SAVi Sustainable Asset Valuation

Sustainability Assessment of an Onshore Wind Portfolio in Germany.

An Application of the Sustainable Asset Valuation (SAVi) for B Capital Partners

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IISD International Institute for Sustainable Development

MAVA Fondation pour la Nature

B Capital Partners

The Scope of this SAVi Assessment

B Capital Partners, a Swiss-based investment house focusing exclusively on investing in sustainable infrastructure, invited the International Institute for Sustainable Development (IISD) to conduct a sustainability assessment on one of their onshore wind portfolios. The portfolio is located in Germany and has a total capacity of 29 MW.

The objective of the assessment was to integrate a range of environmental, social, and economic costs and benefits into an asset valuation to improve the transparency of the asset's impacts on the environment and important stakeholders. In addition, the assessment served to reveal the asset's financial resilience toward climate change risks. IISD customized and applied the Sustainable Asset Valuation (SAVi) methodology to conduct a comparative sustainability assessment of the onshore wind portfolio and a hypothetical gas-fired power plant with the same power generation capacity.

The SAVi assessment valued the environmental, social, and economic costs and benefits (externalities) in financial terms and calculated the costs induced by climate change risks for both assets. Externalities and risks were incorporated into the following three components of the SAVi assessment:

- Cost-benefit analysis (CBA)
- Levelized cost of electricity (LCOE)
- Financial analysis, generating performance results for the equity and project internal rate of return (IRR).

Externalities and Risks

The SAVi assessment provided a valuation, in financial terms, of the following environmental, social, and economic externalities per asset:

Income spending: Due to labour income generation from road construction, local construction of energy equipment, and maintenance of energy capacity.

Real estate value depreciation: Impacts on buildings in proximity to the energy asset.

Biodiversity management costs: A semi-natural area is established to provide a new habitat for birds and keep these away from the onshore wind farm. The impeded agriculture production on the new habitat serves to value this externality.

Land use: Land required by the energy asset, valued based on foregone profit and foregone tax revenues from impeded agriculture production.

Road construction: Cost for construction and maintenance of roads required to build and operate the energy asset.

Social cost of carbon: Lifecycle CO_2eq emissions caused by the energy asset, valued as the economic cost caused by an additional ton of CO_2eq.[1]

Further, it was assessed how the following climate change risks would impose costs for each asset if they materialize:

1.5°C air temperature increase (physical climate risk): Cost implications of operational inefficiencies caused by an air temperature increase.

A carbon tax (transitional climate risk): Imposition of a carbon tax of EUR 25/t CO_2 for operational emissions from electricity generation.

[1] The SAVi report provides details on an additional method to value emissions of each asset by calculating the health cost of air pollution.

Results of the SAVi Assesssment

Cost-Benefit Analysis

The summary results of the integrated CBA are displayed in Table 1 and cover cost and benefit factors that occur over the lifetime of each asset. Negative values are indicated in brackets. For the gas-fired power plant, a lifetime of 40 years is assumed, while the lifetime of the onshore wind farm amounts to 23 years. Indicated values are discounted at an interest rate of 4.5%. Reflecting the current market conditions in Germany, the price for electricity generated by onshore wind is assumed to remain 23.23% higher over time than the price for electricity generated by the gas-fired power plant. Details on diverging electricity price assumptions for both assets are explained in the report.

Table 1. Integrated CBA – Comparison of the gas-fired power plant and the onshore wind portfolio (in EUR million)

Cost and benefit position	Gas-fired power plant (in EUR million)	Onshore wind (in EUR million)
Conventional costs: Capital expenditure (CAPEX), operating expenditure (OPEX), cost of financing, decommissioning, fuel costs, compensation payments	(65.73)	(49.89)
Revenues	82.13	75.05
(1) Net results (conventional)	**16.40**	**25.16**
(2) Potential costs induced by climate risks	(7.57)	0.00
(3) Total value of externalities	(11.70)	(3.58)
(4) SAVi net results (1 + 2 + 3)	**(2.87)**	**21.58**

Why Use SAVi?

SAVi calculates the environmental, social and economic risks and externalities that impact the financial performance of infrastructure projects. These variables are typically ignored in traditional financial analyses.

SAVi is a simulation tool that is customized to individual infrastructure assets. It is built on project finance and systems dynamics simulation.

Visit the SAVi webpage: iisd.org/savi

Levelized Cost of Electricity

The Levelized Cost of Electricity (LCOE) is a useful indicator for comparing the unit cost of electricity generation over the lifetime of an asset. Table 2 provides a full breakdown of cost components and the integrated LCOE results per asset. Positive externalities are, in this case, indicated with a negative sign because they reduce the LCOE. The lower the LCOE, the more preferable is the asset because it implies that electricity can be generated at a lower cost.

The results in Table 2 highlight that the onshore wind portfolio is the more affordable asset for electricity generation across all subtotals. While both assets are almost on par when comparing the conventional LCOE results (subtotal 1), the superiority of onshore wind becomes apparent when the potential costs induced by climate change risks are integrated into the LCOE (subtotal 2) and even more when externalities caused by the respective asset are accounted for. The integrated LCOE results (subtotal 3) indicate that from a societal perspective, electricity generated by onshore wind is almost 18.5% less expensive than electricity generated by the gas-fired power plant.

