FINANCING NEW ENERGIES

Executive Summary

In this paper we first examine the challenges of financing the transition to new energies and highlight that the financing needs are very large, that both public and private finance are required, and that the characteristics of new energy investments makes sourcing capital more difficult.

We then describe five important building blocks which can increase the availability of finance:

- Legislate long term climate commitments to provide a clear and stable investment environment.
- Reduce the overall need for finance by reducing the amount of new infrastructure assets that need to be constructed.
- Establish clear funding models by completing markets.
- Ensure an attractive risk/return balance for investors.
- Green the private financial system to help unlock additional finance.

Nine short case studies have been included to give examples of the building blocks in different countries.

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The new energies financing challenges

New energies requires very large investments. According to the IEA Net Zero Roadmap (Net Zero by 2050 - A Roadmap for the Global Energy Sector), developing a new low carbon energy system requires substantial investment in infrastructure, with annual infrastructure investment maintained at almost double today's levels over the next three decades. Estimates are that within China, to meet the country's net zero goals and a 2 degree compatible global warming limit, annual investment in infrastructure may need to increase by USD 500 billion, which is equivalent to 1.5-2.0% of China's annual GDP.

The additional investment will be required in both centralised (such as renewable generation, transmission and distribution infrastructure, and CCS capacity) and decentralised (such as small-scale generation, storage, and charging and refueling infrastructure) new energy technologies. More than three quarters of this additional investment is likely to be for renewable energy infrastructure.

Given the large scale of investment required, efficient finance with a low cost of capital is required. The total cost of energy typically includes both an initial asset investment and ongoing operating expenses. For similar total costs (measured in USD/kWh), new energies tend to have a much higher asset cost and are therefore much more capital intensive. Higher capital costs mean that efficient, low cost, financing, is required and so it is important to have a low cost of capital.

Other ways of keeping costs low include avoiding uneconomic investments and letting pressures from the finance system encourage projects to drive down capital costs as they compete for funding.

A mix of public, private, and international private finance is required to provide the necessary scale of capital and allocate it efficiently. Some countries are increasing public finance for new energy infrastructure to help support a green recovery and take advantage of low interest rates. However, public borrowing has limits and large-scale private finance will also be required to meet the financing challenge. In addition, while the cost of capital is typically lower for public capital, private capital achieves greater allocative and operating efficiency through competitive drivers.

More needs to be done to attract private finance to new energies. In recent years investors and policy makers have been stimulating private green finance particularly in Europe. This is resulting in some changes in the allocations of capital, but it is less than what is needed to reach net zero. There has been a shift

towards policy which supports new energy business models, including the large upfront private investment requirements.

In China, private investors have already provided substantial finance for new energy infrastructure, but additional finance will be required to meet China's 3060 goals of peak CO2 emissions before 2030 and being carbon-neutral by 2060. A strong framework for attracting private finance for new energies can thus help China to meet its goals. This framework can be enabled by five key actions. Working together, these actions can both disincentivise investment in high carbon emissions infrastructure and incentivise investment in low-carbon infrastructure.

The five actions, which are covered in the next sections are:

- Legislate long-term, national climate commitments.
- Reduce the overall need for finance.
- Establish clear funding models by completing markets.
- Ensure an attractive risk/return balance for investors.
- Green the private financial system to help unlock additional finance.

1. Long-term national commitments

Clear commitments and targets from national governments are important to set a clear vision and demonstrate a long-term commitment to transitioning to new energy systems. Long term commitments help to reduce policy risk by setting expectations and by increasing certainty around national policies such as carbon pricing. Setting clear targets increases investor confidence by providing clarity for projects with very long lifespans. Long-term commitments and targets also help increase the availability of finance for technologies like CCS which are at an early stage now but will be important in the long term such as CCS by establishing a clear direction of travel, affirming the potential for future opportunities for businesses.

2. Reduce the financing need

Reducing the need for financing means reducing the amount of new infrastructure assets which need to be constructed. This can be done through efficient market design including aggregation and flexibility options, such as in the power sector.

Aggregating distributed energy resources under a single entity allows for the optimal utilisation of existing energy infrastructure. These benefits can be even greater when intermittent renewable energy infrastructure is also integrated. The market for aggregated energy companies is growing.

