class indicators for Green Bond Baden-Württemberg #2 in the area of “Climate Change Mitigation”

Project	**Strong evidence for substantial contribution** (Quality B)	**Criteria for unequivocal evidence** (Quality A)
No 2: Notably energy-efficient new buildings in the public building construction	GHG emission reduction compared to 1990	The total GHG emissions of public buildings in the State of BW decreased and continues to decrease in the future.
No 3: Notably energy-efficient restructuring measures in the public building construction	GHG emission reduction compared to 1990	The total GHG emissions of public buildings in the State of BW decreased and continues to decrease in the future.
No 12: state funding of broadband	GHG reductions of broadband systems compared to conventional connections	The total GHG emissions from data transfer in the State of BW decreased and continues to decrease in the future.
No 48: CAMPUS high i - Intelligent and user-oriented planning processes for climate neutrality in buildings	future GHG reduction (estimated, building 1)	The GHG reductions become reality, while the total GHG emissions of the campus decrease and continues to decrease in the future.

The following sections describe which data and methods were used for this assessment. For some of the projects, savings in greenhouse gas (GHG) emissions could be estimated as an indicator for the contribution to climate protection goals (out of a total of estimated annual

GHG savings of 5,000 tons, circa 450 tons could directly be attributed to financing). In each of these cases, the global warming potential over 100 years (GWP 100a) was used as a metric. The GWP is the standard for calculating GHG effects and expressed in kg of CO_2-equivalents. The reports by the International Panel on Climate Change (IPCC) are the main source for the corresponding GWP factors for greenhouse gases.

4.1.1 Notably energy-efficient new buildings in the public building construction

Besides the prevailing investment in the refurbishment of state-owned properties, the state promotes the building of new, energy efficient buildings with an estimated share of financing of 8% in 2021. About 85% of the newly constructed net-area can be attributed to new university and research buildings (including university clinics).

The new buildings are expected to be more energy-efficient compared to the public building stock in the state and thus avoid GHG emissions on an annual basis. In order to estimate these GHG emission savings, the heat demand of these buildings is compared to the heat demand of public buildings in stock. This is based on information provided by the issuer (primary energy demand, net floor area, type of building, heating system) and auxiliary variables for a GHG saving estimate. The following sources were used for this purpose: primary energy factor (PEF) of district heating in the local community according to AGFW (2021), PEFs of other heating systems according to the German GEG regulation (Annex 4), GHG emission factor of wood pellets according to DGNB (2020) as well as GHG emission factors for other heating systems according to the "Energiebericht 2020" of the State of BW (Ministerium für Finanzen Baden-Württemberg 2020). The last source also included information on the energy demand of public buildings in the State of BW.

The following indicators could be identified and quantified:

- Firstly (1), the overall future GHG emissions of the new buildings have been compared to average GHG emissions for the state's building stock in 1990 as an indicator for intermediate outcomes (B). Compared to this building standard, GHG emissions could be reduced by 86% (of which 7% are directly financed through expenditures in 2021).
- Secondly (2), the annual expected avoided GHG emissions have been estimated as an output-indicator (C). The new buildings are expected to save 3,334 t CO2e per year, of which 252 tons are directly financed through expenditures in 2021.
- Thirdly (3), the newly added net-floor area is reported as an activity-indicator (D). Out of a total of 136,700 m2, 10,300 m2 can be directly attributed to the Green Bond.
- Fourthly (4), the overall expenditures as well as the overall costs of the measures in this category are reported as an input-indicator (E). The annual expenditures in 2021 of EUR 54m can be associated with overall costs of EUR 714m.

The following table lists the results and evaluates the robustness.

table 4-2: results for the project "Notably energy-efficient new buildings in the public building construction (No 2)"

indicator	quality	full effect	financed effect	robustness
GHG emissions compared to 1990	B	- 86%	- 7%	3
GHG emissions avoided per year	C	3,334 t CO2e	252 t CO2e	3
energy-efficient net floor area added	D	136,688 m²	10,337 m²	3
funding for public buildings	E	EUR 713.6m	EUR 54.0m	1

The construction of buildings is one of the few measures in the Green Bond that can be associated with rebounds (noteworthy risks of violating DNSH criteria). According to the risk assessment in section 2, it cannot be excluded that some of the buildings violate the generic taxonomy criteria for climate change adaptation (G1).

4.1.2 Notably energy-efficient restructuring measures in the public building construction

The project invests in the refurbishment of state-owned properties with an estimated share of financing in 2021 of 13%. Universities account for around 76% of the refurbished net floor area in 2021. Additional efforts targeted buildings for police, the judiciary, and staff.

The refurbished buildings are expected to save energy and thus also contribute to the reduction of greenhouse gas emissions. The GHG saving estimates were calculated in accordance with the available data and auxiliary variables (see section 4.1.1), whereas the issuer also provided data on the energy demand of the buildings before and after renovation.

The following indicators could be identified and quantified:

- Firstly (1), the overall future GHG emissions of the renovated buildings have been compared to average GHG emissions for the state's building stock in 1990 as an indicator for intermediate outcomes (B). Compared to this building standard, GHG emissions could be reduced by 82% (of which 11% are directly financed through expenditures in 2021).
- Secondly (2), the annual expected GHG emissions savings have been estimated as an output-indicator (C). The renovated buildings are expected to save 355 t CO2e per year, of which 46 tons are directly financed through expenditures in 2021.
- Thirdly (3), the net-floor area to be renovated is reported as an activity-indicator (D). Out of a total of 37,000 m², 4,800 m² can be directly attributed to the Green Bond.
- Fourthly (4), the overall expenditures as well as the overall costs of the measures in this category are reported as an input-indicator (E). The annual expenditures in 2021 of EUR 20m can be associated with overall costs of EUR 156m.

The following table lists the results and evaluates the robustness of the results.

table 4-3: results for the project "Notably energy-efficient restructuring measures in the public building construction (No 3)"

indicator	quality	full effect	financed effect	robustness
GHG emissions compared to 1990	B	- 82%	- 11%	3
GHG emissions avoided per year	C	355 t CO2e	46 t CO2e	3
energy-efficient net floor area renovated	D	36,916 m²	4,832 m²	3
funding for public buildings	E	EUR 155.7m	EUR 20.4m	1

Building renovation is covered by Activity 7.2 (Renovation of existing buildings) in the EU-Taxonomy. According to the risk assessment in chapter 2, it cannot be excluded (at this point) that none of the measures violates the generic taxonomy criteria on climate change adaptation (G1). Additional “small risks” or hazards relate to the violation of water-usage thresholds in public buildings (F1 for Water and Marine Resources) as well as insufficient preparation of construction waste for reuse, recycling, or other material recovery (F2 for Circular Economy).

4.1.3 Strategy for sustainable bio-economy

The state strategy "Sustainable Bio-economy Baden-Württemberg" is intended to contribute to a reduction in greenhouse gas emissions in Baden-Württemberg, the conservation of natural resources and the preservation of biodiversity. Innovative biological concepts are to be used to develop renewable or recyclable raw material sources. In 2021, expenditures of EUR 2.54m were attributed to this project.

Two indicators have been identified and assessed.

- Firstly (1), the number of events (14 in 2021) is reported as an activity-indicator (D). A share of financing of 100% is assumed according to the issuer.
- Secondly (2), the expenditures themselves are reported as an input-indicator (E) for "funding for a sustainable bio-economy".

The following table lists the results and evaluates the robustness.

table 4-4: results for the project "Strategy for sustainable bio-economy (No 10)"

indicator	quality	full effect	financed effect	robustness
no of events	D	14	14	1
funding for a sustainable bio-economy	E	EUR 2.54m	EUR 2.54m	1

4.1.4 State funding of broadband

The issuer's framework presumes a positive causation between high-speed internet access of entities (public services, companies, households), energy-savings compared to conventional (previous) connections and therefore a potential reduction in greenhouse gas emissions. With the knowledge of newly installed fibre connections, the savings compared to the previous connections could be estimated. Four indicators have been defined.

- Firstly (1), the GHG emission savings have been estimated (B). For this purpose, the emissions caused by fibre optic connections were compared with the emissions caused by copper cables. In total, about 1,060 t CO2 eq. per annum could be potentially saved.
- Secondly (2), the energy savings from network access compared to conventional connections have been estimated (C). In total, about 700 MWh per annum could be potentially saved.
- Thirdly (3), the additional connections of broadband access have been assessed as an activity indicator (D). The data was directly provided by the responsible ministry in BW. In 2021, about 142,000 broadband connections had been installed.
- Fourthly (4), the funding for additional broadband connections is reported as an input-indicator (E). EUR 68.4m has been invested in 2021.

The following table lists the result and evaluates the robustness.

table 4-5: results for the project "state funding of broadband (No 12)"

indicator	quality	full effect	financed effect	robustness
GHG reductions of broadband systems (compared to conventional connections)	B	1,060 t CO2 eq.	150 t CO2 eq.	4
energy savings from network access (compared to conventional connections)	C	697 MWh	100 MWh	3
additional connections	D	142,000	20,000	1
funding for broadband	E	EUR 480.30m	EUR 68.35m	1

4.1.5 GVFG Electrification Projects

Due to the considerable costs of local rail transport infrastructure measures, a co-financing contribution from the state in addition to federal funds is required to relieve the mostly municipal sponsors of such projects. The fund supports municipal light rail projects as well as the expansion and electrification of regional rail lines. In 2021, EUR 0.75m have been invested with an estimated share of financing of 45% (circa EUR 48m out of total funding of EUR 108m including federal funding). Two indicators have been assessed and quantified:

- Firstly (1), the additional electrified railway of 12 km has been assessed as activity-indicator (D).
- Secondly (2), the overall funding of EUR 0.75m for the electrification of the railway system has been reported as input-indicator (E).

