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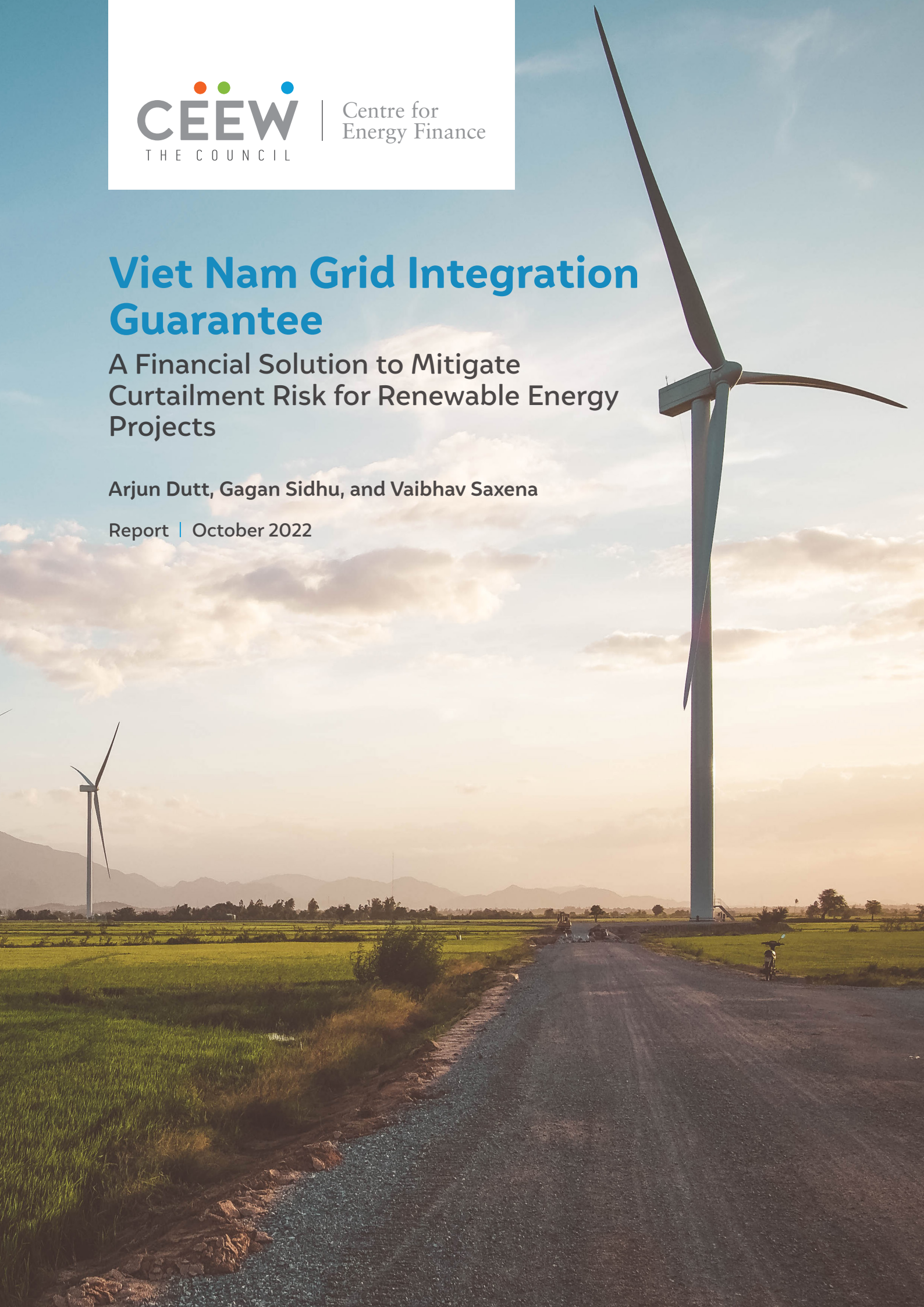
Viet Nam Grid Integration Guarantee

A Financial Solution to Mitigate Curtailment Risk for Renewable Energy Projects

Arjun Dutt, Gagan Sidhu, and Vaibhav Saxena

Report | October 2022



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The **CEEW Centre for Energy Finance** (CEEW-CEF) is an initiative of the Council on Energy, Environment and Water (CEEW), one of Asia's leading think tanks. CEEW-CEF acts as a non-partisan market observer and driver that monitors, develops, tests, and deploys financial solutions to advance the energy transition. It aims to help deepen markets, increase transparency, and attract capital in clean energy sectors in emerging economies. It achieves this by comprehensively tracking, interpreting, and responding to developments in the energy markets while also bridging gaps between governments, industry, and financiers.

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The need for enabling an efficient and timely energy transition is growing in emerging economies. In response, CEEW-CEF focuses on developing fit-for-purpose market-responsive financial products. A robust energy transition requires deep markets, which need continuous monitoring, support, and course correction. By designing financial solutions and providing near-real-time analysis of current and emerging clean energy markets, CEEW-CEF builds confidence and coherence among key actors, reduces information asymmetry, and bridges the financial gap.

Financing the energy transition in emerging economies

The clean energy transition is gaining momentum across the world with cumulative renewable energy installation crossing 1000 GW in 2018. Several emerging markets see renewable energy markets of significant scale. However, these markets are young and prone to challenges that could inhibit or reverse the recent advances. Emerging economies lack well-functioning markets. That makes investment in clean technologies risky and prevents capital from flowing from where it is in surplus to regions where it is most needed. CEEW-CEF addresses the urgent need for increasing the flow and affordability of private capital into clean energy markets in emerging economies.

CEEW-CEF's focus: analysis and solutions

CEEW-CEF has a twin focus on markets and solutions. CEEW-CEF's market analysis covers energy transition–related sectors on both the supply side (solar, wind, energy storage) and demand-side (electric vehicles, distributed renewable energy applications). It creates open-source data sets, salient and timely analysis, and market trend studies.

CEEW-CEF's solution-focused work will enable the flow of new and more affordable capital into clean energy sectors. These solutions will be designed to address specific market risks that block capital flows. These will include designing, implementation support, and evaluation of policy instruments, insurance products, and incubation funds.

CEEW-CEF was launched in July 2019 in the presence of H.E. Mr Dharmendra Pradhan and H.E. Dr Fatih Birol at Energy Horizons.

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The decarbonisation of the power sector, the largest source of Viet Nam's energy-related emissions, is critical to the attainment of the net zero by 2050 goal.

Image: iStock

Executive summary

The year leading up to the 26th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26) saw a firming of the global resolve to decarbonise. During this period and at COP26, several developed and developing countries committed to achieving net-zero economy-wide emissions around mid-century. One of the emerging economies to make such a commitment was Viet Nam, which announced its intention to achieve net-zero economy-wide emissions by 2050. To realise this ambitious goal, Viet Nam would need to tackle its single-largest source of emissions, i.e., the power sector. Recognising this imperative, the Vietnamese government committed to building no new coal capacity after 2030 as well as incorporating a focus on renewable energy (RE) capacity in its power development plans. At the time of writing, market projections of power capacity development in Viet Nam indicate a ~2x and ~11x growth in non-hydro RE capacity by 2030 and 2045, respectively, compared to capacity at the end of 2020.[1]

Even before its commitment to net-zero emissions, Viet Nam had made considerable progress in RE deployment. Solar (including grid-connected rooftop) and wind installed capacity at the end of 2020 stood at 16.6 GW and 0.6 GW,[2] respectively, accounting for around a quarter of the country's installed capacity. However, this capacity addition was made possible by generous feed-in tariffs (FiTs), which were considerably higher than the tariffs prevailing in some emerging economies such as India. Cost-competitive RE tariffs can contribute significantly to the sustained decarbonisation of the power sector, as envisioned in Viet Nam's goal of realising net-zero emissions by 2050. By minimising the financial burden on the offtaker, low-cost RE deployment can catalyse large-scale capacity addition.

