

OECD – IEA Virtual Workshop

Unlocking transmission grid finance and investment for the clean energy transition in emerging markets and developing economies

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SUMMARY RECORD

Investment in electricity networks, including transmission and distribution infrastructure, needs to be significantly scaled up in the next decade in emerging markets and developing economies (EMDEs) to support the rapid scaling-up of clean energy globally as well as broader energy access, demand and safety goals. Yet investment in transmission grid faces significant challenges, linked to regulatory, market and financing issues associated with transmission grid infrastructure planning, investment and provision. Recognising this need, a number of emerging markets have asked the OECD, through its [Clean Energy Finance and Investment Mobilisation \(CEFIM\) Programme](#), to share emerging practices internationally on transmission grid financing to inform their domestic strategies. This workshop, held jointly by the OECD and the IEA virtually under the Chatham House rule, brought together over 150 experts from international organisations, governments, transmission network operators, regulators, development financial institutions, financial market participants, civil society and project developers to deepen collective understanding of these issues. In terms of next steps, the OECD, through its Clean Energy Finance and Investment Mobilisation CEFIM programme, stands ready to support countries to unlock transmission grid investment, including through capacity building, knowledge sharing and dialogues including in Egypt and Viet Nam. The workshop's lessons will help inform follow up activities by the OECD, including providing tailored support for CEFIM partners countries on transmission grid infrastructure financing, in addition to the IEA's work in Southeast Asia including the development of ASEAN Power Grid, and an analysis of barriers to transmission interconnectors in Latin America in 2024.

Session 1: Global context: investment needs and challenges facing transmission systems to achieve the clean energy transition

The first session provided a global overview and outlook for transmission grid infrastructure, thanks to a [presentation by Pablo Hevia-Koch of the IEA](#). Investment in transmission and wider electricity networks will need to ramp up significantly over the coming decades. This is driven by the changing dynamics of both the demand for and supply of electricity. On the demand side, the growth in demand by industry, buildings, and agriculture, particularly as they decarbonise ramp up electrification. This is compounded by new sources of demand, for example electric vehicles and electrolyzers for green hydrogen production. On the demand side, the growing role of renewables means grids will need to be fit for purpose to absorb a

new type of generation capacity. As a result, transmission grid infrastructure is undergoing massive transformation across OECD and non-OECD countries.

Grids are becoming a significant priority and possible bottleneck for renewable power integration globally, and especially in emerging and developing economies. Unlocking financing and investment for transmission grids is therefore critical to achieving the goals of the Paris Agreement and the targets and commitments adopted under the UAE consensus at COP28. There is evidence that grids are struggling to keep pace with the rapid development of renewables, creating a bottleneck. The slow pace of progress in grid investments means that today numerous solar PV and wind projects are waiting for grid connection: at least 1 500 gigawatts of renewable energy projects in advanced stages are in connection queues today. These are mostly solar PV and wind. A key reason for this is that while investment for wind and solar PV has almost doubled on the last ten years, investment in grids has remained stagnant. As countries accelerate the permitting of new renewable energy projects, grids will need to keep up, to avoid risking an increase in this waiting queue.

Over the last 20 years, grids have grown by more than 25 million km worldwide; but this pace needs to accelerate. Expanding grids is critical to decreasing generation costs, avoiding curtailment of renewable power, and mitigating greenhouse gas emissions. Over the next two decades, grids need to double in size, to create the link between new electricity demand, new power plants and new sources of flexibility. Transmission needs to expand to bring power from distant wind and large-scale solar PV projects to cities and citizens. And distribution grids need to be upgraded where distributed solar takes off and electrification moves forward with more electric vehicles and heat pumps. In addition, 30 million km of ageing grids will need to be replaced and modernised. In total, close to 80 million km need to be added or replaced by 2040.

Grid investment needs to double by 2030, from around USD 300 billion to over USD 600 billion. This would break a decade of stagnation for grid investment at the global level and put it in lockstep with rising investment in renewables. This is not only well above the level today; it is also much more than where the recent pace of growth would bring us, giving an indication of the gap that needs to be filled. Accelerating grid development would also raise material needs – for transmission and distribution lines, the amount of aluminium needed each year would increase by over 50% by the 2030s and copper demand for grids would double, along with rising demand for other niche products like electrical steel.

The IEA's recent report on [*Electricity Grids and Secure Energy Transitions*](#) outlined six priority actions needed to accelerate investment towards transmission and distribution networks:

- **Bringing planning up to date:** It needs to be strategic, and integrated across sectors, to correctly capture synergies that exist. Given the lead times for new grid projects a forward-looking approach is essential.
- **Investment needs to be unlocked globally:** Here, improving the way that grid companies are being remunerated today will be key. Additionally, investment in

emerging markets and developing economies will require particular focus to address cost of capital issues.