The following table lists the results and evaluates the robustness.

table 4-6: results for the project "GVFG Electrification Projects (No 20)"

indicator	quality	full effect	financed effect	robustness
additional electrified railway	D	12 km	5 km	1
funding for electrification of rail traffic	E	EUR 1.66m	EUR 0.75m	1

The risk assessment in section 2 also indicated minimal risks of violating the DNSH criteria of the EU taxonomy (indicated as hazards in the report at hand). Regarding climate change adaptation (F1), no climate risk assessment was conducted that rules out a violation of the generic technical criteria for this environmental objective. Similarly, it cannot be ruled out

that the generic criteria for water and marine systems (F2) as well as biodiversity and ecosystems (F4) are violated. In addition, it could not be ensured that the activities involved in the project uphold the thresholds for re-use and recycling of demolition waste as required by the specific criteria for the objective of a circular economy (F3). We deem any of these violations as very unlikely.

4.1.6 Cycling Culture Initiative

The funding of EUR 2.48m for the state's cycling culture initiative aims at the avoidance of GHG emissions. Although it is likely that this project results indeed in a lower motorised mobility (e.g., by replacing car-km) for the participants and thus lower GHG emissions, the overall effect has not been monitored yet.

The current report therefore includes one input-indicator (E) on the number of funded communities with the option of estimating GHG effects later on.

The following table lists the results and evaluates the robustness of this indicator (we assume a financing share of 100%).

table 4-7: results for the project "Cycling Culture Initiative (No 21)"

indicator	quality	full effect	financed effect	robustness
communities funded	E	17	17	1

4.1.7 Support program state initiative electromobility

The state's Electromobility III initiative aims at making Baden-Württemberg the centre of development and production for electromobility within Germany. This year's expenditures of EUR 35m were used as grants and supports for various forms of climate-friendly mobility options such as electric cars or electric bicycles. Two indicators were identified and reported in the current report:

- Firstly (1), 9,458 implementations (such as partial disbursements) were reported in 2021 as an activity-indicator (D). Since the actual shares differ, no "financed" effect can be reported for this indicator.
- Secondly (2), 9,202 new approvals were reported in 2021 as an input-indicator (E).

The following table lists the results and evaluates the robustness of the results.

table 4-8: results for the project "Support program state initiative electromobility (No 23)"

indicator	quality	full effect	financed effect	robustness
number of implementations by stakeholders (disbursements)	D	9,458	not available	1
number of approvals for electromobility measures	E	9,202	9,202	1

The purchase or production of climate-friendly vehicles is addressed in the EU taxonomy, which is why our risk assessment identified 3 hazards for this project. There are minimal risks of violating the generic criteria for climate change adaptation (F1), the regulatory criteria for a circular economy (F2) as well as the regulatory risks regarding pollution prevention (F3).

4.1.8 Support Program for Municipal Cycling and Pedestrian Infrastructure

The state Municipal Transport Financing Act (LGVFG) is the central instrument for promoting municipal transport infrastructure in the state. The Funding Program for Municipal Bicycle and Pedestrian Infrastructure (LGVFG-RuF), established by the state government in 2013, makes an important contribution to improve bicycle and pedestrian infrastructure throughout the state. In 2021, EUR 4m have been invested.

One indicator has been assessed and quantified: The funding of 36 communities in 2021 is reported as an input-indicator (E).

The following table lists the results and evaluates the robustness of the results.

table 4-9: results for the project "Support Program for Municipal Cycling and Pedestrian Infrastructure (No 24)"

indicator	quality	full effect	financed effect	robustness
communities funded	E	36	36	1

4.1.9 Cycling Routes Network

The RadNETZ Baden Württemberg connects and crosses all major and medium-sized centres throughout the state via defined main routes, also for everyday bicycle traffic. It has a length of circa 7,000 kilometres and circa 700 municipalities are connected to the network. In 2021, EUR 0.4m have been invested.

One indicator has been assessed and quantified: The number of communities funded in 2021 (721) is reported as an input-indicator (E).

The following table lists the results and evaluates the robustness of the results.

table 4-10: results for the project "Cycling Routes Network (No 25)"

indicator	quality	full effect	financed effect	robustness
communities funded	E	721	721	1

4.1.10 Fast Cycling Routes

The State of BW funds the construction of bicycle expressways as direct, climate-efficient and attractive routes for commuters. In 2021, EUR 2.2m were invested for that purpose. Two indicators were identified and reported:

- Firstly (1), 1.3 km of additional bicycle expressways are reported as output-indicator (C) with an assumed share of financing of 100%.
- Secondly (2), the funding of EUR 2.2m itself is reported as an input-indicator (E) for the funding of communities.

The following table lists the results and evaluates the robustness of the results.

table 4-11: results for the project "Fast Cycling Routes (No 26)"

indicator	quality	full effect	financed effect	robustness
km bicycle lanes	C	1	1	1
funding for communities	E	EUR 2.2m	EUR 2.2m	1

4.1.11 eLNG (e-Liquefied Natural Gas) from Air

The aim of the "eLNG from Air" project is to demonstrate the overall process for producing CO_2-neutral gas and to derive recommendations for industrial operation. The project uses already existing technology modules and infrastructures to design an overall process chain for the electricity-based production of regenerative eLNG (e-Liquefied Natural Gas) from green hydrogen (water electrolysis) and carbon dioxide of the ambient air and to implement it for the first time in the form of a demonstrator in Stuttgart. The state´s expenditures in 2021 amounted to EUR 0.43m and three indicators have been identified:

- Firstly (1), the future CO_2 absorbance rate of the demonstrator (0.7 kg/h) is reported as output-indicator, for which no "financed" effect can be derived.
- Secondly (2), the current rate of development of the demonstrator is based on the overall costs of the project and reported as activity-indicator (D) with a share of financing of 3%.
- Thirdly (3), the funding itself is referenced as an input-indicator (E) for climate change mitigation funding, whereas the full effect refers to the overall investments of EUR 15.5m.

The following table lists the results and evaluates the robustness of the results.

table 4-12: results for the project "eLNG (e-Liquefied Natural Gas) from Air (No 28)"

indicator	quality	full effect	financed effect	robustness
future absorbance rate of CO2	C	0.7 kg/h	not available	5
development of a demonstrator	D	100%	3%	3
climate change mitigation funding	E	EUR 15.48m	EUR 0.43m	1

4.1.12 High Efficiency Solar Cells

In the "Center for Highest Efficiency Solar Cells", technologies with the highest photovoltaic efficiencies are evaluated and implemented. A new laboratory building, the "Center for Highly Efficient Solar Cells", has been built. Advanced PV technologies can be tested and optimized there. In 2021, EUR 3.8m have been invested by the State of BW. Three indicators have been identified and quantified.

- Firstly (1), the number of persons working in the laboratory in the future (68) is reported as an output-indicator (C) with a share of financing of 11% (circa 8 jobs financed from expenditures in 2021 alone).
- Secondly (2), the construction of the research building is reported as an activity-indicator (D) based on the same rate of financing (11% of the building from funding in 2021).
- Thirdly (3), the funding itself is reported as an input-indicator (E) on funding for research infrastructure.

The following table lists the results and evaluates the robustness of the results.

table 4-13: results for the project "High Efficiency Solar Cells (No 29)"

indicator	quality	full effect	financed effect	robustness
No of persons working at site in the future (approved)	C	68	8	5
research building construction (and equipment)	D	100%	11%	1
funding for research infrastructure	E	EUR 34m	EUR 3.8m	1

As described in the risk assessment, it cannot be excluded that the building itself violates the generic criteria of the taxonomy on climate change adaptation (G2), as no such assessment was conducted (yet).

4.1.13 HyFab BW - New Building

With the "HyFab Baden-Württemberg" research project, the state government is supporting plans by science, industry and politics to make fuel cell products suitable for series production and thus more affordable. In 2021, the State of BW funded the construction of a HyFab research building with EUR 6.6m. Three indicators have been identified and quantified.

- Firstly (1), the number of future researchers (10) is reported as an output-indicator (C), for which no direct "financed" effect can be attributed to from the construction of the building alone.
- Secondly (2), the construction of the research building is reported as an activity-indicator (D) based on rate of financing in 2021 compared to the overall costs (62% of the building from funding in 2021).
- Thirdly (3), the funding itself is reported as an input-indicator (E) on funding for research infrastructure based on the same share of financing (with EUR 10.5m reported as "full" effect).

The following table lists the results and evaluates the robustness of the results.

table 4-14: results for the project "HyFab BW - New Building (No 31)"

indicator	quality	full effect	financed effect	robustness
No of future employees (researchers)	C	10	not available	5
research building construction	D	100%	62%	1
funding for research infrastructure	E	EUR 10.5m	EUR 6.6m	1

According to the risk assessment, it cannot be excluded that the generic climate change adaptation criteria for the ownership of buildings (G1) are violated.

4.1.14 Energy-efficient heat networks

The support program for energy-efficient heating networks promotes not only the construction and expansion of heating networks, but also the preparation of heating plans as a basis for heating networks. Expenditures of EUR 3.2m have been designated to that purpose with a share of financing of 100% according to the issuer and the reporting agencies.

One indicator was identified: 4 communities have been supported in 2021, which is reported as an input-indicator (E).