A. Risk mitigation as a driver of a cost-effective and sustained energy transition

To facilitate this sustained, low-cost RE deployment, policies and regulations must address risks specific to the country facing investors. As an example, this report includes a case study of certain measures to mitigate risks in pursuit of cost-effective RE deployment in India.

Curtailment risk is a prominent medium-term challenge facing both domestic and international investors which can become a barrier to low-cost RE capacity addition.

From the perspective of advancing Viet Nam's energy transition, the CEEW Centre for Energy Finance (CEEW-CEF) investigated the major risks facing RE deployment in the country with a view towards de-risking investments and clearing the path for cost-effective RE deployment. To do so, CEEW-CEF conducted one-on-one consultations with 21 organisations associated with the Vietnamese RE ecosystem spanning financiers (RE developers/equity investors and debt financiers), consulting firms, industry bodies, international development and technical agencies, and government agencies. These consultations revealed the following as the most prominent risks facing investors, with the first two considered more serious than the third:

- Curtailment risk
- Bankability of power purchase agreements (PPAs)
- Land acquisition and permitting risks

Of the three most prominent risks highlighted by stakeholders, this report focuses on addressing curtailment risk. This is because curtailment risk is a prominent medium-term challenge facing both domestic and international investors and can slow down the pace of capacity addition; it can also become a barrier to achieving low-cost RE capacity addition. Largely, curtailment risk is a function of the inadequate availability of transmission infrastructure (as of 2022) at key points from source to load in certain transmission corridors together with the absence of deemed generation or take-or-pay clauses in model PPAs. While stakeholders noted that instances of curtailment were common in existing deployments, the generous FiTs provided a sufficient cushion against it. What is even more pertinent is that stakeholders expect execution delays in the near to medium term in setting up infrastructure to bridge the aforementioned transmission deficit, which is likely to worsen with additional generation capacity development plans. In contrast, stakeholders were confident about long-term transmission strengthening plans to support RE deployment at scale.

1. Considering the upper end of projected non-hydro RE capacity addition.
2. This had further risen to ~4 GW by October 2022.

Table ES1 Stakeholder consultations conducted during the study

Category	No. of organisations
Financier (RE developer/equity investor or debt financier)	7
Industry bodies	3
International development or technical agencies	2
Government	2
Consulting firms	2
Law firms	2
Catalytic finance funds	2
Think tanks	1
All stakeholders	21

Source: Authors' analysis

As a result, and despite there being plans in place for the strengthening of transmission infrastructure, both debt and equity investors expect some curtailment in the near to medium term for new projects. Project sponsors (equity) account for this risk by factoring in lower than optimal offtake, and thus, lower than optimal revenue projections in their financial models. On their part, project lenders (debt) generally account for this risk by extending debt at more onerous, or inferior, terms. Either way, from the perspective of equity investors, this translates to higher tariffs to meet a specific level of returns expectations.

B. The proposed solution

CEEW-CEF proposes a financial solution to mitigate curtailment risk stemming from potential mismatches in the pace of generation and transmission capacity addition. We propose that this solution be used to support new RE projects to be developed in accordance with approved capacities under Viet Nam's Power Development Plan VIII (PDP8). This solution may also be applied to transitional solar and wind projects, that is, those approved under Power Development Plan VII (PDP7) but which failed to commence commercial operations before the expiry of FiTs. However, it is not a substitute for developing transmission capacity. It should be viewed as complementary to transmission capacity development to achieve low-cost calibrated capacity addition, while Viet Nam prepares its grid for large-scale capacity addition (Table ES2). It also builds upon near-term actions already undertaken by Vietnamese power-sector planners.

The financial solution takes the form of a first-loss guarantee[3] that safeguards investors against a defined level of curtailment (based on technical studies) stemming from delays in implementing planned transmission upgrades. The baseline against which curtailment will be measured will be specified in consultation with Vietnamese power-sector stakeholders. To simulate such transitory curtailment risk, the guarantee proposes to provide protection for two years from the commissioning of the RE plant.

Table ES2 A proposed phased approach to RE capacity addition

Timeframe	Action
Near term (by end-2022)	• Manage the pace of grid-connected RE capacity addition to avoid overburdening the grid » Introduce power procurement through auctions to regulate pace: * Stakeholders already anticipate that solar photovoltaic (PV) power procurement could shift to auctions * The government is considering an auctions regime for wind, but it is yet to specify a procurement policy following the expiry of FiTs in Oct 2021 • Align transmission capacity development plans with the RE capacity addition trajectory (being done as part of PDP8)
Medium term (2023–2025)	• Calibrated RE capacity addition along with transmission capacity development • **Financial solution to mitigate curtailment risk and enable low-cost RE capacity addition**
Long term (beyond 2025)	• Transmission grid that is in sync with the envisaged scale of RE capacity addition

Source: Authors' analysis

3. A first-loss guarantee is a financial mechanism whereby a third party compensates the lender up to a defined limit in the event of default by the borrower.

It proposes to provide protection against the maximum expected level of simulated curtailment in year one, and half the maximum simulated level in year two. Our analysis is based on two simulated levels of maximum curtailment – 10 per cent and 20 per cent. Finally, in our simulation, the grid is expected to support the dispatch of the entire electricity generated from year three.

In case of curtailment, the guarantee may be invoked to make up for a reduction in the special purpose vehicle's (SPV) cash flows up to the defined limit of protection. In case of a timely upgrade of transmission capacity, there will be no curtailment (from delays in transmission upgrades), and the guarantee need not be invoked. However, regardless of whether or not the guarantee is invoked, its presence transfers curtailment risk from the financial models of investors and onto the pool of capital underwriting the guarantee. This gives comfort to financiers and allows them to offer superior terms of finance to RE projects, which in turn enables the realisation of lower tariffs.

C. Simulated cost–benefit analysis

Tables ES3 and ES4 summarise the costs and benefits under various simulation scenarios. As is evident, the Viet Nam Grid Integration Guarantee (V-GIG) can unlock many multiples in benefits for every dollar that capitalises it. It does so via two levers. First, by enabling investors to factor in higher revenue projections, and second, by giving comfort to debt and equity financiers to offer superior terms of finance.

D. Way forward

The precise scale of capitalisation needed depends upon the scale of project deployment to be supported and the extent of curtailment protection required. This requires deeper analysis in consultation with Viet Nam's electricity planning and implementation agencies. The report estimates the scale of capital required under an assumed set of conditions.

To empirically demonstrate the value of the V-GIG in realising competitive tariffs, CEEW-CEF proposes a pilot demonstration of the facility as the next step in this report. The proposed pilot would ideally take the form of an auction of onshore wind capacity, with the V-GIG providing cover against curtailment risk. Price discovery through auctions is recommended as a practical approach to gauge the effectiveness of the guarantee in mitigating risk perceptions and realising lower tariffs. Our analysis finds that a pilot of 50–100 MW may be operationalised by a facility that is funded to the tune of USD 1.4-5.7 million.

Table ES3 Cost–benefit analysis for curtailment protection of 10% in year 1 and 5% in year 2

Expected equity IRR (VND)		Cost per MW* (VND Mn)	Benefit per MW (VND Mn)	Benefit to cost ratio
Without V-GIG	With V-GIG			
12%	11%	656	3,644	5.6x
13%	12%	678	3,988	5.9x
14%	13%	699	4,269	6.1x

Source: Authors' analysis

*The cost mentioned corresponds to the case in which curtailment of 10 per cent in year 1 and 5 per cent in year 2 actually occurs. This cost is lower if lower levels of curtailment are realised.

Note: The underlying technology considered in this analysis is onshore wind. Similar analyses can be conducted for other RE technologies.

Table ES4 Cost–benefit analysis for curtailment protection of 20% in year 1 and 10% in year 2

Expected equity IRR (VND)		Cost per MW* (VND Mn)	Benefit per MW (VND Mn)	Benefit to cost ratio
Without V-GIG	With V-GIG			
12%	11%	1,311	5,253	4.0x
13%	12%	1,355	5,718	4.2x
14%	13%	1,399	6,199	4.4x

Source: Authors' analysis

*The cost mentioned corresponds to the case in which curtailment of 20 per cent in year 1 and 10 per cent in year 2 actually occurs. This cost is lower if lower levels of curtailment are realised.

