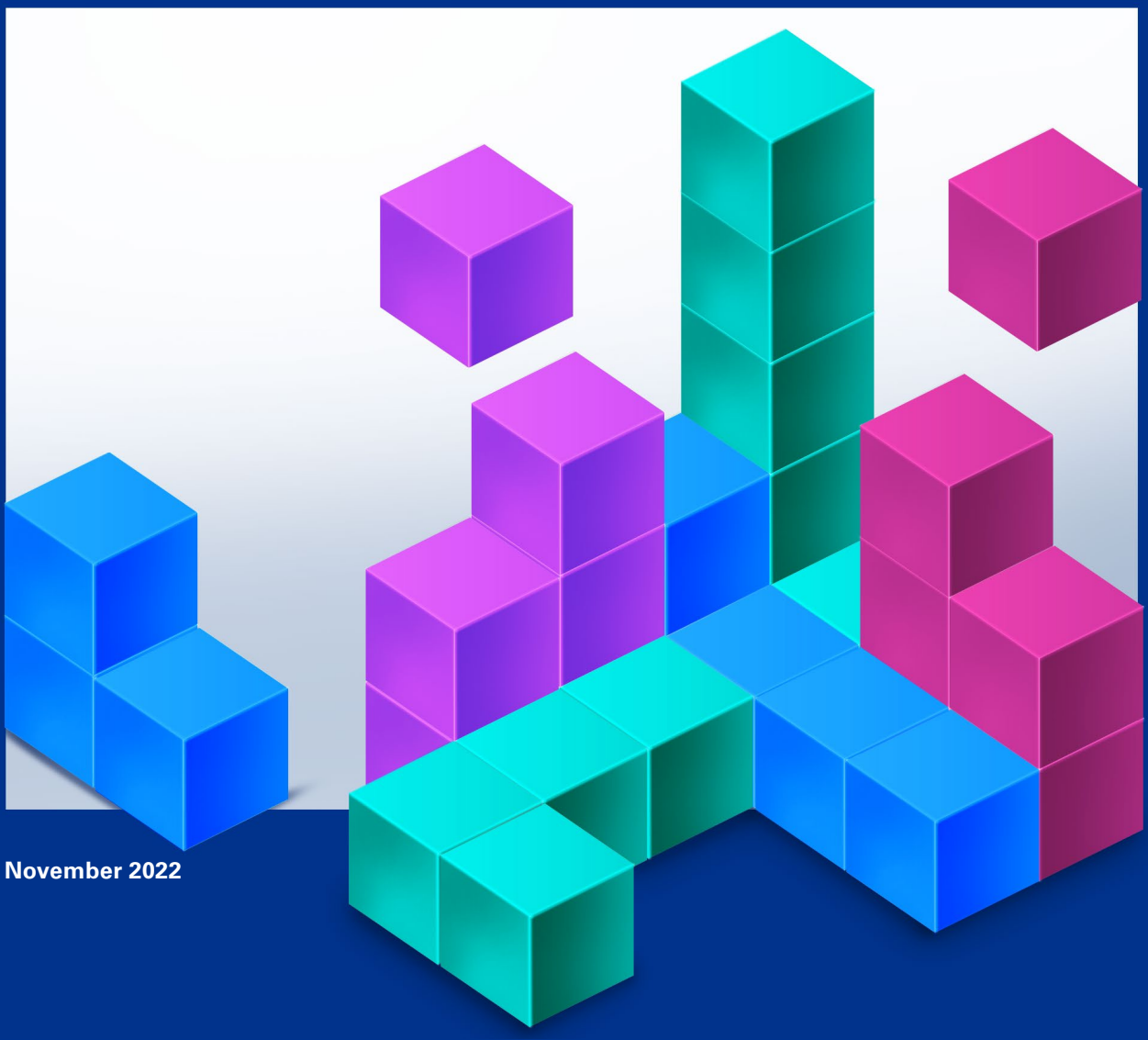
KPMG

Closing the climate finance gap

A rapid yet sustainable scale-up of financing is critical to realise the Global Net Zero ambition



November 2022

Foreword

CoP 27 at Sharrm el Sheikh has produced in a mixed bag of results. The disappointing part has been the realisation that pathways for containing global warming to 1.5 degrees have pretty much disappeared, and the world has to prepare for the extreme effects of climate change. However, on the positive side we have seen a sense of urgency among stakeholders to take talk to action. Loss and damage has found recognition in the formal global agenda. The key sentiment prevailing among attendees is that the initiative has now gone beyond governments to civil society, businesses and the world of finance. The CoP 27 event saw the release of four new reports on climate finance by UNFCCC's Standing Committee on Finance (SCF), reflecting on the importance of moving ahead on finance if this all has to come together. It was backed by a number of purposeful discussions the remit of which has expanded quite substantially into funding both mitigation and adaptation at scale, transition finance, newer approaches to risk management, etc., across energy, infrastructure, cities, manufacturing, agriculture, food, water, health, and transport.

ENRich 2022, KPMG's global annual event on energy and related themes, is focusing significantly on reinforcing the finance agenda for several reasons. Firstly, despite the increasing focus, climate financing supply remains well short of levels needed. Secondly, given the heterogeneity of demand segments in terms of emission impact, technology evolution and distance to commercial viability, differentiated financing pathways will need to be configured and a one-size fits all approach is unlikely to work. Most importantly, it struggles to reach where it is most needed due to risks that the geographies and the emergent technologies carry.

Solving the challenges will require greater resolve among governments, especially emerging markets and developing economies (EMDEs) to squarely tackle the intractable issues including reforms in financial markets, rationalisation of fossil-fuel subsidies, building institutional capacities, and nurturing vibrant carbon markets. Tackling the climate finance issues will also require deep collaboration at scale among governments, multi-laterals, corporates and financial institutions.

This paper, released on the occasion of ENRich 2022, builds on the above strands and the underlying financing demand-supply context they emanate from. It enhances the growing body of knowledge in the rapidly evolving landscape, and specifically points to the calls to action. I trust you will find this useful.

Regards,
Anish De
Global Head for Energy Natural Resources & Chemicals (ENRC)
KPMG International

Summary

The increasing recognition of the immediacy and potency of climate change threat is reflected in the growing number of Net Zero commitments by countries and corporates alike. Yet, climate financing supply, a leading marker for meaningful, expeditious progress towards the global Net Zero aspiration, is falling well short of levels needed.

Estimates of investment needed to undertake required climate mitigation and adaptation initiatives range between 3-6 per cent of global Gross Domestic Product (GDP) through 2050. Prevalent level of financing supply prints at below 1 per cent is dominated by financing flows to mitigation, and remains narrowly concentrated by sector and geography.

Near-term headwinds, including inflation, interest rate hikes, public debt overhang and an ensuring growth slowdown following COVID-19 pandemic and Ukraine shocks, complicate the climate financing math further.

In this milieu, a redoubling of commitment to step up and sustain a higher trajectory of climate finance flows is vital. Concerted action is required on five fronts.