The following table lists the results and evaluates the robustness of the results.

table 4-15: results for the project "Energy-efficient heat networks (No 36)"

indicator	quality	full effect	financed effect	robustness
communities funded	E	4	4	1

The project is also associated with four hazards according to the risk assessment in section 2. Each of the following DNSH violations is considered to be very unlikely and thus designated as minimal risk: violation of generic criteria for climate change adaptation (F1), violation of generic criteria for water and marine resources (F2), violation of regulatory criteria for pollution prevention (F3) and violation of generic criteria for biodiversity and ecosystems.

4.1.15 INPUT - Intelligent network link of parking garages and underground garages

The projects INPUT and INPUT 2.0 provide state funding for charging stations and intelligent grid connections in parking lots and parking garages. These systems are intended to charge electric vehicles but also have the goal of avoiding high net loads in the electric grid. As such, they have the potential to reduce the necessity of energy production or to provide renewable energy for electric cars, thus reducing the GHG emissions. However, there is currently not sufficient data to estimate these effects. The projects were funded with state expenditures of EUR 3.8m in 2021.

One indicator was identified and reported: the number of funded projects in 2021 (25) with a share of financing of 100%.

The following table lists the results and evaluates the robustness of the results.

table 4-16: results for the project "INPUT: Intelligent network link of parking garages & underground garages (No 37)"

indicator	quality	full effect	financed effect	robustness
projects funded	E	25	25	1

All associated risks are minimal and therefore considered to be hazard-indicators. They relate to a chance of violating the generic DNSH harm criteria for climate change adaptation (F1) as well as biodiversity and ecosystems (F2).

4.1.16 Solar battery storage systems

The state subsidies battery storage systems that are installed in conjunction with a new photovoltaic system. It aims to promote innovative and climate-friendly technologies. In 2021, the project was funded with EUR 2.2m. Two indicators have been identified and quantified.

- Firstly (1), the additional capacity for electricity storage is reported as an output-indicator (C). Although the "full" effect is not known for 2021, the financing itself can be associated with an additional capacity of 5.9 MWh based on typical funding of 300 EUR/kWh.
- Secondly (2), the funding itself is reported as an input-indicator (E).

The following table lists all indicators and evaluates the robustness.

table 4-17: results for the project "Solar battery storage systems (No 38)"

indicator	quality	full effect	financed effect	robustness
renewable storage capacity added (estimate)	C	not available	5.9 MWh	4
funding for renewable battery capacity	E	not available	EUR 2.2m	1

4.1.17 Regional centers of excellence for energy efficiency

In order to fully exploit the energy efficiency potential of companies, the Ministry of the Environment is promoting regional Competence Centers for Energy Efficiency (KEFF) in 12 regions of Baden-Württemberg. They are intended to provide companies (especially SMEs) with free and independent information about energy efficiency options throughout the state, to arrange energy consulting services, and to support them in integrating into company networks and implementing energy efficiency measures. In 2021, EUR 0.86m have been invested and three indicators have been identified and quantified.

- Firstly (1), the number of evaluated energy efficiency measures by companies (36 in 2021) is reported as output-indicator (C), for which no "financed" effect can be derived due to lack of further information on the efforts of all the actors involved.
- Secondly (2), the number of consultations by energy advisers (107 in 2021) is reported as activity-indicator (D). Accordingly, no "financed" effect can be reported here as well.
- Thirdly (3), the number of arranged consultations for companies (1,752 in 2021) is reported as an input-indicator as "full" as well as "financed" effect.

The following table lists the indicators and evaluates the robustness.

table 4-18: results for the project "Regional centers of excellence for energy efficiency (No 39)"

indicator	quality	full effect	financed effect	robustness
evaluated energy efficiency measures in companies	C	36	not available	1
energy consultations in companies	D	107	not available	1
number of arranged consultations	E	1,752	1,752	1

4.1.18 Enhanced Resource Efficiency Programme

This program supports investments in energy-efficient commercial buildings or building technologies. Small and medium-sized enterprises (SMEs) can also receive a climate premium for their eligible projects. The programme was funded with EUR 2.5m in 2021 by the State of BW. Two indicators have been identified and quantified.

- Firstly (1), the number of approved loans (175 in 2021) is reported as activity-indicator (D).
- Secondly (2), the expenditures themselves are reported as input-indicator (E) for resource efficiency in SMEs.

The following table lists the indicators and evaluates the robustness.

table 4-19: results for the project "Enhanced Resource Efficiency Programme/Combi loan for SMEs with climate premium (No 40)"

indicator	quality	full effect	financed effect	robustness
number of loans for energy-efficiency	D	175	175	1
funding for resource efficiency in SMEs	E	EUR 2.5m	EUR 2.5m	1

4.1.19 KARLA - Karlsruhe Reallabor for Sustainable Climate Protection

The activities in the project are intended to promote sustainable climate protection in Karlsruhe in an exemplary manner and to contribute to lasting change in the city. To achieve this, climate protection measures are supported, initiated, investigated and evaluated. In 2021, expenditures of EUR 0.08m were reported that represent 7% of the share of financing. Three indicators have been identified and quantified.

- Firstly (1), the publication of one peer-reviewed scientific article in 2021 is reported as output-indicator (C).
- Secondly (2), the overall number of activities (9) such as presentations and publications is reported as an activity-indicator (D).
- Thirdly (3), the number of funded projects in 2021 (4) is reported as input-indicator (E).

The following table lists all indicators and evaluates the robustness.

table 4-20: results for the project "KARLA - Karlsruhe Reallabor for Sustainable Climate Protection (No 47)"

indicator	quality	full effect	financed effect	robustness
no of published peer-reviewed articles	C	1	0.07	1
no of public activities (presentations, articles, etc.)	D	9	0.63	1
no of projects funded	E	4	0.28	1

4.1.20 CAMPUS high i - CAMPUS made intelligent

The aim of the project is to work together with the stakeholders at the site to achieve realistic implementation prospects for achieving climate neutrality in the building sector. In 2021, the project received state funding of EUR 0.17m. Two indicators have been identified and quantified.

- Firstly (1), the future GHG reduction of one of the investigated buildings (200 tons per annum) has been estimated and reported as an indicator for an intermediate-outcome (B). As this relates to only a portion of the project, no "financed" effect can be derived for that.
- Secondly (2), the overall number of funded projects (4 in 2021) is reported as an input-indicator (E).

The following table lists the indicators and evaluates the robustness.

table 4-21: results for the project "CAMPUS high i - CAMPUS made intelligent (No 48)"

indicator	quality	full effect	financed effect	robustness
future GHG reduction (estimated, building 1)	B	200 t CO2e / a	not available	5
no of funded projects	E	4	0.68	1

4.1.21 Climate Connect industrial area Donautal (KliConn)

The project aims to develop a strategy for sustainable action and climate protection in the Donautal industrial and commercial area. Expenditures of EUR 0.08m in 2021 were attributed for the report at hand. Two indicators have been identified and quantified.

- Firstly (1), the number of conducted workshops with stakeholders in 2021 (3) is reported as activity-indicator (D). This relates to a "financed" effect of 0.15 workshops when assuming a share of financing of 5% (as stated by the issuer).
- Secondly (2), the funding itself (EUR 0.08m) is reported as input-indicator (E) for "funding for climate change mitigation strategies". This means that the expenditures in 2021 also represent a "full" funding effect of EUR 1.7m.

The following table lists the results and evaluates the robustness.

table 4-22: results for the project "Climate Connect industrial area Donautal (KliConn) (No 49)"

indicator	quality	full effect	financed effect	robustness
No of workshops conducted	D	3	0.2	1
funding for climate change mitigation strategies	E	EUR 1.66m	EUR 0.08m	1

4.1.22 MobiQ – Sustainable mobility through sharing in the neighbourhood

The project aims at identifying sustainable mobility options in the neighbourhood. Three different real laboratories are being supported: Stuttgart Zuffenhausen-Rot, Geislingen an der Steige and Waldburg. In 2021, expenditures of EUR 0.2m have been allocated to the project. Two indicators have been identified and quantified.

- Firstly (1), the number of events held in 2021 (5) is reported as an activity-indicator (D). Accounting for the share of financing in this year (17% according to the issuer), 0.45 of these events are considered "financed".
- Secondly (2), the overall "funding for real-world laboratories" is reported as input-indicator (E) for both the "financed" (EUR 0.2m) and "full" (EUR 1.3m) effect.

The following table lists the results and evaluates the robustness.

table 4-23: results for the project "MobiQ - Sustainable mobility through sharing in the neighbourhood (No 50)"

indicator	quality	full effect	financed effect	robustness
No of events with citizens	D	5	0.5	1
funding for real-world laboratories	E	EUR 1.30m	EUR 0.02m	1

4.1.23 Reallabor for climate-neutral Reutlingen

The project accompanies, supports and researches the transformation process of the city of Reutlingen towards climate neutrality. For this purpose, real experiments in five climate-relevant fields of action are carried out in teams from research and practice. In 2021, EUR 0.2m have been invested by the State of BW. Two indicators have been identified and quantified.

- Firstly (1), the number of projects or measure bundles (11 in 2021) is reported as activity-indicator (D). With a share of financing of 17% according to the issuer, the “financed” effect is reported as 1.9 projects in 2021.
- Secondly (2), the overall funding of EUR 0.19m is reported as input-indicator (E) for “funding for real-world laboratories” with a “full” effect of EUR 1.19m.