Note: The underlying technology considered in this analysis is onshore wind. Similar analyses can be conducted for other RE technologies.

1. Introduction

On 1 November 2021, at COP26, Viet Nam announced that it would achieve net-zero emissions by 2050 (Reuters 2021). In doing so, Viet Nam joined the ranks of scores of other nations that made net-zero commitments at COP26 and in the year leading up to it. Soon after the announcement, the government issued Notification No. 30/TB-VPCP on 30 January 2022. It highlighted eight central tasks necessary for Viet Nam to achieve its COP26 commitments (Thu Vien Phap Luat 2022):

- transform from fossil energy to green and clean energy sources
- reduce greenhouse gas emissions in industries
- reduce methane emissions, especially in agricultural production and waste treatment
- encourage research, development and use of electric cars
- manage and sustainably use the existing forest area and boost afforestation for carbon absorption and storage
- research, produce and use building materials and development of urban areas in accordance with green and sustainable development
- promote and innovate communication in order that the achieve consensus and cooperation of the entire people and business community with the Government in fulfilling commitments at COP26
- speed up digital transformation in response to climate change.

1.1 The power sector's centrality to Viet Nam's net-zero target

It is not surprising that the first of the eight tasks relates to the transformation away from fossil energy to green and clean energy sources. This is because, at 65 per cent, an overwhelming majority of Viet Nam's net emissions of 317 mtCO2e can be traced to the energy sector (Ministry of Natural Resources and Environment, Socialist Republic of Viet Nam 2020). The other three sectors (a) industrial processes and product use (IPPU) (b) agriculture, forestry, and other land use (AFLU), and (c) waste account for only 14.6 per cent, 13.9 per cent, and 6.5 per cent of net emissions, respectively. Further, among the various sub-sectors that make up each of these four sectors, fuel consumption for electricity generation is the single-largest emitter – accounting for 20.6 per cent of Viet Nam's net national emissions.

> **65% of Viet Nam's net national emissions can be traced to the energy sector with fuel consumption for electricity generation, the single-largest source, accounting for 20.6%.**

The notice of 30 January 2022 was followed by the issuance of Viet Nam's "National Strategy on Climate Change for the period to 2050" (Ministry of Natural Resources and Environment, Socialist Republic of Viet Nam 2022). Signed on 26 July 2022, it lays down specific targets for the various sectors that contribute to Viet Nam's emissions (S&P Global 2022). The energy sector, as the largest emitter, is central to the strategy. Specifically, the targeted reductions in energy sector emissions are as follows:

i. **By 2030**: energy sector emissions are to be reduced by 32.6 per cent vs. a business as usual (BAU) scenario, and capped at 457 mtCO2e
ii. **By 2050**: energy sector emissions are to be reduced by 91.6 per cent vs. a BAU scenario, and capped at 101 mtCO2e

Achieving such an ambitious reduction in energy sector emissions requires Viet Nam to tackle its largest sources of energy-related emissions. The road to Viet Nam's decarbonisation cuts through its power sector. But how exactly is the power sector expected to evolve to meet this challenge?

1.2 Way forward for electricity generation and transmission capacities

The final version of Viet Nam's Power Development Plan-VIII (PDP8), when published, will chart the way forward for the electricity sector. At the time of writing, various market projections of Vietnamese power capacity addition highlight the following pathways for electricity generation sources (Table 1).

Viet Nam's total non-fossil-based generating capacity is forecast to increase by ~1.6x and ~6.2x, respectively, by 2030 and 2045, compared to the capacity installed at the end of 2020. In terms of non-hydro RE, the majority of the planned capacity up to 2045 is slated to be developed in the period beyond 2030. In the nearer term (2030), non-hydro RE capacity addition plans are focused on onshore and nearshore wind (capacity could rise to 11.7–16.1 GW by 2030 from 0.6 GW in 2020), with the possible addition of 7 GW of offshore wind.

Table 1 Existing and planned power capacity in Viet Nam

Technology	2020	2025	2030 (Lo-Hi)	2045 (Lo-Hi)	2030 (Hi) vs 2020		2045 (Hi) vs 2020	
					GW addition	GW x	GW addition	GW x
Non-hydro RE	17.8	20.4 – 23.3	21.7 – 33.1	129.8 – 201.6	15.3	1.9x	183.8	11.3x
Hydro	20.7	25.8 – 26.8	26.8 – 29.0	33.1 – 35.1	8.3	1.4x	14.4	1.7x
Coal-based	20.4	28.9	37.5	37.5	17.1	1.8x	17.1	1.8x
Gas-based	7.1	15.0	29.9 – 39.0	58.9 – 73.6	31.9	5.5x	66.5	10.4x
Total	**69.3**	**93.9 – 98.4**	**121.0 – 145.9**	**284.7 – 387.9**	**76.6**	**2.1x**	**318.6**	**5.6x**

Source: The projected trajectory of power capacity addition in Viet Nam as extracted from various publicly accessible sources.

Note: 'Lo' and 'Hi' refer to the lowest and highest bounds of market projections. The gap between the sum of generation capacities mentioned and total capacities comprises capacities associated with other generation sources.

To be sure, power capacity addition plans also feature detailed plans for strengthening evacuation and transmission infrastructure.

1.3 Investor concerns regarding RE curtailment persist

A calibrated and significant growth in renewables (RE – primarily solar and wind) generating capacity is thus critical for Viet Nam's energy transition. However, CEEW-CEF's interactions with a range of stakeholders reveal that curtailment continues to be a prominent risk for RE projects. As per stakeholders, this stems from the inadequacy of evacuation and/or transmission capacities in certain areas of Viet Nam. Most importantly, and from the perspective of funding sources of RE projects, it is not only equity sponsors who voiced concerns. Project lenders, who are relatively less exposed to the effects of curtailment due to their senior claim over project cash flows, also expressed concern regarding curtailment risk. This risk perception is largely the result of the incidence of curtailment in the past. CEEW-CEF's stakeholder interactions indicated that a portion of Viet Nam's installed RE fleet has at times experienced curtailment in the range of 10-50 per cent. This is further corroborated by reports in secondary sources (Lam Le 2022).

So far, Vietnam's generous feed-in-tariff (FiT) regime has offered sufficient protection against curtailment risk perception among both equity and debt investors. Table 2 compares Viet Nam's most recent FiTs for both solar and wind and the tariffs discovered in other countries in the Asia-Pacific region.

From a future capacity growth perspective, the challenge is that past experiences are shaping perceptions of how stakeholders expect curtailment to play out, going forward. So, despite detailed plans to upgrade evacuation and transmission infrastructure being developed, our interactions with industry stakeholders revealed widespread concern of a timing mismatch between such upgradation and the actual roll-out of RE generation capacity. This is compounded by the general understanding that FiTs will inevitably make

Table 2 Comparison between RE tariffs in Viet Nam and neighbouring countries

Country	Sovereign rating	Solar		Wind	
		Lowest tariff in 2020 (USD c/kWh)	Lowest tariff realised in the country (USD c/kWh)	Lowest tariff in 2021 (USD c/kWh)	Lowest tariff realised in the country (USD c/kWh)
Vietnam	Ba3	7.09 (FiT)	7.09 (FiT)	8.50 (FiT)	8.50 (FiT)
India	Baa3	2.49 (Auctions)	2.49 (Auctions)	3.45 (Auctions)	3.05 (Auctions)
Philippines	Baa2	15.81 (FiT)	6.60 (Auctions)	10.48 (FiT)	9.62 (Auctions)

Source: Bellini (2022), Philippines National Transmission Corporation (2021), and CEEW-CEF market intelligence.