- First, a sharper prioritisation of different demand segments considering emission impact and distance to commercial viability is crucial to configure differentiated financing pathways. Renewables are tuned for a sharp scale-up of private investment. On the other hand, low carbon hydrogen, electric vehicles and storage will require policy thrust, incentives/ viability support and risk sharing mechanisms to usher in private capital. R&D spending needs to be incentivised too. By some estimates, a third of emission reduction targets for 2050 are contingent on technologies in prototype or demonstration stages. With over USD200 billion invested in climate-related technology firms between 2013 and 2021, venture capital flows have been promising, but still short. Adaptation will require higher levels of public spending, and blended finance flows. Varied resourcing pathways are needed to deal with the heterogeneity of financing demand.
- Second, a threshold level of public financing is a sina qua non to crowd-in private financing. A public debt overhang notwithstanding, finding adequate public outlays will be critical in view of evolving nature of technologies, sub-scale capacities and elevated credit risk profile of climate risk investments in relative terms. In addition, governments ought to back higher and ring-fenced financing outlays with conducive policies, institutional stewardship, well-conceived programmes-at-scale, and de-risked bankable project structures to expand commercial financing. Nurturing capable, well-funded public institutions that can conceptualise and deliver programmes at scale, to translate policy intent into action, will be particularly critical.
- Third, sustained efforts to deepen financial markets while concurrently strengthening risk management mechanisms will be crucial. The proliferation of an array of financing instruments including green bonds, sustainability-linked structures, and risk sharing / credit enhancement facilities holds promise and needs policy facilitation for wider adoption. An expanding investor base that includes pension and insurance funds, private equity and sovereign wealth funds, philanthropic capital and impact investors, offers cause for cautious optimism as well. The imperative to scale cost-competitive capital flows will need to be balanced with putting in place effective risk management mechanisms. Governments and regulators will be challenged to stay ahead of the curve.
- Fourth, carbon markets and ESG disclosure frameworks need harmonious design, expanded coverage and effective operationalisation. A wider coverage of well-designed carbon market instruments is essential to create, monetise emission reductions that can be securitised to raise financing for climate initiatives. The implicit and explicit cost of global fossil fuel subsidies (estimated at 6.8 per cent of GDP and growing) contradicts the challenges in tapping climate finance and needs to be dealt with squarely and expeditiously. Concomitantly, reporting and disclosures centered around clear ESG frameworks will help build higher order assurance among investors and stakeholders.
- Fifth, emerging markets and developing economies (EMDEs) need to be expeditiously co-opted into the climate action agenda. EMDEs account for two-thirds of emissions but receive a tiny fraction of climate finance flows. They will require not only sizable financial commitments, but technology transfers, transition financing and hand-holding support to strengthen policy and institutional enablers from the developed world. Developed countries need to translate their commitments into tangible actions on the above fronts. Multilateral agencies need to play a catalytical role in co-creating programmes, helping governments build capacity to deliver emission reduction programmes at scale and tailor innovative financing instruments to multiply private financing.

This paper expands on the above ideas and the underlying financing demand-supply context they emanate from. It adds to a growing body of knowledge in the rapidly evolving climate finance landscape.

Contents

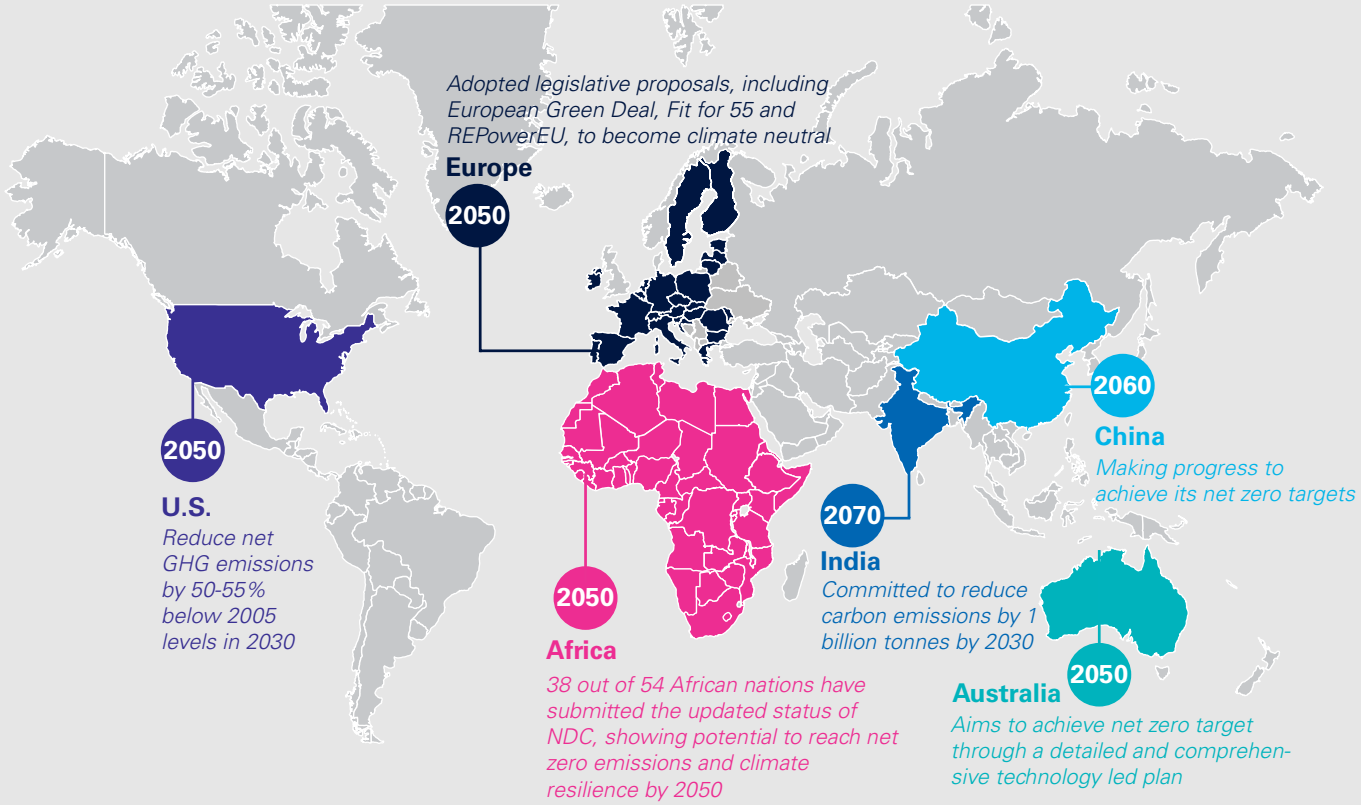
Scaling up climate finance: An urgent global imperative

The climate clock is ticking. Pathways to keep global temperature rise to below 1.5^{0}C have disappeared.

Bending the emissions curve at scale and speed, is among the pressing challenges humanity has had to contend. Events in recent times confirm the potentially catastrophic impacts of climate change. The value of losses from natural catastrophic events was estimated at USD270 billion in 2021, up sharply from an estimated USD210 billion in 2020[1]. The effects of climate change are well and truly visible. Not acting to tackle the same is clearly not an option.

139 countries accounting for 88 per cent of global emissions have announced or are considering Net Zero targets. These include the big five – China, US, European Union (EU), India and Russia – which together account for over 63 per cent of global emissions. Refer Exhibit 1. The Glasgow Financial Alliance for Net Zero (GFANZ), comprising over 550 financial firms and handling over USD130 billion in assets, and over 1500 corporates globally have made Net Zero commitments. Although these targets by themselves don't mean much unless backed up with real action and outcomes, they signal a global acknowledgment and recognition of the immediacy and potency of this threat.

Exhibit 1: Net Zero commitments by large emitters. Net Zero pledges/announcements cover 139 countries



Source: Secondary research, KPMG analysis.

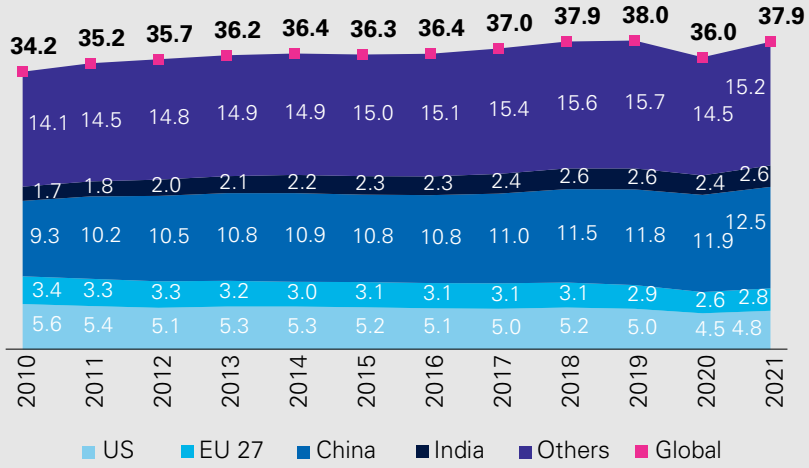
[1] Facts + Statistics; Global Catastrophes/ Insurance Information Institute/ October 2022

Notwithstanding these commitments, CO_2 emissions continue to rise: Overall emissions increased by 6 per cent in 2021, after a dip in 2020 owing to COVID-19 pandemic. The spike was largely on account of increased coal use in China, India and increase in natural gas use in rest of the developed world, which offset gains from growth in power generated from renewables globally.