The following table lists the results and evaluates the robustness.

table 4-24: results for the project "Reallabor for climate-neutral Reutlingen (No 51)"

indicator	quality	full effect	financed effect	robustness
no of projects (measure bundles)	D	11	1.9	1
funding for real-world laboratories	E	EUR 1.14m	EUR 0.19m	1

4.1.24 Mobility Living Lab (MobiLab) Stuttgart

The state is funding the University of Stuttgart's "Mobility Living Lab" project. On the university campus, tests are being conducted to determine how technologies for climate-friendly mobility can be used in a user-friendly way. In 2021, EUR 0.4m have been invested by the State of BW. Three indicators have been identified and quantified.

- Firstly (1), new personnel (1 mobility-authority in 2021) is reported as output-indicator (C). This new job is not allocated to a “financed” effect.
- Secondly (2), the number of projects in 2021 (5) is reported as an activity-indicator (D). With a share of financing of 94%, 4.7 of these projects are attributed as “financed” effect.
- Thirdly (3), the expenditures of EUR 0.4m is reported as an input-indicator (E) “funding for real-world laboratories”. This indicator also relates to a “full” effect of EUR 0.42m.

The following table lists the results and evaluates the robustness.

table 4-25: results for the project "Mobility Living Lab (MobiLab) Stuttgart (No 52)"

indicator	quality	full effect	financed effect	robustness
no of jobs (mobility-authority)	C	1	not available	1
no of projects	D	5	4.7	1
funding for real-world laboratories	E	EUR 0.42	EUR 0.40m	1

4.1.25 Regional Innovation Centre for Energy Technology

Around 60 researchers work in the Regional Innovation Center for Energy Technology at Offenburg University of Applied Sciences. As part of an integrated planning process, a zero-energy building that serves the grid was planned and constructed. The State of BW funded the project with EUR 0.02m in 2021. Two indicators have been identified and quantified.

- Firstly (1), the newly constructed building (1) is reported as activity-indicator (D) with a share of financing as well as "financed" effect of 0.2%.
- Secondly (2), the expenditures itself (EUR 0.02m) are reported as input-indicator (E) that relates to a "full" effect of the total costs of the building (EUR 9.90m).

The following table lists the results and evaluates the robustness.

table 4-26: results for the project "Regional Innovation Centre for Energy Technology" (No 53)"

indicator	quality	full effect	financed effect	robustness
research buildings constructed	D	100%	0.2%	1
funding for building construction	E	EUR 9.90m	EUR 0.02m	1

The construction of buildings is one of the few measures in the Green Bond that can be associated with a rebound (noteworthy risks of violating DNSH criteria). According to the risk assessment, it cannot be excluded that some of the buildings violate the generic taxonomy criteria for climate change adaptation (G1).

4.1.26 Planning and construction of cycle routes on state roads

RadNETZ connects all major and medium-sized cities throughout the state via defined main routes for everyday bicycle traffic and also contains the 19 official state long-distance tourist bicycle routes. In 2021, EUR 11.7m have been invested by the State of BW. Two indicators have been identified and quantified.

- Firstly (1), the additional constructed length of cycle paths (19 km) is reported as output-indicator (C) for both "full" and "financed" effect (share of financing of 100% according to the issuer).
- Secondly (2), the expenditures themselves are reported as input-indicator (E) for "funding for cycle route construction".

The following table lists the indicators and evaluates the robustness.

table 4-27: results for the project "Planning and construction of cycle routes on state roads (No 57)"

indicator	quality	full effect	financed effect	robustness
constructed cycle-paths	C	19 km	19 km	1
funding of cycle route construction	E	EUR 11.69m	EUR 11.69m	1

4.2 Climate Change Adaptation

This section describes the assessment of effects regarding the objective "climate change adaptation". Both eligible projects with total expenditures of EUR 3.9m could be assessed. 7 indicators were identified in total, of which 5 indicators at least related to activities. One project (subsidies for the development of climate-resilient forests) is associated with a desired-outcome (quality B), representing "strong evidence for a substantial contribution" to the environmental objective. Future impact reports will investigate whether the overall long-term implications of the project ensure a persistent and absolute improvement in regard to carbon storage and absorbance.

4.2.1 Timber construction initiative BW

With the Timber Construction Initiative, the state is promoting climate-friendly construction with wood. In 2021, state expenditures of EUR 2.15m were attributed to the project. Three indicators have been identified and quantified.

- Firstly (1), the number of approved timber buildings (6,780 in 2021) is reported as output-indicator (C). Here, only the "full" effect is reported, as no data on the actual financing of the buildings is available.
- Secondly (2), the number of events is reported as activity-indicator (D) with a share of financing of 100%.
- Thirdly (3), the expenditures themselves are reported as input-indicator (E) for "funding for sustainable construction".

The following table lists the indicators and evaluates the robustness.

table 4-28: results for the project "Timber construction initiative (No 7)"

indicator	quality	full effect	financed effect	robustness
no of approved timber buildings	C	6,780	not available	1
no of events	D	45	45	1
funding for sustainable construction	E	EUR 2.15m	EUR 2.15m	1

4.2.2 Subsidies for the development of climate-resilient forests and/or (re-)afforestation

The state aims to eliminate the damage caused by drought, storms and bark beetles, to minimise the occurrence of consequential damage and to quickly replant the forests with suitable tree species. In 2021, expenditures of EUR 1.77m are attributed to this project. The overall re- and afforested area is estimated at 1,497 ha according to the issuer and the related agency. For an estimation of the stored and absorbed carbon by the trees, it is assumed that each hectare stores 99.5 tons of carbon (FAO 2020) and 1.16 tons of carbon are absorbed every year (Umweltbundesamt 2020 p. 631). Four indicators have been identified and quantified.

- Firstly (1), the annually absorbed carbon is estimated (1,737 tons) and reported as intermediate-outcome (B) with a share of financing of 40% according to the issuer (represents 695 tons of "financed" carbon absorbance every year).
- Secondly (2), the stored carbon is estimated accordingly as output-indicator (C) with 149,000 tons of stored carbon (full effect) and 59,600 tons respectively (financed effect).

- Thirdly (3), the promoted forest area is directly reported as activity-indicator (D) with a financed effect of 599 ha compared to 1,597 ha (full effect).
- Fourthly (4), the expenditures themselves are reported as input-indicator for “funding for forest-related measures”. The actual expenditures of EUR 1.8m represent total costs of EUR 4.4m.

The following table lists the results and evaluates the robustness.

table 4-29: results for the project "Subsidies for the development of climate-resilient forests and/or (re-) afforestation (No 11)”

indicator	quality	full effect	financed effect	robustness
annually absorbed carbon (carbon sink)	B	1,737 t C/a	695 t C/a	4
stored carbon (biomass above and below ground)	C	149,011 t C	59,606 t C	4
promoted forest area	D	1,497 ha	599 ha	1
funding for forest-related measures	E	EUR 4.4m	EUR 1.8m	1

4.3 Water and Marine Resources

This section describes the assessment of effects regarding the objective "sustainable use and protection of water and marine resources". Both eligible projects with total expenditures of EUR 47.8m could be assessed. 6 indicators were identified in total, of which 4 indicators at least related to activities. Both projects were associated with at least a "high likelihood of substantial contribution" (indicators with quality C) by implementing a total of 184 measures for sewerage infrastructures and water supply.

4.3.1 Sewerage infrastructure investments

Expenditure on investments directly required for the operation of public wastewater disposal is eligible for funding. The state grants subsidies for water management projects of public interest. In 2021, state expenditures of EUR 33.74m were attributed to these projects. Three indicators have been identified and quantified.

- Firstly (1), the number of implemented measures (126 in 2021) is reported as an output-indicator (C) with a share of financing of 100% according to the issuer.
- Secondly (2), the number of funded communities (99 in 2021) is reported as an activity-indicator (D).
- Thirdly (3), the expenditures themselves are reported as input-indicator (E) for "funding of remediation activities".

The following table lists the indicators and evaluates the robustness.

table 4-30: results for the project "Sewerage infrastructure investments (No 42)"

indicator	quality	full effect	financed effect	robustness
no of implemented measures	C	126	126	1
no of funded communities	D	99	99	1
funding for remediation activities	E	EUR 33.74m	EUR 33.74m	1

4.3.2 Water supply

The project comprises of measures that are directly necessary for the operation of the public water system in the State of BW. In 2021, EUR 14.11m were attributed to this purpose. Three indicators have been identified and quantified.

- Firstly (1), the number of implemented measures (58 in 2021) is reported as an output-indicator (C) with a share of financing of 100% according to the issuer.
- Secondly (2), the number of funded communities (67 in 2021) is reported as an activity-indicator (D).
- Thirdly (3), the expenditures themselves are reported as input-indicator (E) for "funding of remediation activities".

The following table lists the indicators and evaluates the robustness.

table 4-31: results for the project "Water supply (No 43)"

indicator	quality	full effect	financed effect	robustness
no of implemented measures	C	58	58	1
no of funded communities	D	67	67	1
funding for remediation activities	E	EUR 14.11m	EUR 14.11m	1

4.4 Circular Economy

This section describes the assessment of effects regarding the objective "transition to a circular economy". All 4 projects with total expenditures of EUR 0.6m could be assessed. 12 indicators were identified in total, of which 6 indicators at least related to activities and 2 indicators indicated DNSH risks. 3 projects were associated with at least a "high likelihood of substantial contribution" (indicators with quality C).