Notes:

1. Sovereign ratings as issued by Moody's.
2. A new regulation governing RE tariffs in Indonesia has been awaited since 2019. Since this had still not been announced at the time of writing this report, Indonesia has not been included in Table 2.
3. Local currency tariffs have been converted to USD at the following exchange rates: USD/INR = 80 and USD/PHP = 55. Vietnamese RE regulations ensured that payments to developers were the local currency equivalents of the stated dollar figures.
4. Viet Nam's FiTs for solar expired at the end of December 2020, while those for wind expired at the end of October 2021.

way for tariff discovery via competitive auctions in Viet Nam. The following were the main courses of action most often cited as ways to address curtailment risk in a competitive auction regime:

- Delay investing altogether
- For equity sponsors – higher tariff
- For project lenders – sub-optimum terms of debt

The consequences are clear. If this risk perception continues, Viet Nam may either fall behind in its RE capacity expansion plans or pay more for the RE capacity than is required. Neither prospect is desirable.

This report begins by examining the role of risk mitigation in realising a cost-effective energy transition. It highlights the Indian experience in this context before taking a closer look at the risks facing RE investments in Viet Nam. Highlighting the urgent need to tackle curtailment risk, the report proposes a financial solution to mitigate curtailment risk in the medium term which would support calibrated, cost-effective capacity addition. The report locates the financial solution within the context of a wider suite of measures to tackle curtailment risk. It then elaborates on the details of the solution, including its structure, the cost–benefit analysis associated with its deployment, as well as proposed sources of capitalisation. The report concludes by recommending a pilot implementation of the proposal to empirically demonstrate its effectiveness in achieving lower tariffs.

2. Risk mitigation as a driver of a cost-effective and sustained energy transition

The deep decarbonisation of the power sector requires both a cost-effective and sustained deployment of RE. Low-cost RE deployment would minimise the financial burden of the transition on the Vietnamese economy. Crucially, by reducing the financial burden on the offtaker, low-cost RE deployment would also catalyse large-scale capacity addition. Thus, reducing the cost of renewable power should be a key consideration for Viet Nam's energy transition.

Auctions-based mechanisms are increasingly replacing FiT regimes as the preferred mode of pricing for RE procurement (Section 1). However, regardless of the method of power procurement, RE tariffs should balance the need for a reasonable risk-reflective return to equity and debt investors on the one hand, and the larger national interest, which is best served by procuring power at competitive rates, on the other.

> **Stakeholder interactions indicate that curtailment risk for future projects stems from concerns over timing mismatches between transmission upgrades and RE capacity deployment.**

Equipment costs, particularly those associated with solar photovoltaic (PV) modules and wind turbine generators, are the predominant component of project costs. These are dependent on the global balance of supply and demand, with country-level policies and regulations having a limited impact in lowering them. In contrast, investors' returns expectations are a function of their risk perceptions, which are moulded significantly by the prevailing policy and regulatory ecosystem.

Thus, from a policy perspective, the de-risking of investment opportunities is key to lowering investors' returns expectations. Doing so can be an extremely impactful lever in lowering cost of renewable power. While many of these investment risks are common across geographies, domestic policies and regulations should aim to mitigate the most significant risks of the specific market in question to facilitate capacity addition at lower tariffs. This report first describes key measures adopted in India to de-risk investments and their impact, before examining the Vietnamese context.

2.1 Mitigating renewable energy risks: the Indian example

Offtaker risk and construction and permitting risks are two of the most prominent challenges RE developers face in the Indian context (Chawla 2016). This section examines the impact of policies and regulations in rationalising investor risk perceptions, and in turn, returns expectations.

Offtaker risk: India has two major contractual structures associated with long-term RE procurement through auctions:

- Direct PPA between the project developer and distribution utility (discom), the majority of which are state government–owned entities.

- PPA between the project developer and a central government intermediary (usually Solar Energy Corporation of India (SECI), NTPC,[4] or the National Hydro Power Corporation (NHPC)), which signs a back-to-back power sales agreement (PSA) with a discom. The central government intermediary offers security against inordinate delays in payments from discoms.

Offtake risk for RE may be considered a composite of (1) the risk that power will not be offtaken in the first instance (curtailment) and (2) once offtaken, the risk that it will not be paid for in a timely manner by the offtaker (offtaker risk). Given the current level of RE penetration and investments made in the grid, the former is not a major investment risk in the Indian context but the latter is a concern.

Offtaker risk in India stems from concerns regarding the adverse financial condition, and by extension the creditworthiness, of discoms, most of which are owned by state governments. This risk manifests in the form of concerns regarding delays in payments due to project developers, delays in signing or cancelling PPAs, and renegotiation of signed PPAs. The evidence bears out that these risks are perceived to be higher in the case of direct PPAs between project developers and discoms.

The payment security offered by central government-mediated contractual structures considerably lowers offtaker risk perceptions. This is evident when one compares the returns expectations of debt and equity investors between the two structures. In numeric terms, equity internal rate of return (IRR) expectations for PPAs with state government offtakers can be up to 200 basis points higher than those corresponding to PPAs with central government offtakers under the same policy and market conditions (Dutt et al. 2020). On the debt side, interest rates charged by debt financiers can be up to 50 basis points higher for PPAs with state government offtakers relative to those with central government offtakers, controlling for other factors (Dutt et al. 2021).

Construction and permitting risks: The timely availability of sites for project development, and the development of evacuation infrastructure, are challenges for project developers, particularly as land acquisition is an onerous process. Solar parks have been used as a policy tool to mitigate these challenges. These are concentrated zones of project development that offer sites for setting up projects and ready access to evacuation infrastructure to developers in exchange for a fee.

> **While many investment risks are common across geographies, domestic policies should aim to mitigate the most significant risks associated with the market in question to facilitate low-cost capacity addition.**

The lower risk associated with solar park projects becomes evident in investors' returns expectations. Equity IRR expectations for projects set up at solar park sites can be up to 260 basis points lower than those at non-solar park sites, all other factors being equal (Dutt et al. 2020). From the perspective of debt financiers, interest rates can be up to 25 basis points lower for solar park vs. non-solar park sites, controlling for other factors (Dutt et al. 2021).

Thus, policies and regulations have played a key role in mitigating risks, thereby lowering investor returns expectations, which has translated to lower tariffs in the Indian context. Can Viet Nam similarly systematically address major investor risks to achieve lower tariffs?

2.2 Renewable energy risk perception in Viet Nam

The study adopted one-to-one consultations with power-sector stakeholders as the methodology to identify the major investment challenges associated with the RE sector (Table 3).

These consultations indicated that the following stood out as the foremost risks facing investors (Table 4), with the top two risks considered more serious challenges than the third. Similar risks have also been flagged by investors on other forums (Vietnam Investment Review 2022).

4. Formerly National Thermal Power Corporation, now known as NTPC Limited.

Table 3 Stakeholder consultations conducted during the study

Category	No. of organisations
Financier (RE developer/equity investor or debt financier)	7
Industry bodies	3
International development or technical agencies	2
Government	2
Consulting firms	2
Law firms	2
Catalytic finance funds	2
Think tanks	1
All stakeholders	21

Source: Authors' analysis

2.3 Why focus on curtailment risk?

Based on inputs from the stakeholder consultations, CEEW-CEF decided to work towards developing a rapidly implementable financial solution to tackle curtailment risk. The choice to develop a solution for curtailment risk was based on the following factors:

- **Prominent challenge in the medium term**: Based on CEEW-CEF's stakeholder interactions, curtailment risk was identified as one of the most prominent challenges for investors, which also adversely affects project economics (Section 2.4). While investors expressed confidence that EVN's transmission strengthening efforts would address the problem of curtailment risk over the long term, they regarded it as a barrier facing new projects in the near to medium term.
- **The concerns of both domestic and international financiers**: CEEW-CEF endeavoured to develop a solution to a risk that is of concern to a spectrum of investors. Since concerns about the bankability of PPAs are largely limited to international debt financiers, CEEW-CEF opted to work on developing a solution to mitigate curtailment risk, which is a concern for both domestic and international financiers.
- **Sector-specific solution to a sectoral problem**: As highlighted above, infrastructure projects developed under the public–private partnership (PPP) mode offer protection against a broad range of risks. However, it is not realistic to propose that relevant RE projects come under the PPP umbrella and benefit from the resulting broad risk protection.