Flexibility can be integrated into every part of the energy system, including supply-side, demand-side, network, and storage.

Case Study 1: In the UK, a GBP 5 billion investment in flexibility technologies provides a net saving of GBP 40 billion to the energy system.

Modelling of the UK energy system shows that implementing storage, sector coupling, and demand side response technologies could increase the utilisation of existing energy infrastructure in the UK and provide a net saving of GBP 40 billion to the UK energy system to 2050. Integrating these technologies into the UK energy system would require GBP 5 billion in capital expenditure for the required infrastructure. However, by increasing the utilisation of existing infrastructure, fewer additional infrastructure projects are needed, providing savings in the form of avoided capital expenditure. Other flexibility options not modelled, such as interconnection, could also provide further savings.

Implementing market design and flexibility options requires high level coordination across the energy system, meaning that national governments are best placed to carry these policies and regulations forward. However, subnational governments can play an important role in supporting implementation on a more localised level.

3. Establish clear funding models by completing markets

A market which works well has to have customers who see enough value in the products and services on offer to be able to pay a high enough price to cover the product or services costs and make it attractive for suppliers. 'Completing' markets ensures that there are clear funding models for new energy projects by creating revenue streams for elements of the low-carbon transition which do not currently have enough value.

Pricing policies and market design are two ways of achieving this. Examples include:

Pricing Policies

- Taxes, for example carbon taxes or tax offsets, can incentivise investment in abatement technologies and renewables.
- Grants can reduce overall project costs and incentivise investment in specific, high-risk technologies.
- Price guarantees with well-designed tariffs can be an effective way of lowering risk.

Market Design

- Market regulation which increases the time and space granularity and integrates distributed resources improves revenue streams and incentivises flexibility.
- Creating new markets for ancillary power grid services or emissions reductions opens up new revenue streams.

Carbon pricing creates revenue streams for large scale hydrogen production and carbon capture by putting a monetary value on captured carbon, but current carbon prices remain too low. The IMF estimates that hitting a 2-degree warming target requires a carbon price of USD 75 per tonne CO2e by 2030, a price currently reached by only one carbon pricing scheme. Markets can be completed by either creating new markets (e.g., an ETS or a market for increased capacity) or by redesigning existing markets (e.g., increasing the spatial resolution in the electricity wholesale market). Such methods allow for the stacking of benefits from multiple markets, unlocking multiple revenue streams for technologies with distributed benefits, such as battery storage. Where energy markets exist at a subnational level, subnational government can play an important role in completing markets.

Case Study 2: In Texas, good market design and private secondary markets allow utility scale batteries to monetise the system benefits they provide.

For utility-scale battery storage, the monetisation of benefits from multiple markets makes projects viable by increasing revenues. In Texas, several utility-scale battery storage plants are being developed with three intended revenue streams: energy storage and resale, swap agreements, and risk management contracts. Swap agreements and risk management contracts will be entered into with both the state wholesale market operator and individual renewable energy producers, providing the benefit of price risk mitigation for both the demand and supply sides.

Compared to international competitors, utility-scale battery storage in Texas is entirely privately financed. The design of the electricity market has enabled battery storge plants to access multiple revenue streams, making business models viable for private investment. In particular, the structure of Texas' energy market, with a single wholesale buyer, has increased the simplicity and efficiency of the energy market by allowing battery storage plants to connect directly to the grid. The high spatial and temporal resolution of energy pricing means that the value of flexibility across small spaces and timeframes is explicitly priced in the market. This allows battery storage plants to stack benefits within one market: the benefit of flexibility as well as the benefit of simply delivering energy.

4. Ensure an attractive risk-return balance

Private investors make decisions on a risk-return basis which means if they perceive a high risk they expect a high return which increases financing costs. Large infrastructure projects involve different types of risk which occur at different stages of a project depending on the type of project. As new energy technologies are more novel, project risks related to development, technology, and policy are usually higher for new energy projects than for projects with mature technologies. This difference in risk is a key driver for the differences in hurdle rates across technologies, with investors requiring higher rates of return for new energy projects with higher technology risks, such as marine energy. In the UK, the social rate of return (3.5%) is lower than the hurdle rates for all new energy technologies, meaning that investors may not invest in projects that are socially desirable (i.e., returns are above 3.5%, but below the hurdle rate).