The following sections describe all assessed projects, their effects according to their indicator-quality and evaluate the robustness of these effects. No models were used to quantify the effects, but two output-indicators are restricted to estimates for future effects (number of future employees in the INATECH building and future recovery rates for phosphorus).

4.4.1 New research building INATECH

The project aims at constructing the research facility INATECH with a future research focus on the development of sustainable materials, sustainable energy systems and resilience of systems. In 2021, state expenditures of EUR 0.15m were attributed to the construction and equipment of the building. Three indicators have been identified and quantified.

- Firstly (1), the number of future employees in the building (113) is reported as output-indicator (C). In relation to the total costs of the building and its equipment (EUR 26m), the "financed" effects is considered to be 0.7 future employees.
- Secondly (2), the contribution to the construction of the building is reported as activity-indicator (D). The expenditures in 2021 (EUR 0.15m) contribute to 0.6% of the total costs.
- Thirdly (3), the expenditures themselves are reported as input-indicator (E) for "funding for research buildings (circular economy)".

The following table lists the results and evaluates the robustness.

table 4-32: results for the project "New research building INATECH (No 30)"

indicator	quality	full effect	financed effect	robustness
no of future employees	C	113	0.7	5
building construction (research)	D	100%	0.6%	1
funding for research buildings (circular economy)	E	EUR 26.0m	EUR 0.15m	1

This project is also associated with potential violations of DNSH criteria (as are all constructed, renovated or owned buildings within taxonomy-related activities according to the taxonomy). The risk assessment found no hazards. However, there is a low risk (potential rebound) of violating the generic climate change adaptation (G1) criteria.

4.4.2 Phosphorus recovery from sewage sludge

The largest secondary raw material source for phosphorus is sewage sludge. For this reason, the construction of plants for the recovery of phosphorus is promoted. In 2021, state expenditures of EUR 0.38m were attributed to this purpose. Three indicators have been identified and quantified.

- Firstly (1), the future recovery rate of the plant(s) is estimated at 1.4 t/a and reported as an output-indicator (C). In relation to the total costs of the plant (EUR 8.3m), a “financed” effect of 0.1 t/a is assumed.
- Secondly (2), the contribution to the construction of the plant is reported as activity-indicator (D). The expenditures in 2021 (EUR 0.38m) contribute to 5.0% of the total costs.
- Thirdly (3), the expenditures themselves are reported as input-indicator (E) for “funding for research buildings (circular economy)”.

The following table lists the results and evaluates the robustness.

table 4-33: results for the project "Phosphorus recovery from sewage sludge (No 41)”

indicator	quality	full effect	financed effect	robustness
future potentials of recovered phosphorus	C	1.4 t P per year	0.1 t P per year	5
building construction (research)	D	100%	4.5%	1
funding for research buildings (circular economy)	E	EUR 8.3m	EUR 0.4m	1

4.4.3 Professorship for sustainability research and transformative research

This professorship aims to establish interdisciplinary research approaches. The Ministry of Science, Research and the Arts is funding the bridge professorship with a total of EUR 300,000 over the entire funding period of five years. This results in a 20% share of financing when compared to expenditures of EUR 0.06m for 2021. Two indicators have been identified and quantified.

- Firstly (1), the number of theses (master’s and bachelor’s degrees with no dissertations yet) in 2021 (7) is reported as output-indicator (C).
- Secondly (2), the expenditures themselves (EUR 0.06m) are reported as input-indicator (E) for “funding for research (circular economy)”.

The following table lists the results and evaluates the robustness.

table 4-34: results for the project "Professorship for sustainability research and transformative research (No 45)”

indicator	quality	full effect	financed effect	robustness
finished theses	C	7	7	1
funding for research (circular economy)	E	EUR 0.30m	EUR 0.06m	1

4.4.4 RecTecKA – Recycling of technology metals from the dismantling of nuclear facilities

As part of the phase-out of nuclear energy, not only the radioactive residues have to be disposed of. All plant components in the non-nuclear area must also be dismantled and recycled. The main focus of the project is to identify particularly interesting plant parts and components. The issuer reports a funding amount of EUR 24,000 in 2021. Two indicators have been identified and quantified.

- Firstly (1), the number nuclear plants that are investigated for material recovery (4 plants in 2021) is reported as activity-indicator (C) with an assumed share of financing of 100%.

- Secondly (2), the expenditures themselves (EUR 0.02m) are considered to be an input-indicator (E) for “funding for material recovery research”.

The following table lists the results and evaluates the robustness.

table 4-35: results for the project "RecTecKA (No 46)”

indicator	quality	full effect	financed effect	robustness
no of nuclear plants to be dismantled	D	4	4	1
funding for material recovery research	E	EUR 0.02m	EUR 0.02m	1

4.5 Pollution Prevention

This section describes the assessment of effects regarding the objective "pollution prevention and control". 7 out of 9 projects with total expenditures of EUR 22.9m could be assessed (99% of all expenditures in this category). A total of 16 indicators were identified, of which 8 indicators are at least related to activities.

Three projects could be associated with output-indicators (quality C) and thus with a "high likelihood of substantial contribution" to the environmental objective. Two of these projects (public air solutions and express bus lines in Stuttgart) will be investigated for intermediate or even long-term outcomes in the future.

4.5.1 E-Mobility in the car pool of BW police - purchase of motorcycle with electric motor

The police of Baden-Württemberg plans to electrify its vehicle pool and purchased an electric motorcycle. In 2021, state expenditures of EUR 0.04m were attributed to this purpose. Two indicators have been identified and quantified.

- Firstly (1), the purchase of an electric motorcycle is reported as an activity-indicator (D) with a share of financing of 100% according to the issuer.
- Secondly (2), the purchase itself is reported as input-indicator (E) for "funding of low-emission mobility".

The following table lists the results and evaluates the robustness.

table 4-36: results for the project "E-Mobility in the car pool of BW police - purchase of motorcycle with electric motor (No 13)"

indicator	quality	full effect	financed effect	robustness
purchase of electric vehicles	D	1	1	1
funding for low-emission mobility	E	EUR 0.04m	EUR 0.04m	1

4.5.2 E-Mobility in the car pool of BW police - purchase of pedelecs

The state government of Baden-Württemberg also funds the purchase of pedelecs with state expenditures in 2021 of EUR 0.23m. Two indicators have been identified and quantified.

- Firstly (1), the purchase of these pedelecs (93 in 2021) is reported as an activity-indicator (D) with a share of financing of 100% according to the issuer.
- Secondly (2), the purchase itself is reported as input-indicator (E) for "funding of low-emission mobility".

The following table lists the results and evaluates the robustness.

table 4-37: results for the project "E-Mobility in the car pool of BW police - purchase of pedelecs (No 14)"

indicator	quality	full effect	financed effect	robustness
purchase of electric vehicles	D	93	93	1
funding for low-emission mobility	E	EUR 0.23m	EUR 0.23m	1

The risk assessment also reports a potential DNSH risk here, as the EU taxonomy requires that the generic DNSH criteria for potential climate change adaptation violations are

assessed for the economic activity of purchasing “personal mobility devices”. There is no indication that this risk is other than minimal (hazard-indicator F1).

4.5.3 Public air solutions – filter cubes

The state promotes the installation of air filters as a measure for improving air quality in inner-city hotspots. They are designed for use in particularly highly polluted road sections. In 2021, 15 air filter columns were added, with a total of 94 columns in use so far. A recent study indicated that air emissions can be reduced with the help of the air filters: circa 9% N_2O reductions near main roads and 10-19% reductions near buildings as well as reductions of particular matter (PM) of circa 10% in general (see also Müller & Warth, 2020). The issuer reports a funding amount of EUR 1.95m in 2021. Three indicators have been identified and quantified.

- Firstly (1), the site-specific reduction of air emissions (N_2O; PM) is reported as output-indicator (C) with a share of financing of 100% according to the issuer. We assume that an average reduction of 10% represents the findings of a recent study on the efficacy of the air filter.
- Secondly (2), the number of additional air filters (15 in 2021) is reported as an activity-indicator (D).
- Thirdly (3), the expenditures themselves are reported as input-indicator (E) for “funding for low-emission mobility”.

The following table lists the results and evaluates the robustness.

table 4-38: results for the project "Public air solutions - filter cubes (No 16)”

indicator	quality	full effect	financed effect	robustness
site-specific reduction of air emissions (N20, PM)	C	10%	10%	4
additional air filter systems	D	15	15	1
funding for low-emission mobility	E	EUR 1.95m	EUR 1.95m	1

4.5.4 Establishment of express bus lines in the Stuttgart region

The project aims at closing the existing service gaps in the S-Bahn network of Stuttgart with the help of high-quality express bus lines. In 2021, EUR 2.09m have been attributed to the project. Two indicators have been identified and quantified.

- Firstly (1), the length of the additional bus lines (circa 61 km) is reported as output-indicator (C). As the share of financing is assumed to be 75% for the State of BW, the “financed” effect is reported with 46 km.
- Secondly (2), the expenditures themselves are reported as input-indicator (E) for “funding for low-emission mobility”.

The following table lists the results and evaluates the robustness.

table 4-39: results for the project "Establishment of express bus lines in the Stuttgart region (No 17)"

indicator	quality	full effect	financed effect	robustness
additional express bus line length	C	61 km	46 km	3
funding for low-emission mobility	E	EUR 2.79m	EUR 2.09m	1

The provision of transport infrastructures is associated with potential DNHS violations according to the risk assessment. The minimal risk of violating the generic DNSH criteria for climate change adaptation is considered to be a hazard (F1).