Table 4 Major perceived RE investment risks in Viet Nam

Risks perceived by investors	Factors driving risk perception
Curtailment risk	• Inadequate availability of transmission infrastructure (as of 2022) at key points from source to load in certain transmission corridors[1] • Execution delays in setting up infrastructure to both bridge the aforementioned transmission deficit and cater to additional generation capacity • Absence of deemed generation or take-or-pay clauses in RE PPAs
Bankability of model PPAs[2] (relevant for international debt financiers)	• Absence of sovereign guarantees for Viet Nam Electricity's (EVN) contractual obligations[3] • Inadequate provisions for the premature termination of PPAs[4] • Absence of provisions for international arbitration for dispute resolution, and Vietnamese law is mandatorily applied as applicable law • Political force majeure protection is excluded
Land acquisition and permitting risk	• Leasing land and obtaining requisite permits from provincial authorities is an onerous process

Source: CEEW-CEF's consultations with Vietnamese power-sector stakeholders

Notes:

1 Existing transmission constraints were perceived to be most severe in Ninh Thuan and Binh Thuan provinces.

2 The bankability of PPAs was largely perceived to be a concern for international debt financiers but not Vietnamese financial institutions.

3 The Viet Nam government typically offers sovereign guarantees for infrastructure projects constructed in the PPP mode but not to projects constructed in the independent power producer (IPP) mode. So far, RE projects have been constructed in the IPP mode. While the PPP mode is also available, subject to qualifications under PPP law, it is yet to be tested in the power sector.

4 In case the seller opts to terminate the contract prematurely due to a default by the offtaker, the maximum termination payment is capped at the value of the electricity output in the year leading up to the termination of the PPA.

Therefore, CEEW-CEF decided to focus on addressing curtailment risk, a sector-specific problem, by developing a rapidly implementable sector-specific solution.

2.4 Why curtailment risk results in higher tariffs: implications for project finance

Project finance is commonly used across the world to finance infrastructure projects, including RE projects (The World Bank 2011). In such a mode of financing, the capital (debt and equity) that funds the project is paid back using the cash flows generated by the project implementing company, known as a special purpose vehicle (SPV). The terms of debt finance offered to the SPV primarily depend on the lender's assessment of the riskiness of project-specific cash flows, with limited or no recourse to the capital or assets of the parent company (sponsor) for debt service. Lenders may demand additional recourse to the sponsor's capital or assets if, in their assessment, pure-play project finance arrangements do not adequately ensure timely and full debt repayment by the SPV.

Post commercial operation date (COD), non-recourse project financing for RE projects is now well established in Viet Nam as well.[5] While both domestic and international financial institutions finance RE projects in Viet Nam, domestic financial institutions have funded the majority of Vietnamese RE capacity.[6] The key facets of domestic RE financing in Viet Nam are summarised below:

- Loan tenors of ~12 to 15 years
- Debt service reserve account (DSRA) requirements of 2–3 quarters of interest and principal repayments.
- Debt made available to the project is sized at a minimum DSCR (ratio of operating cash flows or EBITDA to principal and interest repayment, calculated annually) of 1.2.
- Refinancing of debt from domestic financial institutions is not common due to high prepayment penalties.

From the perspective of investors, curtailment risk results in lower than optimal projections of electricity generated, dispatched, and eventually paid for by the offtaker. In terms of financial modelling, curtailment risk manifests as lower revenue and cash flow projections in the years concerned.[7] As a result, financial models factoring in curtailment require higher tariffs to achieve the same returns that can otherwise be achieved at lower tariffs in a scenario of no curtailment. In reality, debt financiers are also likely to offer superior terms of debt in case no curtailment is expected, while equity investors could also lower their returns expectations, which would further contribute to a difference in tariffs between the two cases (Section 4).

2.5 Addressing curtailment risk in a wider phased approach to drive RE penetration

Deploying RE at a pace and scale necessary to support Viet Nam's low-carbon ambitions necessitates actions in the near term, medium term, as well as long term (Table 5). While upgrading physical transmission/distribution infrastructure is critical to address the curtailment challenge, it will take time.[8] Against this backdrop, well-crafted near- and medium-term policy and regulatory interventions could help manage the existing curtailment challenges. This could be achieved by enabling calibrated low-cost capacity addition even as longer-term fixes are rolled out. Simply put, such near- and medium-term policy interventions could ensure that RE capacity deployment does not need to wait for longer-term fixes to be put into place.

Near term actions (by end-2022)

The lucrative FiT regime incentivised rapid RE capacity addition, particularly in the case of solar. However, it did so with some significant trade-offs. First, it resulted in financially burdensome tariffs. Second, the rapid generation capacity addition caused mismatches between existing generation and transmission capacity, resulting in curtailment of operational capacity.

The introduction of power procurement through auctions is an important policy tool that can tackle both of these trade-offs. Since capacity addition in an auctions regime occurs only when it is tendered, such a regime can help manage the pace of capacity addition.

5. Based on CEEW-CEF's stakeholder consultations.
6. Ibid.
7. Ibid.
8. Transmission upgradation is a minimum condition for eliminating curtailment. Besides transmission infrastructure, adequate flexible balancing capacity and accurate forecasting and scheduling techniques are also necessary for RE integration.

This helps circumvent the possibility of RE capacity addition overwhelming the transmission grid, as had happened during the FiT regime for solar PV. At the same time, competition between bidders in an auction also facilitates cost-competitive power procurement. While stakeholders already anticipate the introduction of an auctions regime for solar, policymakers are considering introducing the same for wind.

Further, power-sector planners must also review transmission capacity addition plans. Vietnamese power-sector planners are conducting this exercise as a part of developing the PDP8. This is necessary to address prevailing deficiencies in transmission corridors that support RE deployment as well as to assess the additional infrastructure needed to support Viet Nam's RE capacity addition plans going forward.

Medium term actions (2023-2025)

The near-term actions set the stage for calibrated low-cost RE capacity addition in the medium term. This calibrated capacity addition can maintain the momentum of Viet Nam's power-sector decarbonisation while simultaneously enabling the development of transmission infrastructure to support long-term capacity deployment.

The calibrated medium-term capacity addition should ideally be directed to take place at sites that have a credible transmission development plan to support the corresponding generation capacity deployment. However, the transmission development plan by itself will not be enough to mitigate curtailment risk. As discussed in the previous section, concerns over delays in the execution of transmission strengthening plans can result in curtailment risk perceptions. This is partly a product of the legacy of prior curtailment challenges. It is also a recognition of the enormity of investments needed in Viet Nam's transmission grid (market projections of USD 32.9 billion investment in transmission between 2021 and 2030) and the possibility of delays in this massive infrastructure development plan.

A financial solution could help mitigate curtailment risk stemming from potential mismatches in the pace of generation and transmission capacity addition (described in detail in Section 3). This financial solution is not a substitute for adding transmission capacity. It should instead be regarded as a complement to the same to achieve low-cost capacity addition.

Long term actions (Beyond 2025)

The building out of the transmission network over the medium term would result in a grid that supports the large-scale deployment of RE capacity consistent with Viet Nam's decarbonisation ambitions.