Table 2. LCOE of the gas-fired power plant and the onshore wind portfolio (in EUR/MWh)

LCOE by cost position	**Gas-fired power plant** (EUR/MWh)	**Onshore wind** (EUR/MWh)
Conventional costs positions		
Capital expenditure	5.56	32.43
O&M expenditure	5.22	23.11
Cost of financing	0.71	7.01
Fuel costs	52.98	0.00
Compensation payments	0.00	0.45
Decommissioning	0.28	1.23
(1) Subtotal: Conventional LCOE for the producer	**64.75**	**64.23**
Potential costs induced by climate risks		
Additional fuel cost (physical climate risk)	1.21	0.00
Carbon tax payments (transitional climate risk)	3.98	0.00
Total potential cost induced by climate risks	**5.19**	**0.00**
(2) Subtotal: LCOE for the producer, incl. potential costs induced by climate risks	**69.94**	**64.23**
Externalities		
Income spending	-0.45	-5.64
Land use	0.03	0.23
Real estate value depreciation	1.96	1.28
Cost of roads	0.20	0.96
Biodiversity management costs	N/A (> wind)*	7.34
Social cost of carbon	9.80	0.36
Total value of externalities	**11.54**	**4.53**
SAVi integrated LCOE results		
(3) Subtotal: LCOE for the society, incl. potential costs induced by climate risks and value of externalities	**81.48**	**68.76**

* The calculated sums do not include a quantitative value for negative impacts of the gas-fired power plant on biodiversity. Explanations are provided in the report. Subtotals of the gas-fired power plant would increase further if this externality is valued in financial terms.

Results of the Financial Analysis

The purpose of the financial analysis is to assess the financial impact of potential costs induced by climate change risks (Table 3) and, on the other hand, the financial implications if the monetary value of environmental, social, and economic externalities are internalized (Table 4). These two elements are integrated separately into the financial models of both assets as a change in cash flows in the cash flow (CF) statement.[2]

Table 3 summarizes the results for the project IRR and equity IRR of both assets if climate change risks materialize. The materialization of the assessed climate change risks would imply additional costs for the gas-fired power plant and negatively affect the asset's cash flows while the onshore wind portfolio would not be affected. Air temperature increases reduce the equity and project IRR of the gas-fired power plant significantly, but it remains positive. An introduction of a carbon tax will imply that both financial performance indicators turn negative for that asset.

Table 3. Financial impact of materialized climate risks on project IRR and equity IRR of a gas-fired power plant and the onshore wind portfolio

	Gas-fired power plant		Onshore wind	
	Project IRR	**Equity IRR**	**Project IRR**	**Equity IRR**
IRR baseline = potential costs induced by climate risks not included	3.27%	3.57%	4.93%	6.70%
IRR, including potential costs induced by physical climate risks	1.24%	0.63%	4.93%	6.70%
IRR, including carbon tax (transitional climate risk)	Negative	Negative	4.93%	6.70%

Internalizing the assessed externalities into the CF statement is rather hypothetical. In the near future, these externalities don't imply costs for either asset and hence don't have cash flow impacts. However, if the asset performance is analyzed from a societal point of view, Table 4 indicates how the project IRR and equity IRR would change if all externalities are internalized. Detailed results are presented in the report.

Table 4. Implications of internalizing valued externalities on project IRR and equity IRR of a gas-fired power plant and the onshore wind portfolio

	Gas-fired power plant		Onshore wind	
	Project IRR	**Equity IRR**	**Project IRR**	**Equity IRR**
IRR baseline = no externalities internalized	3.27%	3.57%	4.93%	6.70%
SAVi IRR, internalizing the total value of externalities	Negative	Negative	4.09%	5.23%

[2] The scope of this financial analysis deviates from CBA and LCOE calculation in one dimension. The financial analysis of the onshore wind portfolio is conducted from the investor's perspective. Hence, it captures the asset's performance from the point of acquisition onwards and not the entire asset lifecycle, whereas for the gas-fired power plant comparator, the entire asset life cycle is considered in the financial analysis.

Conclusion

Altogether, the results across all three components of the SAVi assessment (CBA results, LCOE, IRRs) demonstrate that the hypothetical gas-fired power plant loses its investment attractiveness once potential costs induced by climate change risks or the value of monetized externalities are integrated into the assessment. In contrast, the performance of the onshore wind portfolio is not affected by the assessed climate change risks. The assessment results of this asset, however, diminish if environmental, social, and economic costs and benefits (externalities) are monetized and internalized into the CBA, the LCOE, or the financial analysis. In sum, the wind portfolio is the more resilient and more profitable investment choice, as well as the more beneficial (less costly) energy generation asset from a societal point of view.

About SAVi

SAVi is a simulation service that helps governments and investors value the risks and externalities that affect the performance of infrastructure assets.

The distinctive features of SAVi are:

- Valuation: SAVi values, in financial terms, the material environmental, social and economic risks and externalities of infrastructure assets. These variables are ignored in traditional financial analyses.
- Simulation: SAVi combines the results of systems thinking and system dynamics simulation with financial modelling. We engage with asset owners to identify the risks material to their infrastructure assets and then design appropriate simulation scenarios.
- Customization: SAVi is customized to individual infrastructure assets.

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