4.5.5 Low-emission bus transportation

The State of BW provides funding for local public transport through the acquisition of buses. It aims to increase the share of buses used in local public transport as a contribution to the European strategy for low-emission mobility. In 2021, expenditures of EUR 12.10m were attributed to the project. Two indicators have been identified and quantified.

- Firstly (1), the number of approvals for new busses is reported as activity-indicator (D). It is assumed that only low-emission vehicles contribute to the overarching goal, which is why only 224 out of 358 vehicles (63%) are reported here and the funding has been allocated accordingly (EUR 11.47m).
- Secondly (2), the expenditures themselves are reported as input-indicator (E) for “funding for low-emission mobility” with a share of financing of 100%.

The following table lists the results and evaluates the robustness.

table 4-40: results for the project "Low-emission bus transportation (No 19)"

indicator	quality	full effect	financed effect	robustness
approved purchases of low-emission vehicles	D	224	224	1
funding for low-emission mobility	E	EUR 12.10m	EUR 12.10m	1

4.5.6 Intelligent public transport in Baden-Württemberg

According to the issuer, the project kicks off at the beginning of 2022, and first user data should be available by the end of 2022. Accordingly, a full effect (such as numbers of tickets sold or estimates for avoided car-km) cannot be determined yet. So far, only the input-indicator (E) "funding for low-emission mobility" is reported (with a share of financing of 100% according to the issuer).

The following table lists the results and evaluates the robustness.

table 4-41: results for the project "Intelligent public transport in Baden-Württemberg (No 22)"

indicator	quality	full effect	financed effect	robustness
funding for low-emission mobility	E	EUR 0.44m	EUR 0.44m	1

4.5.7 Remediation of contaminated sites

The project funds the investigation and remediation of municipal sites. The aim of the funding is to identify suspected contaminated sites and, if necessary, to eliminate the dangers

they pose. In this way, land consumption can be reduced through the remediation and reuse of contaminated sites. The issuer reports a funding amount of EUR 6.07m in 2021. Three indicators have been identified and quantified.

- Firstly (1), the number of implemented measures (40 in 2021) is reported as an output-indicator (C) with a share of financing of 100% according to the issuer.
- Secondly (2), the number of affected communities (24 in 2021) is reported as an activity-indicator (D).
- Thirdly (3), the expenditures themselves (EUR 6.07m) is reported as input-indicator (E) for “funding for remediation activities”.

The following table lists the results and evaluates the robustness.

table 4-42: results for the project "Remediation of contaminated sites (No 44)"

indicator	quality	full effect	financed effect	robustness
implemented measures of remediation	C	40	40	1
funded communities	D	24	24	1
funding for remediation activities	E	EUR 6.07m	EUR 6.07m	1

4.6 Biodiversity and Ecosystems

This section describes the assessment of effects regarding the objective "protection and restoration of biodiversity and ecosystems". All 11 projects with total expenditures of EUR 60.2m could be assessed. Overall 31 indicators were identified, of which 18 indicators at least related to activities.

For 5 out of 11 projects, desired outcomes could be reported that represent positive societal changes beyond the scope of the projects. They are "strong evidence for substantial contributions" towards the environmental objectives of the EU taxonomy (with an additional 3 projects that showing a "high likelihood of substantial contribution"). The following table lists these five projects and their desired outcomes. It also shows how long-term benefits as "unequivocal evidence for substantial contributions" could be ensured. These criteria are going to be investigated for any project in this list that is also part of the next Green Bond.

table 4-43: Best-in-Class indicators for Green Bond Baden-Württemberg #2 in "Biodiversity and Ecosystems"

Project	**Strong evidence for substantial contribution** (Quality B)	**Criteria for unequivocal evidence** (Quality A)
No 3: Investing in properties with importance for environmental protection	Increase in natural protection area in the State of BW	Regulation must ensure that the land remains protected for several decades and that other land-use is restricted in the affected regions.
No 9: Preserving manually cultivable vineyards in steep slope and terraced areas	Increase in organically farmed land in the State of BW	Regulation and funding must ensure that the cultivation restrictions remain in place for the foreseeable future.
No 32: Biotope mapping	Increase in biotopes in the State of BW confines of the project	Regulation must ensure sufficient funding for not only the protection of the biotopes but also their active management for the next decades.
No 33: Non-productive investments in conservation	additional protected/enhanced eco-friendly area	Regulation and funding must exclude any future productive use of the habitats and conserved lands.
No 34: Special Programme for Biodiversity	additional protected/enhanced eco-friendly area	Evaluation and monitoring are needed to ensure that the additional area is and remains "enhanced" in terms of the preservation of biodiversity and ecosystems.

The following sections describe all assessed projects, their effects according to their indicator-quality and evaluate the robustness of these effects. No models were used to quantify the effects, although auxiliary variables were used to estimate the attribution to "financed" compared to "full" effects in some cases.

4.6.1 Visitor and information centre Nationalpark Black Forest

The visitor centre of the newly founded Black Forest National Park offers services related to environmental education. In 2021, the State of BW invested EUR 2.6m into the construction of the centre. Two indicators have been identified and quantified.

- Firstly (1), the construction of a building for environmental education is reported as an activity-indicator (D) with a share of financing of 6% according to the issuer (6% of the constructed building as "financed" effect).

- Secondly (2), the expenditures themselves are reported as an input-indicator (E) for "funding for environmental education" that relates to a "full" effect of EUR 41.5m.

The following table lists the indicator and evaluates the robustness of the result.

table 4-44: results for the project "Visitor and information centre Nationalpark Black Forest (No 1)"

indicator	quality	full effect	financed effect	robustness
building construction for environmental education	D	100%	6.2%	1
funding for environmental education	E	EUR 41.5m	EUR 2.6m	1

The risk assessment did not identify any hazards. One potential rebound has been identified, as a violation of the generic DNSH criteria for climate change adaptation cannot be excluded.

4.6.2 Investing in properties with importance for environmental protection

The state's nature conservation strategy includes acquiring land for the purpose of nature and climate protection. Baden-Württemberg owns around 14,000 parcels of land with an area of nearly 12,000 hectares that are important for nature conservation. In 2021, the State of BW invested EUR 2.5m for this purpose. Three indicators have been identified and quantified.

- Firstly (1), the desired intermediate-outcome (B) of increasing the natural area in BW has been achieved and reported. The additional 1.1% of protected area is considered both a "financed" and "full" effect due to a share of financing of 100% according to the issuer.
- Secondly (2), the additional protected area of 132 ha in 2021 is reported as output-indicator (C).
- Thirdly (3), the expenditures themselves (EUR 2.5m) are considered as input-indicator (E) for "funding for nature conservation and biodiversity".

The following table lists the indicators and evaluates the robustness of the results.

table 4-45: results for the project "Investing in properties with importance for environmental protection (No 3)"

Indicator	quality	full effect	financed effect	robustness
increase in natural protected area in the State of BW	B	1.1%	1.1%	1
additional protected area	C	131.9 ha	131.9 ha	1
funding for nature conservation and biodiversity	E	EUR 2.5m	EUR 2.5m	1

4.6.3 Aid for pruning of meadow orchards

The project has the goal to support the preservation and development of scattered fruit stands through professional tree pruning and to promote the habitat for scattered orchard-typical animals and plants. The state promoted the project with EUR 3.17m in 2021. Two indicators have been identified and quantified.

- Firstly (1), the number of pruned trees (211,500 trees in 2021) is reported as output-indicator (C) with a share of financing of 100% (according to the issuer).
- Secondly (2), the expenditures themselves are considered to be an input-indicator (E) for "funding for organic/sustainable farming" with EUR 3.17m.

The following table lists the results and evaluates the robustness of the results.

table 4-46: results for the project "Aid for pruning of meadow orchards (No 5)"

indicator	quality	full effect	financed effect	robustness
number of pruned trees	C	211,500	211,500	1
funding for organic/sustainable farming	E	EUR 3.17m	EUR 3.17m	1

4.6.4 Preserving steep-hill grassland

The funding aims to support the difficult management of steep grassland and thus maintain it in the long term. In 2021, the State of BW funded the project with EUR 5.67m. Three indicators have been identified and quantified.

- Firstly (1), the promoted area for organic/sustainable farming (46,840 ha in 2021) is reported as an output-indicator (C) with a share of financing of 100% according to the issuer.
- Secondly (2), the number of applicants for the programme (8,116 persons or entities) is reported as activity-indicator (D).
- Thirdly (3), the expenditures for the project in 2021 of EUR 5.67m is reported as input-indicator (E).

The following table lists the results and evaluates the robustness of results.

table 4-47: results for the project "Preserving steep-hill grassland (No 6)"

indicator	quality	full effect	financed effect	robustness
promoted area for organic/sustainable farming	C	46,840 ha	46,840 ha	1
number of applicants	D	8,116	8,116	1
funding for organic/sustainable farming	E	EUR 5.67m	EUR 5.67m	1

4.6.5 Exemplary regions for organic food

There are 14 organic model regions in Baden-Württemberg in which organic agriculture is to be strengthened along regional value chains. The core of the funding is the position of a regional management, which links the key players, i.e. farmers, artisanal processors, regional marketers and consumers, and brings them into dialogue with each other. State expenditures of EUR 0.74m have been attributed to the project in 2021. Two indicators have been identified and quantified.

- Firstly (1), the number of funded communities in 2021 (16) is reported as an activity-indicator (D) with a share of financing of 100%.
- Secondly (2), the actual expenditures of EUR 0.74m is report as an input-indicator (E) for “funding for organic/sustainable farming”.