3. The Viet Nam Grid Integration Guarantee

Curtailment risk manifests as reduced revenue projections in the financial models of debt and equity investors (Section 2.4). This translates to inferior terms of debt for RE projects, resulting in elevated tariffs. CEEW-CEF's proposed financial solution, the Viet Nam Grid Integration Guarantee (V-GIG) mitigates

Table 5 A proposed phased approach to RE capacity addition

Timeframe	Action
Near term (by end-2022)	• Manage the pace of grid-connected RE capacity addition to avoid overburdening the grid » Introduce power procurement through auctions to regulate pace: * Stakeholders already anticipate that solar photovoltaic (PV) power procurement could shift to auctions * The government is considering an auctions regime for wind, but it is yet to specify a procurement policy following the expiry of FiTs in Oct 2021 • Align transmission capacity development plans with the RE capacity addition trajectory (being done as part of PDP8)
Medium term (2023–2025)	• Calibrated RE capacity addition along with transmission capacity development • **Financial solution to mitigate curtailment risk and enable low-cost RE capacity addition**
Long term (beyond 2025)	• Transmission grid that is in sync with the envisaged scale of RE capacity addition

Source: Authors' analysis

curtailment risk by providing greater comfort to financiers to extend improved terms of finance and hence facilitates the realisation of lower tariffs. We propose that this solution be used to support new RE capacity deployments approved under PDP8 as well as transitional solar and wind projects, that is, projects under PDP7 that failed to commence commercial operations before the expiry of the FITs. Figure 1 is a schematic representation of the interactions between the project SPV, offtaker, debt and equity investors, and the financial solution.

The financial solution takes the form of a first-loss guarantee[9] that safeguards investors against a defined level of curtailment (based on technical studies – details in Sections 4 and 5) stemming from delays in implementing planned transmission upgrades. The baseline against which curtailment will be measured will be specified in consultation with Vietnamese power-sector stakeholders. In case of curtailment, the guarantee may be invoked to make up for a reduction in the SPV's cash flows up to the defined limit of protection.

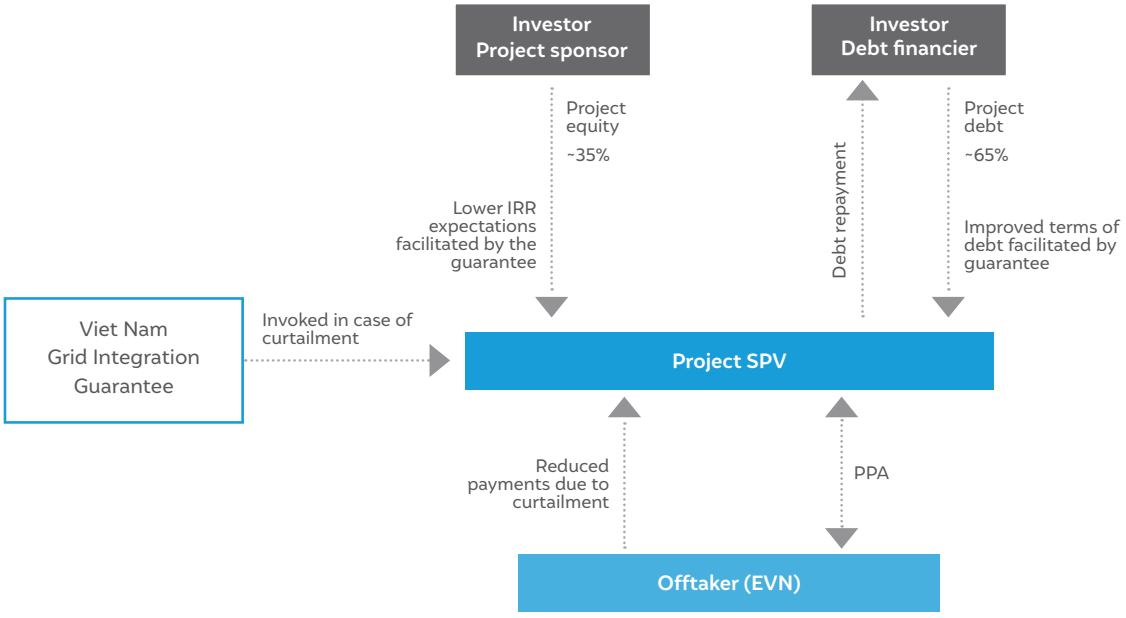
It is worth noting that the guarantee will only be invoked in case there is actual curtailment. In case of a timely upgrade of transmission capacity, there would be no curtailment (from delays in transmission upgrades) and the guarantee does not have to be invoked. However, regardless of whether or not the guarantee is invoked, its presence transfers curtailment risk from the financial models of investors to the pool of capital underwriting the guarantee. This gives comfort to financiers and enables them to offer superior terms of finance to RE projects, which in turn allows the realisation of lower tariffs.

4. Solution design and simulation

Power-sector stakeholders were broadly supportive of the V-GIG as a potential solution to mitigate curtailment risk and facilitate low-cost RE capacity addition.[10] CEEW-CEF's stakeholder consultations indicated that tariff reduction would result from two levers – higher revenue projections factored into financial models and superior terms of debt and equity finance offered to projects.

> **A financial solution could help mitigate curtailment risk stemming from potential mismatches in the pace of generation and transmission capacity addition.**

Figure 1 Schematic representation of the Viet Nam Grid Integration Guarantee



Source: Authors' analysis

9. A first-loss guarantee is a financial mechanism whereby a third party compensates the lender up to a defined limit in the event of default by the borrower.

10. CEEW-CEF's stakeholder interactions.

From a policy perspective, a quantitative cost–benefit analysis is necessary to evaluate the merits of the proposed solution. The cost and benefits associated with the solution would vary depending on the extent of curtailment protection offered and the consequent improvement in terms of finance. Based on inputs from stakeholders, CEEW-CEF estimated the potential reduction in tariffs enabled by the V-GIG. This section summarises the results of such a simulated cost–benefit analysis.

4.1 Extent of curtailment protection

The level of curtailment protection offered by the guarantee should equal the maximum estimated curtailment stemming from a deficit of transmission infrastructure between the generation source and load centre. Load-flow simulations conducted during feasibility studies for specific sites may be used to establish the expected curtailment at the project site in the absence of grid upgrades. To illustrate the cost and benefits associated with the solution, this study assumes two levels of expected curtailment in the absence of grid upgrades: 10 per cent and 20 per cent.

The objective of the guarantee is to offer protection stemming from potential delays in implementing grid upgrades, which if implemented, would reduce the estimated curtailment to zero. To simulate such transitory curtailment risk, the guarantee proposes to provide protection for two years from the commissioning of the RE plant. Further, it proposes to provide protection to the maximum expected level of curtailment in year one, and half the maximum expected level in year two. Finally, the grid is expected to support the dispatch of the entire electricity generated from year 3 in our simulation.

4.2 Simulating costs and benefits associated with the Viet Nam Grid Integration Guarantee

This section summarises the results of a simulation conducted to evaluate the trade-off between the costs and benefits associated with the V-GIG.

Cost

The cost of the guarantee depends upon the extent to which the pool of capital underlying the guarantee is drawn to make up for losses due to curtailment. In case there is no delay in upgrading transmission infrastructure, the guarantee is not invoked, and the cost would be equal to the opportunity cost of maintaining a fully-funded facility. In the case of actual curtailment, the cost equals the present value of capital necessary to bridge the deficit in revenues in years one and two corresponding to the level of curtailment.

Therefore, the maximum cost corresponds to the case in which the maximum expected level of curtailment occurs.

Benefits

The lower tariffs facilitated by the guarantee translate to savings for the offtaker, EVN, relative to the higher tariffs it would have had to pay without the guarantee. The benefit equals the present value of these savings relative to the base case (in which tariffs would be higher due to curtailment risk).

Cost–benefit analysis

Figure 2 summarises the input parameters for our simulation – the terms of debt and expected amount of curtailment. It also summarises the expected tariffs corresponding to various scenarios in the simulation.

The detailed assumptions underlying the analysis have been summarised in Table A1 in the Annexure. The analysis factors in progressively superior terms of debt as the expected level of curtailment reduces, with the best terms of debt available if no curtailment is expected as a result of the guarantee facility.[11]

As indicated in Figure 2, the availability of the guarantee (0 per cent expected curtailment) results in an improvement in the terms of debt finance as well as a decline in tariffs. A decline in tariffs of around 11 per cent occurs if both debt and equity investors lower their expected returns by 100 basis points as a result of the guarantee.

The objective of the guarantee is to offer protection stemming from potential delays in implementing grid upgrades, which if implemented, would reduce the estimated curtailment to zero.