Analysis by the International Energy Agency (IEA) in October 2022 suggests that emissions may grow at a much slower pace in 2022. This is despite the energy crisis being sparked by the Russian invasion of Ukraine. Though the war increased global coal demand in 2022, IEA projects this to be considerably offset by expansion in renewables. Refer Exhibit 1

Exhibit 2: Global CO_2 emissions still on the rise, with developing countries showing a slow tapering

Global CO_2 emissions trend (billion tonnes)



- A silver lining was a dip in emissions in the US, EU and Japan which were lower in 2021 by 2 to 4 per cent relative to 2019 levels.
- Reported per capita emissions in developed countries at 8.2 tonnes was lower than the 8.4 tonnes reported for China in 2021.
- Also, new IEA analysis, however, suggests CO2 emissions may register a lower growth in 2022.

Source: Emissions Database for Global Atmospheric Research (part of Europe), IEA press releases 2022.

Realisation of intermediate targets for 2030 will be crucial to build credible pathways to Net Zero. The EU, under its 'Fit for 55' package, targets to reduce its 2030 emissions by 55 per cent relative to its 1990 baseline, while the US has committed to bring down 2030 emissions by 50-52 per cent relative to 2005 levels. China seeks to reach its emissions peak, while India targets to reduce its emission intensity of GDP by 45 per cent by 2030 from 2005 levels. As of 2019, Europe and US had reduced their emissions by 26 per cent and 7 per cent against their respective baselines.

As the intent around Net Zero acquires momentum, it is yet to gain 'currency'. Climate finance supply falls well short of levels needed.

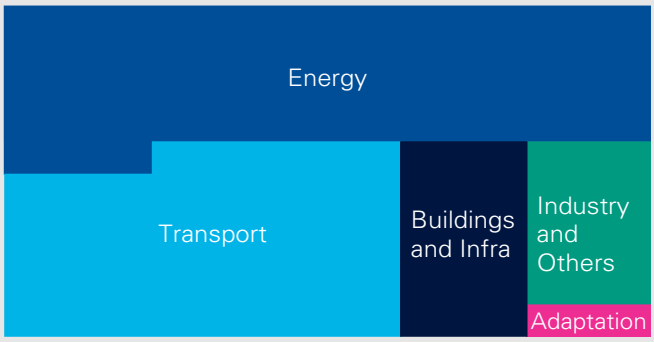
Climate financing demand is estimated at ~USD7.6 trillion annually through 2050. Annual investment required to achieve necessary transition, as estimated by various agencies, ranges between USD5.2 and 11.5 trillion through 2050, and varies widely depending on scenarios, transition pathways and other assumptions. Taking a doubling of global GDP between 2022 and 2050 (or 2.5 per cent CAGR), the mid-point of the above range of ~7.6 trillion translates to 5 per cent of global GDP through this period. *Energy and Transport account for a dominate share of climate financing demand with a 44 per cent and 34 per cent shares respectively. Buildings & Infrastructure accounted for 11 per cent share and Industry had a 5 per cent share. Other sectors accounted for the remainder 6 per cent share.*

[2] Global landscape of climate finance – a Decade of Data 2011-2020/ Climate Policy Initiative, 2022/ October 2022

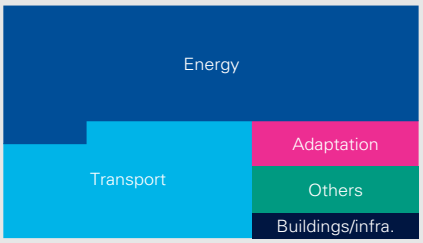
Against this, climate finance supply was estimated at USD850 billion in 2021 after trending lower at ~USD653 billion in 2019 and 2020. The supply of climate finance trailed demand by a wide margin and translated to just 0.7 per cent in GDP terms in 2019/20 and slightly higher at 0.9 percent in 2021. In 2019 and 2020 *51 per cent of climate finance supply was in Energy while Transport had a 25 per cent share. Buildings & Infrastructure accounted for 8 per cent share and Industry had a 0.5 per cent share. Adaptation measures secured only a 8 per cent share despite an increase in investment in 2021.*[2] Refer Exhibit 3

Exhibit 3: Climate finance supply trails the levels needed for a 1.5 0C pathway

Annual financing demand 2020-50 ~USD7.6 trillion



Annual financing supply ~USD0.65 trillion



The climate financing gap is large

- Supply @ ~0.7 per cent of GDP
- Demand @ 3-5 per cent of GDP

Source: Climate Policy Initiative

As a leading marker for climate agenda, the climate finance gap needs urgent attention and collective action.

[2] Global landscape of climate finance – a Decade of Data 2011-2020/ Climate Policy Initiative, 2022/ October 2022

Financing demand – Diverse needs, varying bankability

Defossilising power. Renewables are a bright spot within the climate agenda, but more needs to be done.

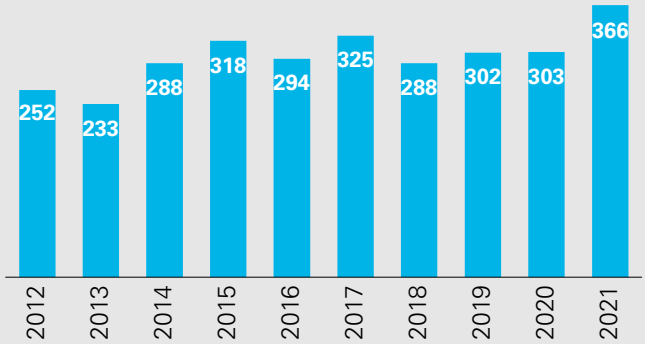
Power, Transport and Industry contribute to ~80 per cent of emissions. A peek into progress in these sectors reveals the heterogeneity (in terms of technology evolution, policy/institutional context, scale economies, emissions impact) and implications on financing attractiveness and investment riskiness. Tackling the diverse climate needs requires differentiated, contextually configured financing pathways.

Renewable power has emerged as the primary choice for energy capacity addition globally. Globally, renewable capacity grew from 1,347 GW in 2010 to 3,068 GW in 2021. Solar saw a meteoric rise, growing 34X from 25 GW to 854 GW during this period, while wind energy more than quadrupled from 196 GW to 823 GW. In 2021, the EU had 1,060 GW or 35 per cent of the global renewable capacity. China (1,020 GW) leads with over a third of global capacity, followed by the US, Brazil, Norway and India. These five countries account for 59 per cent of global renewable capacity.[3]

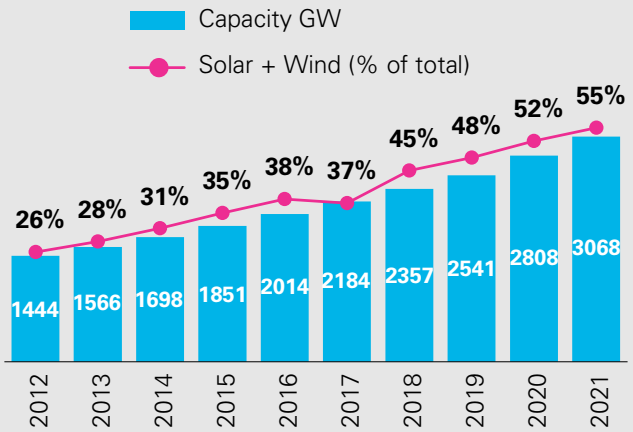
Renewables have become commercially viable and attract private financing at scale. Conducive and progressive policies, evolving technology, sharp reduction in costs, and scaled economies have come together to create enabling conditions for private financing flows which account for over two-thirds of all incremental investment in renewables globally. Renewable investments have remained robust in the post pandemic phase, with investments crossing USD366 billion in 2021 and an estimated USD226 billion in H1 2022, notwithstanding a rise in input costs and near term macro-economic headwinds. A rapid scale-up of the green bonds ecosystem, entry of corporates and institutional investors and global policy thrust to low carbon hydrogen could help scale investments from current levels. Refer Exhibit 4.