The following table lists the results and evaluates the robustness of the results.

table 4-48: results for the project "Exemplary regions for organic food (No 8)"

indicator	quality	full effect	financed effect	robustness
no of funded communities	D	11	11	1
funding for organic/sustainable farming	E	EUR 0.74m	EUR 0.74m	1

4.6.6 Preserving manually cultivable vineyards in steep slope and terraced areas

Vineyard sites with high ecological development potential are to be further ecologically enhanced by dispensing with mechanical management measures (tractors, heavy self-propelled machinery). In 2021, state expenditures of EUR 0.96m have been attributed to the project. Three indicators have been identified and quantified.

- Firstly (1), the desired intermediate-outcome (B) of increasing organically farmed area in the State of BW (18.6% in 2021) is reported with a share of financing of 100% according to the issuer.
- Secondly (2), this additional organically farmed area (50 ha in 2021) is reported as output-indicator (C).
- Thirdly (3), the actual expenditures are considered an input-indicator (E) for “funding for organic/sustainable farming”.

The following table lists the results and evaluates the robustness of the indicators.

table 4-49: results for the project "Preserving manually cultivable vineyards in steep slope and terraced areas (No 9)”

indicator	quality	full effect	financed effect	robustness
increase in organically farmed area in the State of BW	B	18.6%	18.6%	1
additional organically farmed area	C	50 ha	50 ha	1
funding for organic/sustainable farming	E	EUR 0.96m	EUR 0.96m	1

4.6.7 Biotope mapping

The mapping of biotopes is considered to be a contribution to the protection of biodiversity and ecosystems. In 2021, state expenditures of EUR 3.59m were attributed to this project. Three indicators have been identified and quantified.

- Firstly (1), the desired intermediate-outcome (B) of an increase in biotopes (3.2% in 2021) has been achieved and is reported as an indicator with a share of financing of 100% according to the issuer.
- Secondly (2), the number of updated and new biotopes (7,480 in 2021) is reported as an activity-indicator (D).
- Thirdly (3), the expenditures themselves (EUR 3.59m) are reported as input-indicator (E) for “funding for nature conservation and biodiversity”.

The following table lists the results and evaluates the robustness.

table 4-50: results for the project "Biotope mapping (No 32)"

indicator	quality	full effect	financed effect	robustness
increase in biotopes	B	3.2%	3.2%	1
no of updated/new biotopes	D	7,480	7,480	1
funding for nature conservation and biodiversity	E	EUR 3.59m	EUR 3.59m	1

4.6.8 Non-productive investments in conservation

This project refers to maintenance, enhancement and conservation measures and new construction of various habitats in the open countryside, such as the creation of wetland biotopes or the planting of hedges. The added value in terms of nature conservation results from the comparison (evaluation) of the area in terms of nature conservation before and after implementation. In 2021, state expenditures of EUR 13.92m have been attributed to the project. Three indicators have been identified and quantified.

- Firstly (1), the desired intermediate-outcome of additional protected/enhanced eco-friendly area is reported (11,445 ha) with a share of financing of 100% according to the issuer. However, only a portion of the overall measures and therefore a portion of the overall funding is related to this indicator (EUR 10.19m out of EUR 13.92m)
- Secondly (2), the number of projects (5,593) is reported as activity-indicator (D).
- Thirdly (3), the expenditures themselves (EUR 13.92m) are reported as input-indicator (E) for “funding for nature conservation and biodiversity”.

The following table lists the results and evaluates the robustness of the indicators.

table 4-51: results for the project "Non-productive investments in conservation (No 33)"

indicator	quality	full effect	financed effect	robustness
additional protected/enhanced eco-friendly area	B	11,445 ha	11,445 ha	3
funded projects for nature conservation and biodiversity	D	5,593	5,593	1
funding for nature conservation and biodiversity	E	EUR 13.92m	EUR 13.92m	1

4.6.9 Special programme for biodiversity

The funds in this program are used to implement individual projects to strengthen biodiversity by various funding recipients such as clubs, associations, private individuals, counties, municipalities and others. In addition to these projects, monitoring measures are implemented by contractors (engineering companies). In 2021, state expenditures of EUR 11.01m were attributed to this project. Three indicators have been identified and quantified.

- Firstly (1), the area that is either protected or enhanced in the context of biodiversity is directly reported by the issuer (primary data). This is considered not only a direct output of the projects but an intermediate-outcome (B) in line with the environmental objective of biodiversity. Not all measures relate to such areas which is why no specific monetary value or share can be assigned. However, the overall area reported here (circa 4,200 hectare) is fully applicable as an annual result.
- Secondly (2), the number of projects funded is reported as activity-indicator (D). So far, circa 1,600 projects can be attributed to the funding in 2021.
- Thirdly (3), the overall funding from the state's budget is reported as input-indicator (E) as "funding for nature conservation". The total funding of circa EUR 11.0m is reported.

The following table lists the results and evaluates the robustness of the indicators.

table 4-52: results for the project "Special programme for biodiversity (No 34)"

indicator	quality	full effect	financed effect	robustness
additional protected/enhanced eco-friendly area	B	4,208 ha	4,208 ha	3
funded projects for nature conservation and biodiversity	D	1,616	1,616	1
funding for nature conservation and biodiversity	E	EUR 11.01m	EUR 11.01m	1

4.6.10 Nature conservation contracts

With this guideline, the state promotes measures or investments that serve the maintenance and design of the cultural landscape or specific nature conservation goals. Important objectives are the realisations of the goals of the Federal Nature Conservation Act and the Nature Conservation Act of Baden-Württemberg, the protection and preservation of animal and plant species and biotopes, as well as the conservation, restoration and improvement of biodiversity, ecosystems, natural heritage, and the cultural landscape. In 2021, state expenditures of EUR 15.76m were attributed to this project. Two indicators have been identified and quantified.

- Firstly (1), the number of projects is reported as an activity-indicator (D). Out of the “full” set of projects in 2021 (6,562), 50% (share of financing according to the issuer) or 3,281 projects are attributed as “financed” effect.
- Secondly (2), the expenditures themselves (EUR 15.8m) are reported as input-indicator (E) for “funding for nature conservation and biodiversity” with a “full” effect of EUR 31.5m.

The following table lists the results and evaluates the robustness of the indicators.

table 4-53: results for the project "Nature conservation contracts (No 35)"

indicator	quality	full effect	financed effect	robustness
no of projects	D	6,562	3,281	1
funding for nature conservation and biodiversity	E	EUR 31.5m	EUR 15.8m	1

4.6.11 Research programme organic farming

The bundling of research on organic farming and the further development of research activities with non-academic actors are the focus of the research program organic farming. The aim is a contribution to the transformation towards a sustainable society and to generate concrete practical benefits for the organic sector in Baden-Württemberg. In 2021, state expenditures of EUR 0.25m have been attributed to the project. Three indicators have been identified and quantified.

- Firstly (1), the number of scientific publications (3 in 2021) is reported as an output-indicator (C) with a share of financing of 31% ("financed" effect of 0.9 publications).
- Secondly (2), the number of held events (4 events in 2021) is reported as an activity-indicator (D). For "financed" effects, 1 such event is attributed to the Green Bond.
- Thirdly (3), the expenditures themselves are reported as an input-indicator (E). Due to a share of financing of 31%, the expenditures of EUR 0.25m represents a "funding for organic/sustainable farming" of EUR 1.0m.

The following table lists the results and evaluates the robustness.

table 4-54: results for the project "Research Programme Organic Farming (No 54)"

indicator	quality	full effect	financed effect	robustness
no of scientific publications	C	3	0.9	1
no of held events	D	4	1	1
funding for organic/sustainable farming	E	EUR 1.0m	EUR 0.25m	1

5 Discussion and Outlook

The report on the first Green Bond Baden-Württemberg provided a proof-of-concept for an impact assessment of a Green Bond aligned with the EU taxonomy. The current report expanded on this and updated the methodology. It is more comprehensive, as it covers all projects as part of the risk assessment and almost all of the projects regarding the reporting of contributions to the environmental objectives of the EU taxonomy.

Apart from an overall increase in coverage, a lot more projects could be associated with direct project outputs as a pre-condition for desired positive changes as well as evidence for intermediate-outcomes as evidence for these changes on a societal level. These desired outcomes should be further investigated in the future. If evidence can be found that the relative improvements also lead to persistent long-term outcomes, then direct contributions to the overarching sustainability goals can be shown. This evidence could be regulatory in nature (e.g. ensuring that protected land remains protected for a foreseeable future), but could also be empirical. For example, if it can be shown that the overall GHG emissions from public buildings in the state decreased despite the construction of new buildings, then a contribution to the state's climate targets is achieved as well. This process can be guided by not only additional data from the issuer but also by Theories-of-Change as well as methods of Process-Tracing (e.g. see Befani and Mayne (2014)). This would provide plausible narratives and hypotheses for the underlying cause-effect relationship and also the means to test these hypotheses in a more reliable manner.

The report at hand is also the first report that investigates which of the reported indicators are accumulative in nature. Future reports can add up the annual effects for some of the projects, showing to investors how continuous progress has been achieved over the course of several Bonds. This additional information also provides a more comprehensive picture of the effects, since most of the projects relate to state programmes that are funded over longer periods.

The next report will use some of the detailed information in the report at hand as a point of reference. It will summarize the information from previous reports in regard to effects that were already reported as well as in regard to the risk assessment. This will result in a more concise reporting, but will also enable the authors to investigate those projects in more detail, where a more thorough scientific investigation might help to identify stronger evidence for significant contributions to the overarching goals.