11. Based on CEEW-CEF's stakeholder consultations.

Figure 2 Input parameters and simulated tariffs

Terms of debt		
Tenor (Y)	Interest	D:E
12	12.0%	65:35
13	11.5%	65:35
15	11.0%	65:35

Expected curtailment	Tariffs (VND)			
	Expected equity IRR			
	14%	13%	12%	11%
20%	1894	1827	1761	NA
10%	1822	1761	1698	1640
0%	1742	1689	1636	1583

~11% tariff reduction achieved due to V-GIG support driven by

1. Reduction in expected equity IRR from 14% to 13%
2. Reduction in cost of debt from 12% to 11%
3. Tenor extension from 12 years to 15 years

Source: Authors' analysis

Assumptions:

- Minimum DSCR = 1.2, minimum DSRA requirements = 2 quarters
- The curtailment levels indicated correspond to the levels expected for the first year. These are estimated to reduce to half of year 1 values in year 2 and reduce further to 0 per cent over the remainder of the PPA. The guarantee safeguards against curtailment in the first two years.

Note: Our simulation did not yield a tariff that met the minimum DSCR of 1.2 for 20 per cent curtailment and 11 per cent equity IRR without structuring debt repayments. Since equated repayment is one of our assumptions across scenarios, no output is provided for the cell in question.

Tables 6 and 7 summarise the costs and benefits under various simulation scenarios. As is evident, the V-GIG can unlock many multiples in benefits for every dollar that capitalises it.

Table 6 Cost–benefit analysis for curtailment protection of 10% in year 1 and 5% in year 2

Expected equity IRR (VND)		Cost per MW* (VND Mn)	Benefit per MW (VND Mn)	Benefit to cost ratio
Without V-GIG	With V-GIG			
12%	11%	656	3,644	5.6x
13%	12%	678	3,988	5.9x
14%	13%	699	4,269	6.1x

Source: Authors' analysis

*The cost mentioned corresponds to the case in which curtailment of 10 per cent in year 1 and 5 per cent in year 2 actually occurs. This cost is lower if lower levels of curtailment are realised.

Note: The underlying technology considered in this analysis is onshore wind. Similar analyses can be conducted for other RE technologies.

Table 7 Cost–benefit analysis for curtailment protection of 20% in year 1 and 10% in year 2

Expected equity IRR (VND)		Cost per MW* (VND Mn)	Benefit per MW (VND Mn)	Benefit to cost ratio
Without V-GIG	With V-GIG			
12%	11%	1,311	5,253	4.0x
13%	12%	1,355	5,718	4.2x
14%	13%	1,399	6,199	4.4x

Source: Authors' analysis

*The cost mentioned corresponds to the case in which curtailment of 20 per cent in year 1 and 10 per cent in year 2 actually occurs. This cost is lower if lower levels of curtailment are realised.

Note: The underlying technology considered in this analysis is onshore wind. Similar analyses can be conducted for other RE technologies.

5. Capitalisation of the Viet Nam Grid Integration Guarantee

The V-GIG presents a compelling proposition in terms of the trade-off between costs and benefits. To realise these benefits, the facility first needs to be capitalised. So, what is the scale of funding needed, and which are the entities best equipped to fund it?

5.1 Simulating the scale of capital required

The scale of capitalisation needed depends upon the scale of project deployment to be supported and the extent of curtailment protection required. This requires deeper analysis in consultation with Viet Nam's electricity planning and implementation agencies. For the purposes of our simulation, Table 8 captures the indicative capital requirements under a set of assumptions. This assumes that 10 per cent of Viet Nam's planned onshore and nearshore wind capacity addition between 2020 and 2030 requires curtailment protection. The capital requirements vary with the extent of protection required. These figures assume that equity investors are comfortable with return expectations of 12 per cent.

5.2 Sources of capital

The funds used to capitalise the guarantee face capital erosion as a trade-off for unlocking many multiples in terms of benefits. Grant capital is best placed to meet these funding requirements, and hence public or philanthropic sources of capital are best suited to fund the facility.

Several possibilities can be explored for funding the V-GIG. Given that the benefits from the implementation of the facility would accrue to EVN, the state-owned utility itself or another Vietnamese government agency could consider funding the facility, at least in part. To defray the costs of funding the facility for Vietnamese government entities, interest from intergovernmental or multilateral agencies and philanthropies could be explored. Some of these possibilities are listed below.

Intergovernmental platforms

- The Green Climate Fund (GCF) is mandated to support developing countries in realising and raising their ambitions in the pursuit of decarbonisation objectives (Green Climate Fund 2022a). The GCF has already supported clean energy initiatives in Viet Nam. As the Ministry of Planning and Investment (MPI) is Viet Nam's National Designated Authority for the GCF, any application to the GCF would be made under its overall supervision (Green Climate Fund 2022b).

- Coalitions of developed countries could also consider funding this facility as part of their climate finance commitments. At COP26, under the Just Energy Transition Partnership (JETP), the US, UK, France, Germany, and the EU agreed to provide an approximately USD 8.5 billion to support the repurposing of a portion of South Africa's coal-fired power plants that are due for decommissioning (Andreas 2021). The Vietnamese government could consider engaging with specific developed countries in the lead-up to and at COP27 to secure funding for the facility under similar arrangements.

Development finance agencies

- Agence Française de Développement (AFD): The Indo-Pacific is a key component of French foreign policy endeavours towards achieving a stable, multipolar world order (France Diplomacy 2022). The AFD has supported numerous climate-related projects in the region, which are mainly focused on adaptation (France Diplomacy 2022). The AFD has previously extended a USD 100 million concessional line of credit to Bank for Investment and Development of Vietnam (BIDV) to support investments in renewable energy and energy

Table 8 Capital requirements under assumed scenarios

Capacity (MW)	Year 1 curtailment protection	Expected equity IRR without V-GIG	Cost per MW (VND Mn)	Capital required (VND Bn)	Capital required (USD Mn)
1328	10%	12%	656	871	38
1328	20%	12%	1,311	1,741	76

Source: Authors' analysis

Note: The total onshore wind capacity addition between 2021 and 2030 is estimated to be the difference between the mid-point of 2030 onshore wind capacity market projections (11,700–16,121 MW) and installed capacity at the end of 2020 – 630 MW.

efficiency (Phi Nhat 2021). While funding the V-GIG could potentially advance the AFD's priorities in the region, further consultations would be necessary to gauge interest.

Multilateral development banks

- Asian Development Bank (ADB): The ADB's USD 25 million Climate Innovation and Development Fund (CIDF) aims to de-risk climate mitigation and adaptation projects in India and Viet Nam (Asian Development Bank 2022). RE projects are eligible under this facility. Grant funding from this facility could be considered for capitalising the V-GIG.

Philanthropies

- Bloomberg Philanthropies: As a part of its USD 242 million fund to support the energy transition in developing countries, Bloomberg Philanthropies is looking to develop partnerships in Viet Nam (Climateworks Foundation 2022). Further consultations are necessary to assess if the V-GIG fits in with the objectives of the fund.

Other catalytic finance funds

- SEACEF: The Southeast Asia Clean Energy Facility (SEACEF) aims to accelerate the energy transition in Southeast Asia (SEACEF 2022). This fund does not provide grant capital, but it supports investments that offer returns to investors. To align with the investment mandates of this fund, developers would have to be charged user fees to implement the V-GIG.

Carbon markets

- Carbon markets under Article 6 of the Paris Agreement as well as voluntary carbon markets could be a means to complement other sources of funding the V-GIG. Greater analysis is necessary to examine the feasibility of linking the funding requirements of the V-GIG with carbon markets.

5.3 Applicability to other emerging economies

While this report focuses on transmission risks in Viet Nam, the fact remains that most developing countries will need to invest considerably in upgrading transmission infrastructure to support accelerated power-sector decarbonisation as a part of their wider decarbonisation efforts. Therefore, delays in implementing planned transmission capacity addition are a possibility across developing countries. Though the V-GIG has been tailored to address curtailment risk stemming from transmission delays in Viet Nam, it could also be used to mitigate similar risks in other developing countries and facilitate low-cost RE capacity addition. Thus, the V-GIG could potentially be concurrently deployed across multiple developing countries.