Exhibit 4: Global Renewable capacity additions and investment trends

Investment in renewables (USD billion)



Renewables capacity (GW) | Solar and wind (% of total)



Source: IRENA, IEA, KPMG analysis. Chart on Investments in Renewables does not include investments in large hydropower

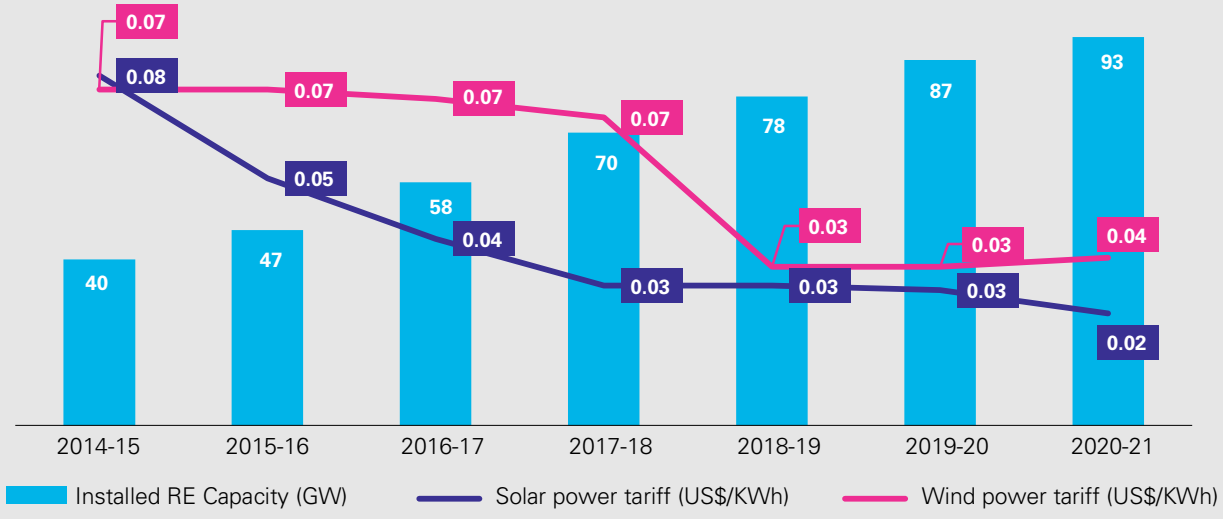
[3] Renewable Energy Statistics/ International Renewable Energy Agency (IRENA), 2015 and 2022/ October 2022

Despite these positives, regional concentration, and rising inputs costs remain concerns, as investment needs to triple from current levels. Even as EU, the US and China witness robust investments, EMDEs barring exception have lagged, and remain constrained by higher financing costs, weaker credit profile and market/regulatory risks. India's experience in ramping up grid-scale renewable capacity in the last few years is instructive. Conducive policies, institutional support and a maturing financing ecosystem have helped crowd-in private financing. Refer Exhibit 5. IEA notes supply chain constraints, higher commodity prices and tighter financing conditions of late have increased renewables costs for the first time in a decade, even though the cost of renewable power remains competitive.

Renewables score high on both bankability and impact dimensions, and remain a critical priority area to channel higher climate financing flows. EMDEs have an opportunity to leapfrog to renewables but will need to up the ante on conducive policies, institutional strengthening and financial sector reforms to crowd-in private financing.

Exhibit 5: Conducive policy, maturing financial ecosystem, widening investor base underpin India's renewables journey

Falling tariffs aid India's solar, wind capacity additions



Source: BNEF, PIB, UNFCC, CEEW, Secondary research, KPMG analysis

India's non-fossil power generation capacity doubled between FY15 and FY21, crossing 152 GW in 2021. Solar capacity grew 18-fold during this period. Solar (49 GW), large hydro (47 GW), wind (40 GW) accounted for 86 per cent of capacity, with nuclear, small hydro and bio-energy accounting for the rest. While doing so, India achieved 40 per cent share of non-fossil power generation capacity, ahead of 2030 timeline committed at the United Nations Climate Change Conference 2015 (COP-21).

This ramp-up has been driven by favourable sectoral policies, institutional support and measures to deepen the financing ecosystem. Conducive policies, capital subsidies, tax holidays, duty exemptions, institutional stewardship through

the federal agency, Solar Energy Corporation of India (to pool demand, hold auctions, provide counterparty comfort) and falling costs have all played a key role in securing private financing at scale.

Deployment of financing instruments across equity and debt structures by a diversified investor base, including developers, PE firms, global pension funds, banks, non-banking finance companies have aided the scale-up. Today, global sovereign funds, PE firms, MNCs hold equity in India's renewable sector. Foreign direct investment (FDI) flows crossed **~USD7.3 billion**[4] during FY15 and FY21. Over USD11 billion[5] raised through foreign currency denominated green bonds since FY14 have become a preferred mode for refinancing debt. Institutional investors, including global and sovereign wealth funds have also made investments in the sector.

M&As in India's renewable sector have intensified in recent years, accounting for close to 40 per cent of the investment in the renewable space in FY22. Big M&A deals included Adani Green Energy Limited's acquisition of SB Energy, Reliance New Energy Solar acquisition of REC Solar Holdings, Shell's acquisition of Sprng Energy, JSW's acquisition of Mytrah energy, Waaree's buyout of Indosolar.

The Government of India's updated Nationally Determined Commitment includes 50 per cent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. This will call for adding between 400 GW and 500 GW of renewable energy capacity and an incremental investment of over USD200 billion by 2030. However, concerted actions will be needed on three fronts to turn the vision into a reality:

i. mitigating sectoral risks around counterparty creditworthiness, grid stability, and securing supply chain components including panels, equipment and batteries,

ii. deepening the financial ecosystem to tap and channel domestic and foreign capital, and

iii. operationalise low carbon hydrogen policy focused on industrial decarbonisation as a demand-side trigger

Electrifying transport. Electric vehicles (EVs) have witnessed a private financing surge, although public transport remains under-funded and largely reliant on public outlays and multi-lateral financing

Led by China and Europe with 85 per cent market share, EVs have powered ahead, quadrupling their passenger car market share to 10 per cent and tripling cars-on-road to 16.5 million during 2018-21. China dominated the EV market with over 3.3 million vehicles sold in 2021, followed by Europe (at 2.3 million) and the US (at 630,000). In 2021, EV sales accounted for 15 per cent and 17 per cent share of all cars sold in China and Europe, respectively. It is estimated that by 2030, EVs will account for close to a third of all vehicle sales. EV adoption in rest of the world has been relatively slow. Nevertheless, vehicle makers are expected to invest over USD515 billion till 2030 to create capacities for EVs.[6] Refer Exhibit 6.

[4] India has achieved its NDC target with total non-fossil based installed energy capacity of 157.32 GW which is 40.1% of the total installed electricity capacity/ Press Release – Ministry of New and Renewable Energy, December 2021/ October 2022

[5] Financing India's Energy Transition Through International Bond Markets/ CEEW, August 2021/ October 2022

[6] Global Electric Vehicles Outlook/ International Energy Agency, May 2022/ October 2022

Exhibit 6: China's electric vehicles ecosystem – factors driving the investment surge

China alone accounts for 95 per cent of new registrations of electric two- and three-wheeler vehicles, and 90 per cent of new electric bus and truck registrations globally. Electric two- and three-wheeler vehicles now account for half of China's sales.

China directed specific incentives and subsidies covering both purchase and lifecycle costs. These include government subsidies, discounts on mandatory traffic liability insurance, tax incentives and exemptions on vehicle registration fees, at the time of vehicle purchase. Post purchase incentives include exemptions from tolls (in specific roads), zero/lower parking charges and vehicle inspection fees, and discounts, subsidies for charging infrastructure. China extended its New Electric Vehicle (NEV) subsidy scheme to the end of 2022 from its previous expiry date of 2020 with a reduction in the base subsidy of 10 per cent, 20 per cent and 30 per cent each year between 2020 and 2022. The differentiated subsidy seeks to get local manufacturers move up the value chain. *In recent years, China's battery range of its EVs has gone up by 50 per cent, and EV sales have risen, despite the reduction in subsidies.*

China holds formidable advantages in battery manufacturing and supply chains. China produces 75 per cent of all lithium-ion batteries, has 70 per cent of cathode production capacity and 85 per cent of anode production capacity. It owns over 50 per cent of lithium, graphite and cobalt processing capacities. *A higher share of smaller electric cars relative to other markets, and competitive costs has narrowed price differential with conventional cars to 10 per cent compared with 45 to 50 per cent in other markets.*

China has the largest EV charging infrastructure network in the world, with over 1.1 million public charging points. As part of its electrification ambitions, China is working to expand its EV charging infrastructure services to cater to 20 million EVs. Special emphasis has been given to building a well-connected and distributed EV charging network, particularly in rural areas and along transport corridors. At present though, over 70 per cent of public charging points are in Guangdong and Shanghai.