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7 Appendix

Heuristic risk assessment

(+ indicates attributed risks | - indicates substantial contribution and thus no risk assessment | MAG: high magnitude IF violation occurs | LH: high likelihood for SOME form of violation)

	Project in Green Bond (with attributed NACE code(s))	Status Quo: System for Comparison	Risk of DNSH	CM		CA		WM		CE		PP		BE	
				MAG	LH	MAG	LH	MAG	LH	MAG	LH	MAG	LH	MAG	LH
CM	Notably energy-efficient new buildings in the public building construction	stock of existing public buildings	low risk	-	-	o	+	o	o	o	o	o	o	+	o
	Notably energy-efficient restructuring measures in the public building construction	stock of existing public buildings	low risk	-	-	o	+	o	o	o	o	o	o	o	o
	Strategy for sustainable bio-economy	no stragey	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	State funding of broadband	no additional fibre optic connections	low risk	-	-	o	o	o	o	o	+	o	o	+	o
	Electrification Hochrheinbahn	conventional rail transport (Diesel)	low risk	-	-	o	o	o	o	o	o	o	+	o	o
	GVFG Electrification Projects	conventional rail transport (Diesel)	low risk	-	-	o	o	o	o	o	o	o	+	o	o
	Cycling Culture Initiative	local public transport	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Support program state initiative electromobility	conventional vehicles	low risk	-	-	o	o	o	+	o	o	o	o	o	o
	Support Program for Municipal Cycling and Pedestrian Infrastructure	current modal shift	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Cycling Routes Network	current modal shift	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Fast Cycling Routes	current modal shift	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	reFuels - production of climate-friendly fuels	conventional production of fuels	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	eLNG (e-Liquefied Natural Gas) from Air	conventional fuel production/acquisition/combustion	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	High Efficiency Solar Cells	no research building	low risk	-	-	o	+	o	o	o	o	o	o	+	o
	HyFab BW - New research factory for fuel cells and hydrogen	no research building	low risk	-	-	o	+	o	o	o	o	o	o	+	o
	Energy-efficient heat networks	conventional heat production & distribution	low risk	-	-	o	o	o	o	o	+	o	o	o	o
	INPUT - Intelligent network link of parking garages and underground garages	parking lots and garages without grid integration	low risk	-	-	o	o	o	o	o	+	o	o	o	o
	Solar battery storage systems	conventional batteries	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Regional centers of excellence for energy efficiency	no energy-efficiency measures by companies	low risk	-	-	o	o	+	o	+	o	+	o	o	o
	Enhanced Resource Efficiency Programme/Combi loan for SMEs*	current GHG emissions of companies	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	KARLA - Karlsruhe Reallabor for Sustainable Climate Protection	current risks from R&D	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	CAMPUS high i - CAMPUS made intelligent*	current risks from R&D	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Climate Connect industrial area Donautal (KliConn)	current risks from R&D	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	MobiQ - Sustainable mobility through sharing in the neighborhood	current risks from R&D	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Reallabor for climate-neutral Reutlingen*	current risks from R&D	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Mobility Living Lab (MobiLab) Stuttgart	current risks from R&D	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Regional Innovation Centre for Energy Technology	no research building	low risk	-	-	o	+	o	o	o	o	o	o	+	o
	GVFG Kombi-Solution	current modal shift	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	Planning and construction of cycle routes on state roads	no cycling routes constructed	no risk	-	-	o	o	o	o	o	o	o	o	o	o
	HyFab BW - Research	no research	no risk	-	-	o	o	o	o	o	o	o	o	o	o
CA	Timber Construction Initiative BW	buildings from conventional materials	no risk	o	o	-	-	o	o	o	o	o	o	o	o
	Subsidies for the development of climate resilient forests and/or (re-)afforestation	areas before afforestation	no risk	o	o	-	-	o	o	o	o	o	o	o	o
WM	Sewerage infrastructure investments	no investments in water treatment	no risk	o	o	o	o	-	-	o	o	o	o	o	o
	Water supply	no additional investments in water supply	no risk	o	o	o	o	-	-	o	o	o	o	o	o
CE	New Research Building INATECH	conventional research buildings	low risk	o	+	o	+	o	o	-	-	o	o	+	o
	Phosphorus recovery from sewage sludge	phosphate mining	low risk	o	+	o	o	o	o	-	-	o	+	o	o
	Professorship for Sustainability Research and Transformative Research	no additional research	no risk	o	o	o	o	o	o	-	-	o	o	o	o
	RecTecKA - Recycling of technology metals from the dismantling of nuclear facilities	no research on recycling metals from nuclear waste	no risk	o	o	o	o	o	o	-	-	o	o	o	o
PP	E-Mobility in the car pool of BW police [...]	conventional vehicles for public services	no risk	o	o	o	o	o	o	o	o	-	-	o	o
	E-Mobility in the car pool of BW police - purchase of pedelecs	conventional bicycles	low risk	o	+	o	o	o	o	o	o	-	-	o	o
	Maintenance of leased vehicles with alternative drive systems	leasing of conventional vehicles	no risk	o	o	o	o	o	o	o	o	-	-	o	o
	Public Air Solutions - Filter Cubes	no air filter systems	no risk	o	o	o	o	o	o	o	o	-	-	o	o
	Establishment of express bus lines in the Stuttgart region	other public or private means of mobility	low risk	+	o	o	o	o	o	o	o	-	-	o	o
	Low-emission bus transportation	other public or private means of mobility	no risk	o	o	o	o	o	o	o	o	-	-	o	o
	Intelligent public transport in Baden-Württemberg - digitally mobile nationwide	normal ticketing for public transport	no risk	o	o	o	o	o	o	o	o	-	-	o	o
	Remediation of contaminated sites	no remediation activities	no risk	o	o	o	o	o	o	o	o	-	-	o	o
	Climate action well-founded design	no pilot study on climate information	no risk	o	o	o	o	o	o	o	o	-	-	o	o
BE	Nationalpark Black Forest, new construction visitor and information center	no additional building	low risk	o	+	o	+	o	o	o	o	o	o	-	-
	Investing in properties with importance for environmental protection	no purchase of nature-relevant areas	no risk	o	o	o	o	o	o	o	o	o	o	-	-
	Aid for pruning of meadow orchards	no agricultural activity in that area	no risk	o	o	o	o	o	o	o	o	o	o	-	-
	Preserving steep-hill grassland	no agriculture on slopes	low risk	o	+	o	+	o	+	o	o	o	+	-	-
	Exemplary regions for organic food	conventional farming	low risk	o	+	o	o	o	o	o	o	o	o	-	-
	Preserving manually cultivable vineyards in steep slope and terraced areas	vineyards with machinery	no risk	o	o	o	o	o	o	o	o	o	o	-	-
	Biotope mapping	good condition ecosystems without mapping	no risk	o	o	o	o	o	o	o	o	o	o	-	-
	Non-productive investments in conservation	no investments in land conservation (leave it is as i	no risk	o	o	o	o	o	o	o	o	o	o	-	-
	Special Programme for Biodiversity	no measures for biodiversity (leave it as it is)	no risk	o	o	o	o	o	o	o	o	o	o	-	-
	Nature conservation contracts	land use (e.g. agriculture) without conservation	no risk	o	o	o	o	o	o	o	o	o	o	-	-
	Research Programme Organic Farming	no research on organic farming	no risk	o	o	o	o	o	o	o	o	o	o	-	-

Generic DNSH criteria

Climate Change Adaptation (CA)	The activity complies with the criteria set out in Appendix A to this Annex.	GEN-CA	The physical climate risks that are material to the activity have been identified from those listed in the table in Section II of this Appendix by performing a robust climate risk and vulnerability assessment with the following steps: (a) screening of the activity to identify which physical climate risks from the list in Section II of this Appendix may affect the performance of the economic activity during its expected lifetime; (b) where the activity is assessed to be at risk from one or more of the physical climate risks listed in Section II of this Appendix, a climate risk and vulnerability assessment to assess the materiality of the physical climate risks on the economic activity; (c) an assessment of adaptation solutions that can reduce the identified physical climate risk. [...]
Water and Marine Resources (WM)	The activity complies with the criteria set out in Appendix B to this Annex.	GEN-WM	Environmental degradation risks related to preserving water quality and avoiding water stress are identified and addressed with the aim of achieving good water status and good ecological potential as defined in Article 2, points (22) and (23), of Regulation (EU) 2020/852, in accordance with Directive 2000/60/EC of the European Parliament and of the Council and a water use and protection management plan, developed thereunder for the potentially affected water body or bodies, in consultation with relevant stakeholders. Where an Environmental Impact Assessment is carried out in accordance with Directive 2011/92/EU of the European Parliament and of the Council and includes an assessment of the impact on water in accordance with Directive 2000/60/EC, no additional assessment of impact on water is required, provided the risks identified have been addressed.
Protection and restoration of biodiversity and ecosystems (BE)	The activity complies with the criteria set out in Appendix D to this Annex.	GEN-BE	An Environmental Impact Assessment (EIA) or screening has been completed in accordance with Directive 2011/92/EU15. Where an EIA has been carried out, the required mitigation and compensation measures for protecting the environment are implemented. For sites/operations located in or near biodiversity-sensitive areas (including the Natura 2000 network of protected areas, UNESCO World Heritage sites and Key Biodiversity Areas, as well as other protected areas), an appropriate assessment, where applicable, has been conducted and based on its conclusions the necessary mitigation measures are implemented.