Policymakers can reduce financing costs substantially through reducing, transferring, or (less attractively) compensating for risk. De-risking tools include loan syndication, debt subordination, guarantees, insurance, hedging, public co-investment, and technical assistance. Ultimately, a combination of de-risking measures is often needed to make projects investable for the private sector. State investment banks provide a useful vehicle for offering and implementing such measures.

> **Case Study 3: In the UK, the Green Investment Bank (GIB) de-risked renewables by attracting substantial private capital investments.**
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> The GIB was set up in 2012 as a public company with GBP 3 billion in capital and the aim of mobilising private sector investment in new energy technologies. The GIB was given a target return of 3.5% but was granted operational independence in its investment decisions. The bank invested in 100 projects with a total transaction value of GBP 12 billion. The GIB was able to mobilise substantial private capital through co-investment, concessional finance, and other support, resulting in a total of GBP 8.6 billion of private capital mobilised for renewable energy projects such as offshore wind.

There are also examples of subnational governments developing their own green investment banks to de-risk investment in local energy infrastructure, such as the Montgomery County Green Bank in the US. The Montgomery County Green Bank is a county-level green investment bank in the US which has a portfolio of USD 24 million which is used to mobilise investment in renewable energy projects in the county.

For mature technologies, a number of standard de-risking tools exist, such as Contracts-for-Difference (CfDs) and debt guarantees. Even for mature technologies risk reduction may still be required when construction or pricing risk is high. In the UK, the government has used CfDs to provide a guarantee for energy prices to the offshore wind industry. In 2019, the strike price for CfDs fell below the wholesale energy price, meaning that CfDs have become revenue neutral for the government as hurdle rates have fallen.

Case Study 4: In the UK, Contracts-for-Difference have been an effective tool for de-risking investment in offshore wind.

Now used in over 38 countries, CfDs have become a standard tool for risk-mitigation. In the UK they have been particularly successful in driving the growth of what is now the largest offshore wind industry in the world. De-risking through CfDs have made the typical offshore wind farm in the UK profitable for investors without government subsidy. Without CfDs, a typical offshore wind project would have negative returns (-1.4%). By de-risking investment, CfDs reduced the cost of capital for offshore wind by 8.5%, making projects NPV positive (with a typical return of +7.7%).

The energy transition creates uncertainty about future price trends as the generation mix and demand profile change significantly. Price forecasts suggest average energy prices over the next decade will be higher than the average strike price from the first three CfD auctions, meaning CfDs represent a negative subsidy from the government. When there is uncertainty in prices, developers are willing to forego profits in favour of certainty, effectively paying an insurance premium to government through CfD auctions.

National infrastructure banks can also reduce risk by offering a range of de-risking tools such as debt guarantees.

Case Study 5: In Indonesia, a mix of de-risking instruments secured private finance for a USD 1.6 billion geothermal plant by reducing the cost of capital by an estimated 4.0%.

Indonesia has 40% of the world's geothermal resources with 9,500 MW of power generation potential, but it has been unable to capitalise on this resource because of difficulty securing finance due to high levels of perceived risk. Given the multiple risks involved, a mix of de-risking instruments were required to secure private finance for the new geothermal plant, including Feed-in-Tariffs, guarantees, swaps, and tax incentives. Together, these instruments both mitigated risks to levels that were acceptable to investors and reduced the overall cost of capital by an estimated 4.0%, thus reducing the financing need by an estimated USD 67 million.

For less mature technologies, new tools are being developed internationally to deal with the cross-chain risk that is a particular challenge for large infrastructure projects with multiple links. Less mature technologies have higher risks associated with technology and development, meaning that higher returns are required to secure financing for these projects. Beyond the size of risk, private investors are also less willing to take on risks they have limited control over, such as risks associated with development or the efficiency of a technology itself. This is especially true for technologies which are still under development such as CCUS (Carbon Capture Utilisation and Storage) and hydrogen, driving up financing costs for such projects. Internationally, governments have reduced financing costs through de-risking tools such as subsidies and concessional finance. More innovative tools are also being developed.

Case Study 6: In the UK, part-chain business models are being developed to address cross-party risks in CCUS.