Source; Global Electric Vehicles Outlook 2022. International Energy Agency.

The investment surge into EVs has been catalysed by two factors. First, a *strong policy push* through announcements to eliminate internal combustion engine (ICE)-based cars and/or employ stringent pollution norms or CO_2 reduction target which in effect ban ICE cars by requiring zero emissions. Close to 50 countries have announced such Zero Emission Vehicle (ZEV) policies. **Second,** a range of *subsidies and incentives* has been introduced by governments to promote development of EV manufacturing ecosystems and supply chains. Governments provided over USD43 billion between 2013 and 2020 in incentives, including financial (subsidies, tax credits, tax exemption) and non-financial (preferred parking, road access, etc.).[7] While some countries, including China, Korea and the UK are steadily reducing vehicle direct subsidies as price gap between electric and conventional cars reduces, others (including India, Japan and the EU) are opting for higher subsidies. In 2021, government expenditure on electric car subsidies globally doubled. Adoption has also been helped by product launches with over 450 models introduced till 2021.

On the other hand, public transport, with high upfront capital costs and subsidised services, does not lend itself easily to private financing. While electrification of private vehicles has acquired significant momentum (led by Europe and China), investments to decarbonise public transport, both rail and buses, lag globally. For instance, investment in public transport infrastructure in cities globally lags substantially, especially given that the top 100 cities alone need an estimated USD208 billion annually through 2030, as estimated by C40 cities and International Transport Workers' Federation (ITF). Estimates by C40 and ITF suggest that less than 20 per cent of the global bus fleet is electrified. IEA had estimated a requirement of USD770 billion in rail investments through 2050. As against this, CPI 2021 estimates that less than ~USD13.4 billion was spent on low-carbon rail and public transport with financing largely from public sources and multilateral development banks (MDBs).

Indian Railways, one of the largest railway networks in the world, has reiterated its commitment to a Net Zero by 2030 and has completed electrification of close to **81.51 per cent**[8] of its broad-gauge network. Initiatives on the anvil include dedicated freight corridors, and sourcing of renewable energy to meet requirement of up to 30GW by 2030[9].

[7] Global Electric Vehicles Outlook/ International Energy Agency, May 2022/ October 2022
[8] Press Release. Rail Electrification gets a super boost/ Ministry of Railways Government of India, October 2022/ October 2022
[9] Press Release. Indian Railways has adopted an integrated approach for a Green Environment/ Ministry of Railways Government of India, October 2022/ October 2022

Electric city buses have been slow to catch up outside of China, but this may be changing. China accounts for over 98 per cent[10] of electrified bus fleet globally with over 420,000[11] e-buses in operation. China's rapid expansion has been fueled by public subsidies with Shenzhen reportedly receiving aid of ~USD70,000 per EV annually and had a 100 per cent electrified bus fleet of over 16,000 vehicles.[12] However, other regions are catching up. Europe could have nearly a third of its bus fleet converted to zero emission by 2030. India is likely to become a big market for e-buses too, with several large city bus utilities like Bengaluru, Delhi and Mumbai committing to sharp increases in their e-bus fleets.

In January 2022, Convergence Energy Services Limited (CESL), an India-based public sector undertaking, launched a tender worth approx. USD680 million (INR5,500 crore) to purchase 5,450 single decker and 130 double decker electric buses. Under this programme, Kolkata is expected to get 2,000, followed by Delhi and Bengaluru at 1,500 each.

From a financing standpoint, the transport sector therefore, presents a mixed bag. While regulation and subsidies have aided sizable private financing flows into EVs, public transport investments both in rail and buses continue to lag.

Decarbonising industry. Affordable low carbon hydrogen at scale by turn of the decade the next frontier

Low carbon hydrogen is emerging as a compelling choice to tackle the twin imperatives of energy security and carbon abatement. At COP26, over 32 countries came together to accelerate development of low carbon hydrogen and to ensure that affordable, renewable, low carbon hydrogen is globally available by 2030. This has been followed up with policy pronouncements by several countries. Targets to deploy hydrogen technologies are increasing in ambition, particularly to produce low-emission hydrogen. National targets for electrolysis capacities by 2030 have more than doubled from 74 GW globally in 2021 to reach 145-190 GW in 2022. The European Commission's REPowerEU plan targets production of 10 million tonnes (Mt) of renewable hydrogen within member states and to import 10 Mt of renewable hydrogen by 2030. This translates to 65-80 GW of electrolysis capacity in the EU alone, and a similar capacity is envisaged outside EU to fulfil import targets. In the US, the Infrastructure and Jobs Act and the Inflation Reduction Act has significant provisions to support increased investment in hydrogen projects. The IRA contains provisions to implement a clean hydrogen production tax credit of up to USD3 per kilogram, which is expected to give a massive fillip. Capacity creation to translate this intent is visible. Announced electrolyser manufacturing capacities could add to 94 GW by 2030 while the overall electrolyser deployment pipeline, which, if realised, could lead to 134-240 GW capacity by 2030.

Industrial decarbonisation is a logical starting point to incubate low carbon hydrogen at scale. Prioritising early-stage low carbon hydrogen initiatives at the hard-to-abate industrial sectors, including oil & gas, steel, cement and chemicals, account for an estimated fifth of all CO2 emissions globally (and higher in industrial/ manufacturing economies); it can possibly help tackle bankability and emission impact objectives. Existing global hydrogen demand (not counting potentially new applications) was 94 million tonnes (MT) in 2021[13]. The top four countries had a 60 per cent share; China had a 30 per cent market share, followed by the US with 13 per cent, and Europe and India with 8 per cent share each.[14] However, at this point, there is a price competitiveness challenge; depending on location, type of renewable alternative, price differential between conventional/ unabated, low-emission hydrogen can be anywhere upwards of USD3 – 8 per kg. With economies of scale, the expectation is that cost parity may be achieved by the turn of this decade.

[10] Electric Bus, main fleets and projects around the world/ Sustainable – Bus.com/ October 2022
[11] E-Bus Market is Speeding Up/ IAA Transportation/ October 2022
[12] E-Bus Market is Speeding Up/ IAA Transportation/ October 2022
[13] Global Hydrogen Review – 2022/ International Energy Agency (IEA), 2022/ October 2022
[14] Global Hydrogen Review – 2021/ International Energy Agency (IEA), 2021/ October 2022

Nevertheless, financing low carbon hydrogen programmes at scale can be tricky. Strong policy commitment, offtake certainty, clarity on viability gap treatment and grasp of value chain linkages will all be crucial. A rollout of low carbon hydrogen programme calls for dealing with multiple moving parts concurrently, and taking a comprehensive value chain perspective, one that considers an array of factors, including technology risks, demand aggregation and clustering, storage and transportation infrastructure planning, and linkages with renewable capacities. Programmes will also need to have mechanisms to deal with price differentials and viability gaps to incentivise and secure offtake commitments, which will be a key pre-requisite for bankability. Overall, proactive policy, clustered capacity creation with offtake commitments in decarbonising sectors, R&D incentivisation and innovative structuring will be central to drive scale and commercial viability. Refer Exhibit 7 for policy measures announced by select countries.

Exhibit 7: Policy measures to mitigate low carbon hydrogen project risks

Country	Grants	Tax incentives	Loan guarantees	Contract for differences
Australia	✓			
Canada	✓	✓		
Chile	✓			
EU	✓			✓
Germany	✓	✓		✓
UK	✓			✓
US	✓	✓	✓	

Source: Global Hydrogen Review 2022. IEA.