In this context, the V-GIG could be folded into proposals for collective de-risking of RE projects across developing countries. One such proposal is the Global Clean Investment Risk Mitigation Mechanism (GCI-RMM). This proposal aims to pool together non-project-specific risks that impact RE projects across developing countries to facilitate their de-risking through a common fund (Ghosh and Harihar 2021). Such an approach offers scale and the benefits of diversification. The V-GIG could also be capitalised under the GCI-RMM.

6. Pilot demonstration–validating simulation results

This report concludes that a guarantee that mitigates curtailment risk stemming from delays in the implementation of planned transmission upgrades can facilitate the calibrated, low-cost deployment of RE capacity in Viet Nam, with the benefits far outweighing the costs. To empirically demonstrate the value of the V-GIG in realising competitive tariffs, this report proposes a pilot demonstration of the facility. The proposed pilot would take the form of an auction of onshore wind capacity, with the V-GIG providing cover against curtailment risk. Price discovery through the auction route is recommended as a practical approach to gauge the effectiveness of the guarantee in mitigating risk perceptions and realising lower tariffs.

Specifications of the pilot demonstration

This section elaborates on the proposed size and capital requirements of the pilot.

> **Numerous sources of capital including intergovernmental agencies, philanthropies and carbon markets could defray the costs of funding the facility for Vietnamese government agencies.**

Proposed size of the auction

The pilot project should be sized to a scale that is attractive enough to draw participation from equity and debt financiers. This report proposes that the pilot be sized in the 50–100 MW range. This range is recommended keeping in mind the preference of equity and debt investors for large-sized projects. Constraints such as available substation capacity or capital available for conducting the pilot could help determine the specific megawatt capacity, in case the upper bound of the range is not feasible.

Capital requirements

The capital requirements depend upon the size of the auction and the expected extent of curtailment that could materialise in the absence of transmission upgrades at the proposed site. While sizing the capital requirements requires site-specific data, Table 9 illustrates the scale of these requirements for specific cases.

The stakeholders involved

Conducting the proposed pilot demonstration involves a number of constituent steps and the involvement of varied stakeholders. The following lines elaborate upon these matters.

Site selection

The first step is selecting a substation for the project to be auctioned to be set up. The proposed substation should meet three essential criteria:

- The substation should be one corresponding to which there is a transmission deficit at some point from the generation site to the load centre, that is, where setting up new RE capacity would result in some curtailment.
- Load-flow studies of the transmission corridor from the substation to the load centre should be available which estimate the extent of curtailment the proposed RE project would face if no transmission upgrades were available.
- Plans for upgrading the transmission infrastructure to eliminate the transmission deficit should be in place.

Electricity planning and implementing agencies reporting to the Ministry of Industry and Trade, particularly the Institute of Energy and EVN, would be most suited to suggest suitable sites.

Table 9 Estimated capital requirements of the pilot demonstration

Expected year 1 curtailment	Size of auction (MW)	Capital requirements (USD Mn)
10%	50–100	1.4–2.9
20%	50–100	2.9–5.7

Source: Authors' analysis

Note: Assumes expected equity IRR of 12 per cent without V-GIG.

Capitalisation of the pilot facility

The sources of capital identified for the facility in Section 5 could also be considered to fund a pilot demonstration of the facility. The specifications chosen for the facility would determine the extent of capital required. Depending on the scale of capital requirements, the participation of one or more of these entities could be necessary.

Debt financier

A prominent Vietnamese debt financier of RE projects should be involved to extend debt capital to the winning bidder of the pilot auction.

Project developer

The auction should be open to both Vietnamese and international developers of RE projects.

> **This report proposes that the pilot auction be sized in the 50–100 MW range, keeping in mind the preference of investors for large-sized projects.**

Annexure

Table A1 Assumptions underlying the cost–benefit analysis

Parameter	Units	Value
Capex per MW of onshore wind capacity	USD million	1.4
USD/VND exchange rate		23000
Capex (VND)	VND million	32200
Operations & maintenance costs (Year 1)	VND million	230
Annual escalation in O&M costs		5%
Capacity utilisation factor		35%
Construction years	Years	1
Asset life	Years	20
Debt service reserve account requirements	Months	6
Minimum DSCR		1.2
Debt–equity ratio		65:35
Receivables	Months	2
Interest on working capital		Cost of Long-term debt + 1%
Depreciation		Straight line
Tax rate		
Years 1–4		0%
Years 5–13		5%
Years 14–15		10%
Years 16–20		20%
Viet Nam 10-year sovereign bond yield		4.6%

Source: CEEW-CEF's stakeholder consultations.

Notes:

1. The analysis assumes VND-denominated tariffs, as stakeholders indicated that this would be the likely mode of power procurement going forward.
2. Long-term debt repayment assumes equated annual repayment across all scenarios and a moratorium on principal repayment in the first year of operations.
3. The debt–equity ratio is held constant across scenarios, consistent with the lending practices of major Vietnamese financial institutions.
4. The remaining assumptions associated with the cost–benefit analysis are stated in the appropriate places in Section 4.2.

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Acronyms

ADB	Asian Development Bank
AFD	Agence Française de Développement
AFLU	agriculture, forestry and other land use
BAU	business as usual
CAPEX	capital expenditure
CIDF	Climate Innovation and Development Fund
COD	commercial operation date
COP26	26th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change
DSCR	debt service coverage ratio
DSRA	debt service reserve account
FiT	feed-in tariff
GCF	Green Climate Fund
GCI-RMM	Global Clean Investment Risk Mitigation Mechanism
IPP	independent power producer
IPPU	industrial processes and product use
MPI	Ministry of Planning and Investment
mtCO2eq	million tonnes of carbon dioxide equivalent
NHPC	National Hydro Power Corporation
PDP7	Power Development Plan-VII
PDP8	Power Development Plan-VIII
PPA	power purchase agreement
PPP	public–private partnership
PV	photovoltaic
RE	renewable energy
SEACEF	Southeast Asia Clean Energy Facility
SECI	Solar Energy Corporation of India
V-GIG	Viet Nam Grid Integration Guarantee

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Arjun is a public policy professional working to accelerate the flow of affordable finance towards sustainability in emerging economies. He develops financial solutions to address both sectoral and cross-cutting bottlenecks in the flow of capital. Prior to joining The Council, Arjun worked in equity research and corporate finance. He holds an undergraduate degree in Electronics and Communication Engineering from the Delhi College of Engineering and an MBA from the Management Development Institute, Gurgaon.

"The Viet Nam Grid Integration Guarantee offers a cost-effective, medium-term solution to mitigate investment risks and advance the low-cost, calibrated deployment of renewable power in Viet Nam en route to the objective of net zero by 2050."

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Gagan is the Director of CEEW-CEF, where his focus is on advancing the energy transition. Before joining CEEW, he was CFO of GMR Renewable Energy, and before that, he worked in the investment banking industry across multiple geographic locations, including Tokyo, Singapore, London, and Dubai. Gagan holds a BA (Hons) degree in Economics from Delhi University's Shri Ram College of Commerce and an MBA from Duke University.

"The Viet Nam Grid Integration Guarantee represents a financial solution that smoothens out the impact of any mismatches in transmission capacity rollout, at a cost that pays itself back many times over in the form of savings achieved through lower tariffs."

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Vaibhav is a qualified attorney and Foreign Counsel at VILAF, holding a master's degree in Law from the University of Mumbai and having post-graduate diplomas in Energy Law and Air & Space Law from the WB National University of Juridical Sciences. He graduated from the International School of Nuclear Law, University of Montpelier 1, and certified in Drafting National Legislation from the Nuclear Law Institute at the International Atomic Energy Agency (IAEA).

"This Guarantee acts as an effective tool, providing a unique solution with the capability to create greater impacts for a sustainable energy transition for Viet Nam towards net-zero mission."

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