- **The regulatory framework needs to be fit for purpose:** Today, grid development needs to take place proactively and not reactively. We need to ensure grids are there when they are needed. Streamlining administrative procedures will be important to reduce lead times.
- **Supply chains need to be ready to deliver the materials and components required:** For this, establishing clear pipelines of grid projects will enable the development of resilient supply chains.
- **Leverage digitalisation:** Digitalisation of transmission and distribution grids needs to be expanded, to support efficiency and security, enabling better use of automation and AI.
- **Build a skilled workforce:** There is already a significant need for a high number of skilled white- and blue-collar professionals across the entire supply chain, as well as in system operators and regulatory institutions. Building out a pool of talent is essential, as is ensuring digital skills are integrated into power industry curricula.

There were questions on:

- **The specific challenges in EMDEs.** Investment in grids in EMDEs is slowing down, rather than accelerating. This reflects the poor financial health of many utilities and transmission system operators in EMDEs, straining their access to capital. This makes it even more difficult to set tariffs that are high enough to attract investment, whilst meeting affordability objectives.
- **The suitability of existing regulatory models.** Innovation needs to be applied across the entire spectrum, in regulation as well as technology. There has been some evolution in the regulation governing electricity markets and grids, but it has been largely the same for decades. We therefore needed to consider new regulatory approaches, for example to better account for social welfare and wider societal benefits.
- **The growing role of natural gas if grid expansion is delayed.** If grid investment is delayed and limited, renewable energy investment will suffer due to limitations in reaching users. Under this scenario, fossil generation – serviced by existing transmission assets – would rise to meet increasing demand.

Session 2: The transmission system regulatory framework and its implications on grid investments in support of clean energy transitions

Session 2 discussed some of the main regulatory models for transmission grid infrastructure and their implications on finance and cost of capital, [opened by a presentation by Nathan Appleman of the European Network of Transmission System Operators.](#)

Transmission System Operators (TSOs) conduct their activities in a monopolistic and regulated business environment. Though the majority of TSOs are wholly or in part state-owned, a wide range of business models exist that allow private sector participation. As such, the shareholder base in grid networks includes a combination of public and private stakeholders, all of which expect to be remunerated for the risks they take. In an environment where the regulator sets the parameters for the remuneration framework, many system operators are faced with access to finance and bankability challenge in view of increasing and more diverse investment needs.

In order to finance massive investments, TSOs' rate of return needs to be addressed. TSOs' ability to raise sufficient capital (equity, debt) is largely influenced by the Regulated Rate of Return (RoR) determined by the regulator. Low RoR may benefit current consumers, but lead to under-investment and divert financing towards higher-yielding investment, especially in periods of increasing interest rates. An open and public discussion is needed on how to share the burden of TSO investments between current and future grid users, and other parts of society.

Alternatives for financing TSO investments, other than tariffs, could be considered, including:

- Public funds;
- Cost sharing across countries or sectors;
- New funding and ownership structure, as discussed subsequently;
- Instruments to increase equity financing (see below summary of Session 3).

First, regulatory models need to evolve. Forward-looking regulation is needed to balance current and future consumer needs. TSO business has changed over recent decades, with new more operational expenditure-driven tasks, while also facing lasting challenges, including shortages of skilled labour and supply chain bottlenecks. Regulatory tools and methods need to evolve from looking at mainly short-term cost efficiency to focusing on long-term performance and innovation. This should via a combination of:

- Smart incentives to make best use of existing capacity;
- De-risking investment tools through appropriate RoR and lowering barriers for anticipatory investments;
- Possible extension to investments in the supply chain for critical grid components;
- Development of interconnectors, e.g. at regional level;
- Possible new Net Zero Mandate could complement existing regulatory tasks and act as guiding principle for future decisions to be better aligned with policy goals.

Second, robust regulatory frameworks and improved planning are needed to provide predictable signals to project developers and investors. Both the general investment climate – for example political stability, good governance, effective dispute resolution mechanisms – and specific regulatory features are important for private sector participation in grids. The latter includes a number of features:

- Clear, consistent and up to date legal frameworks.
- Simple and streamlined planning rules with predictable approval times. You need to bring planning up to date to assist with grid and budget planning and provide positive signals to market participants.
- Clear and consistent land use clearance, transfer and acquisition rules.
- Regulated tariffs that strike a balance between attractive returns for investors and affordability for users.
- Mechanisms for measuring project and wider risks and making them transparent to prospective investors. Critically, the gap in project timelines between generation and transmission also needs to be addressed through robust, system-wide central planning.

A number of existing regulatory and business models were discussed:

- Full privatisation, whole of grid concessions, and generation-linked transmission models are often not appropriate due to legal and regulatory contexts.
- Independent power transmission (IPT) and offshore transmission owner framework (OFTO) are both promising business model for ensuring transmission grid provision and investment, for example in Viet Nam.

There were questions on:

- **The impact of various risks, including technological uncertainty, and the growing role of batteries and hydrogen:** Supply chain uncertainty remains a major risk and uncertainty, even in areas with stable regulatory regimes. Most countries' regulatory regimes, however, still do not account for batteries and storage; this needs to be rectified. State entities need to be sufficiently well-funded to undertake required investments, and private sector investment frameworks also need to be attractive.
- **The cost recovery mechanisms and how electricity tariffs are set, and how regulation can strike a balance between the objectives of securing investment and protecting consumers.** This is a common challenge, particularly in vertically integrated systems. Some MDBs are exploring tariff reforms in Africa in order to reform tariffs structures to make them more cost reflective, whilst protecting consumers. One challenge with PPPs, including IPTs, is the reduction of economies of scale which allow TSOs to keep costs and tariffs relatively low.