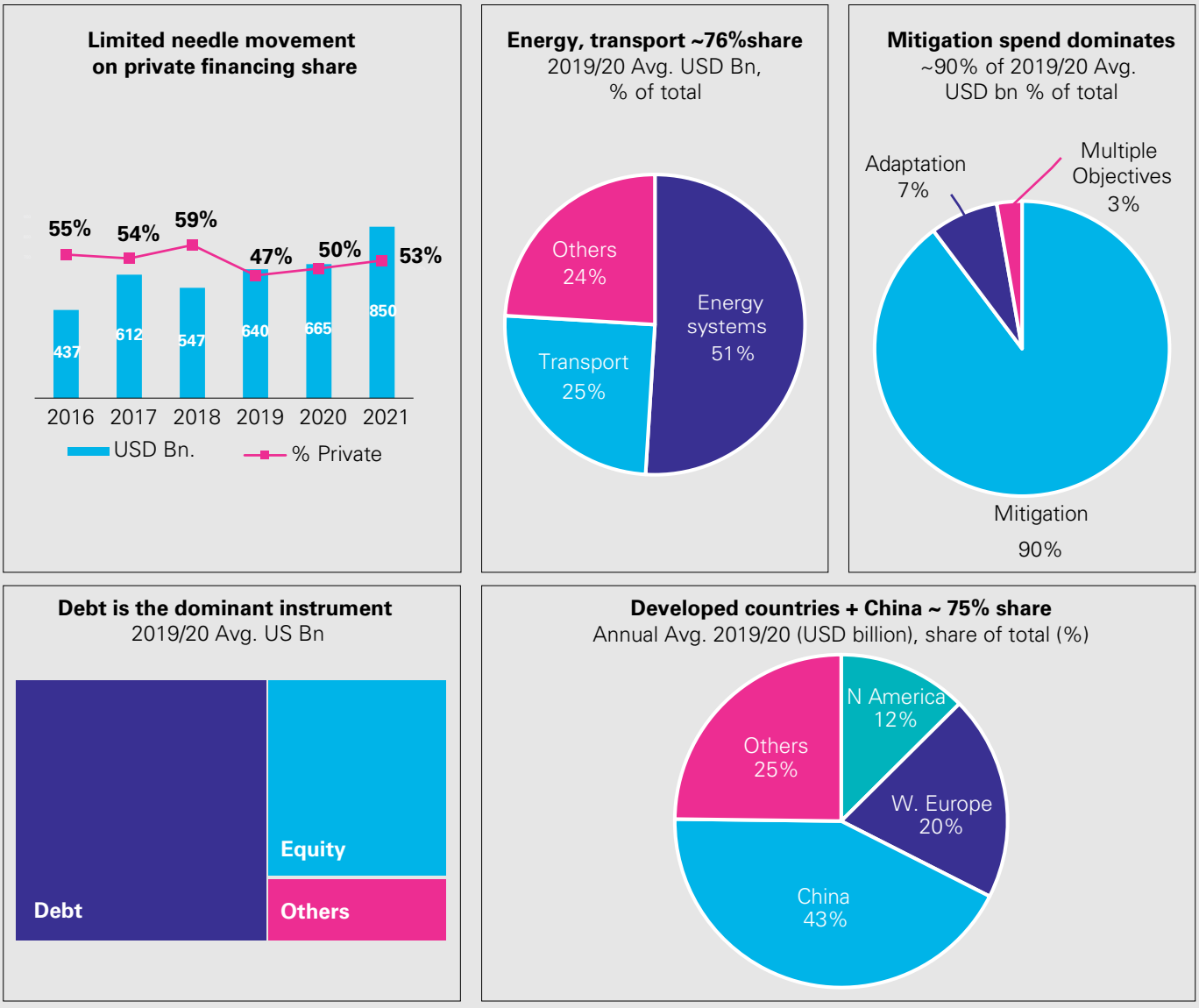
Signaling initiatives from the private sector are taking shape.

1. Japan's largest electricity generator, JERA, invited a competitive tender for supply of low-emission ammonia for Japan's largest coal-fired power plant from 2027,
2. Four automakers in the First Movers Coalition have pledged to source 10 per cent of steel from low-emission sources by 2030,
3. 18 companies have signed non-binding agreements to buy 1.5 Mt of steel produced with low emission hydrogen from 2025,
4. Maersk ordered 12 methanol-powered vessels, signed partnerships for 0.7 Mt of low-emission methanol procurement in 2025.

Supply of finance - Clouds remain, silver linings visible

Climate finance supply flows are concentrated in select sectors, limited to very few geographies and are over-reliant on limited sources and instruments.

Exhibit 8: Facets of climate finance supply



Source: CPI 2021, CBI 2022, Secondary research, KPMG analysis

Exhibit 8: Facets of climate finance supply continued...

Sectors. Energy & Transport garnered nearly 76 per cent of financing flows. Around 49 per cent of all financing flows went into renewables. Within transport, over half of the investments went into EVs and charging infrastructure. Adaptation had a paltry 8 per cent share.[15]

Spatial Dispersion. Over 75 per cent of climate finance supply was garnered by North America, Western Europe and China. The US, Germany, China, France and the UK had more than a 50 per cent share of the USD 500 billion of green bond issuances in 2021, further reflecting the concentration of climate finance flows by geography. Also, domestic supply accounted for over three-fourths of all financing. Financing from OECD to non-OECD countries was around 12 per cent of all supply.[16]

Financing Sources. Public and private sources had an equal share in 2020. Among public sources, Development Finance Institutions (DFIs), including MDBs, had a ~71 per cent share. Government budgets had a ~10 per cent share, and the rest was from other state-owned agencies. In 2020, MDBs committed USD75 billion in climate finance.[17]

Instruments. Debt dominates. Debt accounted for 63 per cent of financing supply, with equity (32 per cent) and grants (5 per cent) making up the rest in 2020. Green bonds crossed USD500 billion of issuances in 2021, although issuances in H1 2022 fell by 21 per cent to USD218 billion.[18]

Deepening of climate finance sources and instruments, and broad basing of financing flows is critical. Take geographic dispersion for instance. EMDEs (other than China) contribute ~40 per cent of emissions but secured approximately a fifth of climate finance flows. IEA observes that EMDEs, under an as-is scenario, could add 5 gigatons in incremental emissions in the next two decades.[19] By some estimates[20], annual climate finance flows in EMDEs will need to quadruple by 2030 to make meaningful progress towards NZE. Achieving this increase without adversely impacting EMDEs' overall credit profile will require:

i. structural reforms around policy, institutions and financial markets, and

ii. the developed world making good on the promised but yet-to-be delivered financial support. Actions to unlock private financing and deepen financial markets to tap a wider array of investors with innovative instruments too become critical for wholesome emission reduction impact.

At the same time, there is discernible dynamism in the climate financing ecosystem. An array of financing instruments opens possibilities, and new investor classes are making their presence felt.

Labeled Bonds. Labelled bonds (also referred to as impact bonds) have specific environmental, social or governance (ESG) or sustainability objectives and fall in the following categories. Overall, labeled debt issuance grew sharply in recent years, crossing USD1 trillion in 2021. Cumulative issuances stood at USD3.3 trillion as of H1 2022.[21]

[15] Global landscape of climate finance – a Decade of Data 2011-2020/ Climate Policy Initiative, 2022/ October 2022
[16] Global landscape of climate finance – a Decade of Data 2011-2020/ Climate Policy Initiative, 2022/ October 2022
[17] Global landscape of climate finance – a Decade of Data 2011-2020/ Climate Policy Initiative, 2022/ October 2022
[18] Global landscape of climate finance – a Decade of Data 2011-2020/ Climate Policy Initiative, 2022/ October 2022
[19] Financing Clean Energy Transitions in Emerging and Developing Economies/ International Energy Agency (IEA), 2021/ October 2022
[20] Achieving Climate and Development Goals: The Financing Question/ World Bank, October 2022/ October 2022
[21] Green Bond Pricing in the Primary Market H1 2022/ Green Bonds Initiative, 2022/ October 2022

Exhibit 9: Labeled sustainable bonds – as of 2021

Characteristics	Green	Social	Sustainability	SLB	Transition
Cum. issuances	USD 1.6 trillion	USD 520.5 billion	USD 538.8 billion	USD 135.0 billion	USD 9.6 billion
Issuance 2021 (YoY%)	USD 522 billion (75%)	USD 220 billion (18%)	USD 192.9 billion (19%)	USD 91.4 billion (10.7x)	USD 4.4 billion (33%)
Issuers Nos.	2,045	425	861	225	15
Instruments Nos.	9,886	2,323	3,471	317	32
Countries Nos.	80	51	44	37	12
Currency Nos.	47	38	33	16	7

Green bonds:

Transition to low-carbon economy

- Developed markets' share: 73% | Europe: 50%
- US (USD 304 bn.), China (USD 199 bn.) led cum. issuances
- 81% of issuances in 2021 in USD, EUR, RMB currency
- 63% of issuances had 10-year tenor

Social bonds:

Affordable housing, financing access etc.