Substantial cross-chain risks exist in large-scale CCUS projects, acting as a key barrier to private investment. Cross-chain risks are risks related to a CO_2 capture plant or transport and storage (T&S) asset not operating, creating a liability for all other businesses along the CCUS chain. This risk drives up the cost of private finance, creating a need for new business models which can mitigate risk and reduce costs. The new business models must also provide sufficient incentives and flexibility to attract investment and phase out government subsidies in the long run.

New business models such as regulated asset base (RAB) and Cost-Plus Open Book were considered by the UK government to address cross-chain risks and encourage private investment in CCUS infrastructure in the UK. Under RAB, the T&S company would receive a license from an economic regulator granting it the right to charge a regulated price to users in exchange for delivering and operating the T&S network. This model also includes the provision of financial support to decrease the upfront capital expenditure of investors. Under Cost-Plus Open Book, the cost of risk is transferred to consumers through billing. While this provides flexibility to account for the site-specific feasibility of projects, it does not incentivise cost reduction, meaning there are no incentives to phase out subsidies over time.

Green the financial system

Greening the financial system is important to secure additional finance. Greening the financial system means reshaping the financial system in order to support investments in new energy infrastructure and rapidly reduce activities that

increase carbon emissions through comprehensive environment and climate risk management.

Internationally, there are two key trends:

- The development of new instruments and markets for green finance, which helps expand the pool of available green capital by attracting a more diverse set of investors with different preferences and appetites for risk.
- An increase in mandatory reporting requirements, which helps shift capital towards green investments by helping investors better understand the financial risks that companies have for their existing business models if they do not adapt to the transition in the energy system. Understanding these risks is especially important given that, at present, such risks are not adequately priced into the financial system.

There is an increasing diversity in the types of green financial products offered through capital markets. Green financial products currently offered include green loans, green bonds, sustainability-linked loans, sustainability-link bonds, green equity funds, green or climate insurance, and green securitisation.

Case Study 7: In Europe, green bonds are heavily oversubscribed, with some examples apparently attracting lower than market cost of capital.

Ignitis Group, a state-controlled international energy company and one of the largest energy groups in the Baltic region, issued green bonds in 2017, 2018, and 2020 to raise capital for renewable energy projects across the region, including wind, small-scale hydro, biogas, solar, and geothermal energy. The bonds have received the highest available credit rating and environmental ambition evaluation by CICERO and were well received by international investors, with an oversubscription rate of 4x. The bonds have been acquired by 115 investors from 22 countries, including pension funds, banks, and insurance companies.

Private investors are able to invest in green infrastructure either directly or through public-private partnerships, where subnational governments can play an important role in coordinating that investment.

Case Study 8: In Germany, energy cooperatives are driving community investment in new energies, making up a significant proportion of national energy investment.

Energy cooperatives have become a popular method for financing small-scale, distributed renewable energy projects in Germany, which has become a world leader in community-based energy projects (Balch, 2015). While the average investment is small (EUR 5,065), collectively Germany's 800+ energy cooperatives have mobilised EUR 2.7 billion in capital for renewable energy

infrastructure. In the North-Rhine Westphalia region, cooperatives have installed a total of 2.9 GW of wind energy.

Energy cooperatives are attracting a more diverse range of investors, who are motivated by financial and non-financial factors. Renewable energy projects financed through cooperatives bring a number of indirect benefits to the communities they are installed in, including improving citizen participation and social innovation, contributing towards achieving local climate change goals, social cohesion, and promoting local job creation. Investors in German energy cooperatives have indicated that they are motivated by non-financial factors such as environmental protection and energy transition support, along with financial factors. As such, energy cooperatives have attracted a more diverse set of investors (with different sets of priorities) to green investment, thus increasing the pool of green capital.

The development of new, green financial instruments has increased the overall volume of private green finance over the last decade by attracting a more diverse set of investors.

Secondary markets help free up development capital by allowing high risk financiers to attract investors to take over funding of assets which have entered the low-risk stages of project development. Different stages of the project lifecycle have different levels of risk to investors, with the planning and development phases being higher risk than the operational phase. Different types of investors are willing to accept different types of risk, with a smaller share of investors willing to put their capital into the higher risk development phase. Without secondary markets, the capital from investors with higher risk appetites is locked into projects throughout their entire lifecycle, limiting the capital available for the development of additional projects. Secondary markets allow investors with higher risk appetites to 'off-load' projects onto investors with lower risk appetites when the project becomes operational, thus freeing up their capital to be 're-cycled' into additional projects more quickly than it otherwise would be. In doing so, secondary markets help to attract different types of investors with different risk profiles.