Session 3: Financing models for transmission grid infrastructure to support the clean energy transition

Session 3 discussed explored the various sources of finance available for transmission grid infrastructure, and how these can be adapted to the evolving needs of transmission system operators.

Many countries are now grappling with the challenge of financing significant investment in transmission grid infrastructure, alongside wider energy transition and economic development financing needs. For emerging and developing economies where public ownership and control remains dominant, public finance remains the most common source of investment for transmission grid infrastructure. Tapping into domestic and private finance will be key to closing the significant transmission infrastructure financing gaps in many countries. But significant barriers to commercial investment remain, including some of the regulatory challenges discussed in the previous session, cross-government planning and coordination, utility creditworthiness, as well as wider socio-economic challenges and poor enabling conditions.

In 2022, public spending accounted for two-thirds of spending on transmission grids in EMDEs. Subsidies and other forms of public support still play a major role. This present challenges to the financial sustainability of state-owned utilities and transmission system operators in many EMDEs.

The financial health of utilities is a major driver of their ability to raise affordable capital. Utilities are rated for their creditworthiness against two overarching features: their business profile and their financial profile. The former includes the sectoral positioning of an entity, the regulatory environment, asset base, and operating profile. The most significant factor in EMDEs is often the regulatory environment, since it determines remuneration structures and cash flow. Other regulatory factors accounted for include the degree of independence of the regulatory, transparency and predictability of regulation, and the nature of licensing requirements. The other major factor accounted for in rating network utilities is their financial profile: profitability, return on capital, volatility of profits, leverage, and financial access and liquidity. Notwithstanding the importance of all these factors, the sovereign rating is often the key determinant, especially where utilities are state owned.

There are a number of models available for transmission operators to tap into commercial finance, including a range of business models. These include:

- **Corporate debt and bonds raised by utilities.** As discussed above, the key challenge in EMDEs is political stability and the regulatory context, currency fluctuations. Credit enhancement, currency hedging can help de-risk.
- **Whole of grid concessions:** Governments or state-owned utilities grants investors to develop, construct, operate and maintain grids, and derive profits from a share of revenue generated. Private investors are responsible for developing grids into the future.

- **Privatisation:** Sale of all or part of shares of utilities to private investor(s). This can be helpful in leveraging private sector expertise and tapping into private capital. But challenges include regulated remuneration structures, which often limit rates of return to below cost of running the network. Expropriation can also be a challenge.
- **Independent transmission projects:** These show promise to scale in EMDEs. Construction and maintenance of single or portfolio of transmission lines, implemented under contract between utility and private company. Annual or monthly revenue payments are relatively constant.
- **Merchant transmission lines:** These are lines constructed by private investment seeking profits for transmission service. Their implementation be challenging in EMDEs because they require returns that the incumbent utility would not earn for the building the same infrastructure.

Public support is often critical to de-risking commercial investment. Sources of public support include government expenditure, multilateral development banks and development finance institutions, and export credit agencies. The latter often require sovereign guarantees, and high EMDE debt levels put a constraint on governments' ability to provide these. Blended finance could help de-risk projects; a range of different instruments needed to be considered and tailored to specific risks. It is also important for public entities to identify specific risks, and tailor de-risking interventions to them, so that public support does just enough to bring in private investment and does not unduly subsidise or crowd it out. The duration of public support is also critical – de-risking and blending approaches need to be time-limited, and with a pre-determined exit strategy so that public support could be withdrawn once projects no longer needed it. Given the relative novelty of blended finance for transmission projects, a number of countries were now piloting different approaches to see what works, expand approaches that are effective, and withdraw those that are less so.

Given the scale and systems-nature of transmission grid investment, including the critical link to wider electricity markets, a systems-based approach to policy, as well as public and private investment, is needed. Country platforms, for example *Just Energy Transition Partnerships*, are a helpful development in addressing transmission grid investment alongside the wider policy, energy sector, and investment landscape in a country/

There were questions on:

- **How to identify and tackle early-stage risks to ensure de-risking instruments, including blended finance, do not unduly subsidise private investment in perpetuity.** Social acceptance and land acquisition is a significant risk for private sector investors. Governments can help resolve and mitigate these, for example through supporting early-stage feasibility studies.
- **Revenue models for IPT models:** Investors are still not prepared to take demand risk from transmission projects, since they do not control it. Availability-based models (where a project company has the responsibility for maintaining the assets for the

duration of the project) or annuity-based models (where they do not) can therefore be appropriate depending on context.

- **How heavily-subsidised SOEs are rated by rating agencies:** Ratings agencies look at the stability, timeliness, and continuity of support, including the record of past support, to inform their ratings. These are considered alongside compensation models, as well as other factors. Support anchored in regulation can strengthen ratings.