- Surged post COVID-19 pandemic
- Grew in all regions in 2021
- France top issuer followed by Supranationals, the US, Korea, Chile
- 89% of issuances 2021 in USD and EUR

Sustainability bonds:

Combination of green and social goals

- Supranational issuers share: 35 per cent | World Bank: 25%
- Top four issuers by country: the US, S. Korea, France and the UK
- Over 75% issuances in 2021 in USD, EUR currency

Sustainability-linked bonds:

Coupon linked to sustainability KPIs.

- Italy, France and China largest issuers
- Over 75% issuances in 2021 in USD, EUR currency

Transition bonds:

Combination of green and social goals

- Smallest category 13 issuances by 10 issuers in 2021
- EBRD and Inter-American Bank had a 19.9% share

Source: Climate Bonds Initiative

Green bonds are getting broad-based with over 50 EMDEs making issuances till 2021. Green bond issuances have grown sharply past USD1.6 trillion of cumulative issuances and annual issuances crossing USD500 billion in 2021. Although there has been a 27 per cent reduction in green bond issuances in H1 2022 (labeled bond issuances are estimated to decline 16 per cent in 2022 to USD865 billion), medium- to long-term outlook for labeled issuances is positive. EMDEs saw a 58 per cent growth ex-China to cross USD95 billion of green bond issuances in 2021. Other labeled issuances by EMDEs topped USD64 billion as well. Over 50 EMDEs issued green bonds till 2021. In recent years, India's renewable developers refinance their high-cost debt with proceeds from green bonds, with some reporting having achieved a reduction in costs by over 150 basis points.

Greenium or pricing benefits from green bonds

A review of 56 Euro and 19 US dollar denominated benchmark sized green bonds with a total value of USD75.9 billion issued between January and June 2021 by Climate Bonds initiative observed that

(i) On average, green bonds are still attracting more interest from investors than non-green bonds, while also exhibiting larger spread compression during the book building process,

(ii) US dollar-denominated green bonds showed particularly strong pricing outcomes, with average oversubscription for this category at 4.7x for green bonds and 2.5x for vanilla equivalents, while spread compression averaged 29.9 basis points for green bonds and 24.8 bps for vanilla bonds. Corresponding average oversubscription for Euro-denominated green bonds was 2.9x, and for vanilla equivalents 2.6x, while spread compression averaged 20.4 bps for green bonds and 19.6 bps for vanilla bonds. Research by ING quoted by S&P Global found savings on green issuance for borrowers between 1 bps and 10 bps on a global basis. India's Reserve Bank of India too notes that pricing differential shows up significantly in USD-denominated green bonds with tenures over 10 years.

Sources: Green bond 'greenium' is evident globally, especially strong for US dollar debt. S&P Global Market Intelligence; Green Finance in India: Progress and challenges. RBI Bulletin January 2021. Reserve Bank of India

Sovereign Climate Bonds are seeing a pick-up in momentum; India expected to enter the fray. In 2021, Sovereign climate bond issuances grew 103 per cent in 2021 with cumulative issuances reported at USD193 billion vis-à-vis the USD95.2 billion raised in 2020[22]. As of mid-2022, over 25 countries have raised USD227 billion of sovereign green bonds.[23] An IMF report points out that although green and catastrophe bonds have gained popularity, they remain nascent. Sovereign green bonds made up just 0.2 percent of all government debt securities in OECD countries. In EMDEs, sovereign green bond issuances account for 12 percent of total green bond issuances (OECD 2021). The sovereign labeled bonds market is likely to expand as more countries enter the fray and existing issuers move from one-off issuances to make sovereign labeled bonds an integral element of their climate resource mobilisation strategy. Apart from resources mobilisation, these issuances could, particularly in EMDEs, engender institutional strengthening and financial sector reforms. The Government of India recently outlined its framework for issuance of sovereign green bonds which spells out its approach to use of proceeds, project evaluation and selection, management of proceeds and reporting. India expects to raise INR16,000 crore (~USD195 billion) during the financial year ending 2023.[24]

Equity. Equity accounted for roughly a third of all financing flows into climate finance and averaged an estimated ~ USD156 billion in 2019/20. While corporates and renewable developers have been the largest class of investors investing in equity in the past, this is changing with **non-energy corporates, institutional investors, private equity and venture capital funds joining in the effort.**

- **Institutional investors:** Investment by institutional investors in 2021 was estimated at USD1.2 billion. A recent study (IRENA, Institutional Capital, 2021) estimates that a fifth of institutional investors (including sovereign wealth funds, insurance & pension firms, philanthropic foundations and endowments, with ~USD87 trillion worth assets under management) had invested in renewable focused funds, although only 1 per cent had made investments directly into cleantech projects. India's renewable energy sector, for instance, has attracted investments from several PE firms and sovereign wealth funds.Institutional investors typically favour operational projects or platforms and their participation often facilitates deepening of financing ecosystem by allowing developers with higher risk appetite to monetise and recycle capital.

[22] Sustainable Debt: Global State of the Market 2021/ Climate Bonds Initiative/ October 2022
[23] Sovereign Green Bonds: What lessons can India draw from other nations/ Business- Standard, October 2022/ October 2022
[24] Govt in debut Green Bonds plans to raise Rs 16,000 crore/ Livemint, September 2022/ October 2022

- **Venture investments in low carbon hydrogen:** Since 2021, venture capital investments in hydrogen and allied areas have seen a surge and accounted for 10 per cent of all early-stage deals in clean energy start-ups. Early-stage deals in hydrogen was up five-fold in 2021 and reached over USD700 million, and this trend continues into 2022. Similarly, later-stage equity investments were upwards of USD3.6 billion, with much of it in the US and Europe.
- **Blended finance, impact investment and philanthropic capital:** Many areas within climate finance will not provide sufficient returns to attract conventional equity and debt. These projects and programmes will need to be financed innovatively through newer structures and approaches, including blended finance structures to bring together impact investors, philanthropic capital, development finance and public spending. Nevertheless, the scale of such financing is small in relation to the overall climate finance flows. Programmes financed with blended finance structures were estimated[25] at USD14 billion during 2019 – 2021, while annual global philanthropic flows into climate change are estimated at ~USD5 billion and USD9 billion annually.[26]

Transition finance. Transition finance seeks to address the needs to support to high carbon-emitters including coal generation, steel, cement, and chemicals, in financing the transition to decarbonisation. Concerns about greenwashing and efficacy of evolving technologies present barriers to secure financing. Such financing will need to be backed with credible taxonomies, financing instruments and mechanisms to mitigate social impacts. Transition financing is increasingly acquiring momentum and a scale-up of the same will be crucial to facilitate the move towards net zero.

Illustrative transition finance funds and mechanisms

Europe – Just Transition Fund: The European Commission proposed to form a Just Transition Mechanism to achieve climate neutrality in the EU effectively and fairly. The mechanism consists of three pillars: (i) the Just Transition Fund, (ii) a dedicated scheme under the InvestEU programme, and (iii) a public sector loan facility provided by European Investment Bank to mobilise additional investments in the regions concerned.

- The Just Transition Fund, which primarily provides grants, is a new financial instrument of the EU with a budget of EUR17.5 billion for 2021-2027. It aims to provide support to territories facing serious socio-economic challenges arising from the transition towards climate neutrality due to their dependence on fossil fuels (including coal, peat and oil shale) and on GHG-intensive industrial processes. The fund will facilitate the implementation of the European Green Deal, which aims to make the EU climate-neutral by 2050.[27]

Asian Development Bank's Energy Transition Mechanism: The Asian Development Bank, the Governments of Indonesia, and the Philippines have launched a partnership to design and establish an Energy Transition Mechanism (ETM) to pilot transition from coal to clean energy in Southeast Asia, in a just and affordable manner. This pilot will seek to retire or repurpose 5 to 7 coal-fired power plants in the pilot countries in the near term. Repurposed plants will be converted to renewable energy generation or alternative uses. Once it is scaled up, ETM has the potential to be the largest carbon reduction model in the world. /

- For example, retiring 50 per cent of coal power plants over the next 10–15 years in Indonesia, the Philippines, and Vietnam could cut 200 million tons of CO2 emissions per year, the equivalent of taking 61 million cars off the road[28].