Recognising these benefits, national and subnation governments have encouraged the development of secondary markets by leveraging green infrastructure banks to bundle green assets, and by using public investment and infrastructure planning levers to directly offload projects in the operational phase. In Australia, the National Australia Bank (NAB) bundles its portfolio of renewable energy projects (worth USD 150 million) into a close-ended investment vehicle that issues project bonds to private investors. The NAB's green bonds provide private investors the opportunity to invest in clean energy infrastructure without investing directly in

individual projects. In the US, the state-level New York Green Bank provides long-term refinancing to new energy projects along with commercial banks. In doing so, the bank has improved the liquidity of the secondary market for new energy infrastructure.

This has led to an increase in the pool of available green capital. Over the past decade, there has been a significant rise in the issuance of green securities, with total issuance rising from USD 0.1 billion in 2013 to over USD 24 billion in 2017. This rise has driven an increase in the number of exchanges which have dedicated green bond segments: from none in 2014 to 21 in 2020. By attracting a more diverse set of investors to new energy projects, countries have been able to scale up investment in new energies without having to scale up the share of public investment. Total finance of green energy increased by 92% over the last decade, with the share of public finance remaining largely unchanged.

Governments have also begun implementing mandatory reporting requirements in recent years, with the aim of encouraging investors to shift their capital towards green investments by ensuring they can make informed decisions on their climate risk exposure. Following the creation of the Task Force on Climate-Related Financial Disclosures (TCFD) in 2015, the number of companies voluntarily disclosing climate risks increased 10% over the following 3 years. TCFD-aligned disclosures consider the physical, liability, and transition risks associated with climate change, thus allowing investors to make more informed decisions. Recently, countries have begun announcing mandatory TCFD requirements, with New Zealand and the UK announcing mandates for TCFD-aligned reporting across all sectors of their economies starting in 2023 and 2025 respectively.

This increase in requirements is leading to a market-led shift in the allocation of capital by helping investors better understand the financial risks associated with the transition to new energy systems. Expectations about changing financial regulations is driving a shift to green finance, with large asset managers announcing changes in their investment strategies in response to climate considerations. This trend is likely to intensify with more countries and more stringent requirements, which could include macro-prudential, micro-prudential, market-making, and credit allocation policies.

Case Study 9: In Europe, monetary regulation is moving from a system of voluntary disclosure to more stringent requirements.

Following the increasing attention from the European Central Bank and EU lawmakers on promoting sustainable investments, the European Banking Authority released its 5-year Action Plan on Sustainable Finance in 2019. The plan aims to reform the European financial system to promote sustainable

finance through 3 policy areas (macro-prudential, micro-prudential, and market-making), with new reforms coming into full effect in 2025.

By shifting investors' expectations about future regulation, the EBA's plan is expected to drive increases in the green capital supply. The EBA's action plan shifts investor expectations both by elevating sustainability as a top priority and by setting expectations about future rule changes. The EBA expect banks to act on climate-related risks as soon as possible, rather than waiting for the related rules to be finalised. Currently, Europe has the highest number of firms committed to voluntary climate-related financial disclosures under the TCFD and this number has been growing, in part, because of an expectation among European investors that mandatory disclosures will be part of the EBA's reforms to come into effect in 5 years (TCFD, 2020).

Climate risks are not yet fully priced into the financial system, leading to an over-allocation of capital in fossil fuel energy and under allocation in new energies. Additionally, the presence of uncertainty with regards to climate risk means that there are 'known unknowns' which cannot be priced into the financial system.

Therefore, current trends alone are not enough to green the financial system, meaning that long-term strategic finance is also required from the public sector. This can include:

- Creating dedicated green banks to provide concessional finance to green projects and encourage the development of secondary markets.
- Reforming monetary policy, such as integrating climate-related financial risks into the government's own collateral frameworks and asset purchases or providing conditional interest rates from central banks.
- 'Soft' policies, such as improvements in coordination and information sharing or the development of information infrastructure to appraise green finance.