[25] Grants for Climate Change/Inside Philanthropy/ October 2022
[26] Global Hydrogen Review 2022/ International Energy Agency (IEA), 2022/ October 2022
[27] The Just Transition Mechanism: making sure no one is left behind/ European Commission/ October 2022
[28] Smoothing a Green and Just Energy Transition in the Asia and the Pacific/ ADB, September 2022/ October 2022

Carbon markets and pricing. Conceptually, carbon pricing involves placing a price on emissions, thereby creating a financial incentive to accelerate emission reduction. By bringing the externality of emissions into commercial decision making, carbon pricing can potentially help create monetisable resources that can be securitised to drive climate friendly investment. **Direct carbon pricing** involves applying a price incentive directly proportional to emissions generated, primarily through a carbon tax or an emissions trading system (ETS) and seeks to ensure consistent cost-effective abatement incentive. **Indirect carbon pricing** refers to instruments that change price of products associated with carbon emissions and include fuel and commodity taxes, and fuel subsidies affecting energy consumers.

The World Bank notes that as of 2021, 68 carbon pricing instruments (CPIs), including taxes and ETSs, were operational and three more were scheduled for implementation. However, these mechanisms cover only ~23 per cent of emissions.

Annual voluntary carbon market value exceeded USD1 billion in 2021 for the first time, driven by corporate commitments. While carbon prices have recently been on an upswing in many markets, including Europe, California, S. Korea and New Zealand, they fall well short of levels needed to meet the Paris climate goals. And while a variety of policy options are available, delivering a greater impact calls for political commitment globally to broaden the scope of emissions covered, price levels and expand the availability of abatement opportunities.

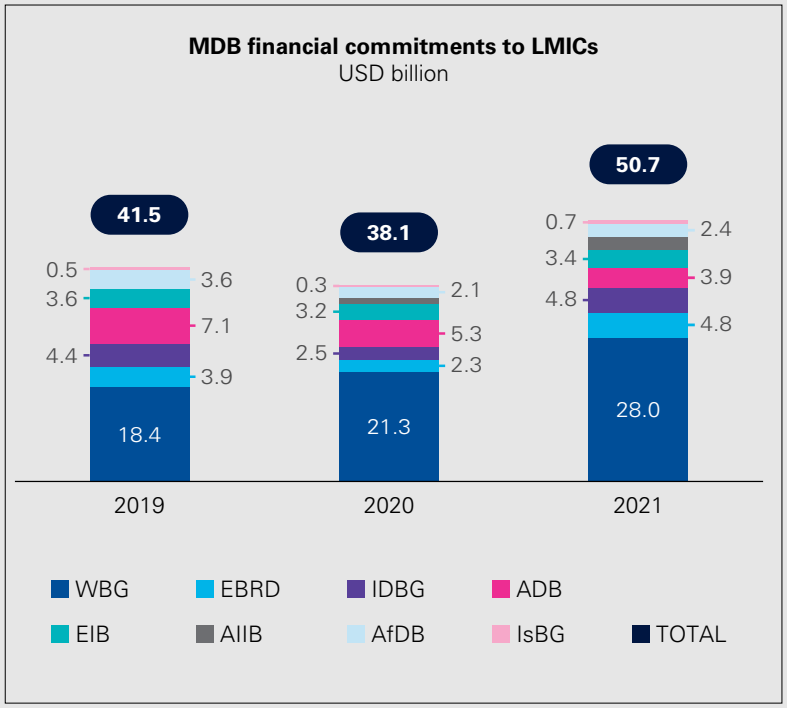
The opportunity cost of fossil fuel subsidies.

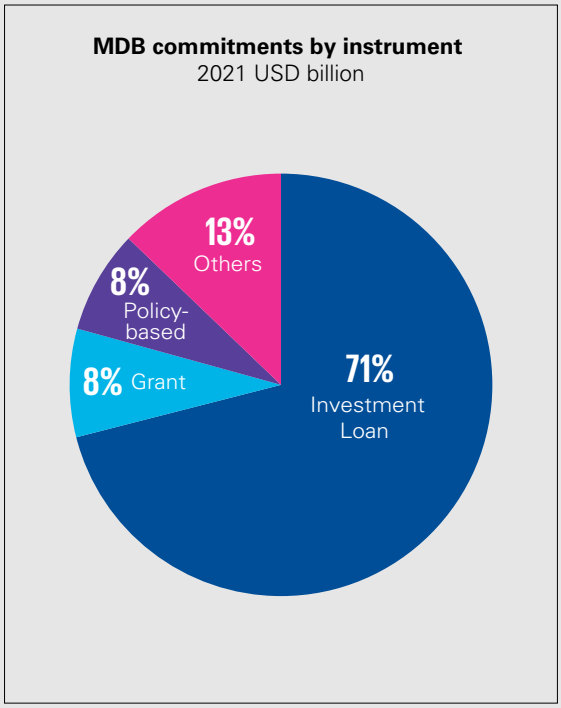
The IMF estimates global fossil fuel subsidies at USD5.9 trillion or 6.8 percent of GDP in 2020 and projects this to increase to 7.4 per cent of GDP in 2025 as the share of fuel consumption in EMDEs (with higher price gaps) increases. While 8 per cent of 2020 subsidy estimate reflects undercharging for supply costs (explicit), 92 per cent is undercharging for environmental costs and foregone consumption taxes (implicit). Even explicit fuel subsidies are expected to have ballooned to USD700 billion in 2021 after a drop in 2020 and are continuing to rise. The Ukraine war and recent rise in energy costs are only making the critical task of dealing with global fuel subsidies harder. The intractable and spiraling fossil fuel subsidy is at odds with the challenge of finding resources to finance the Net Zero imperative.

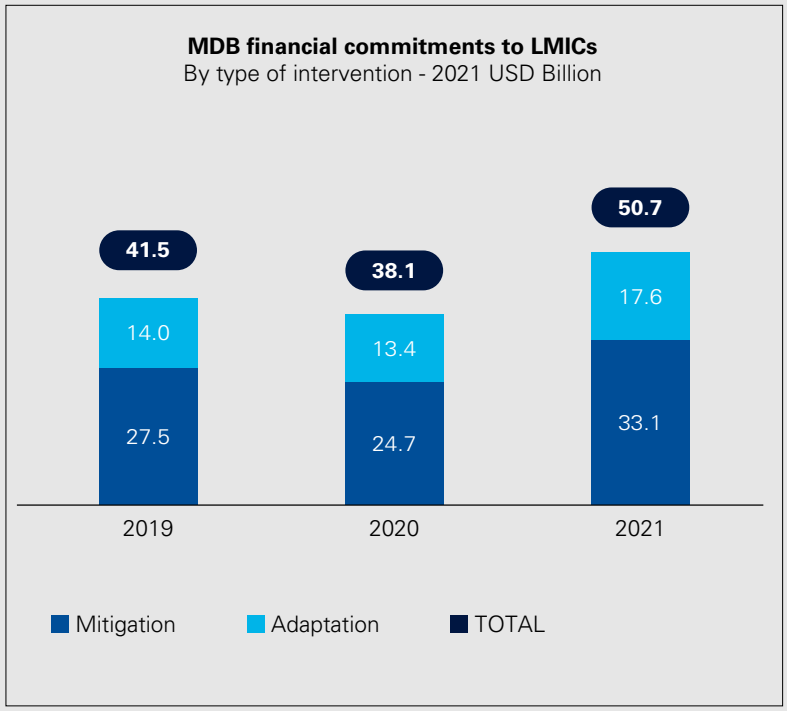
Development finance and role of MDBs. Given the challenges in scaling climate finance, MDBs have a very important role to play, especially in EMDEs. In 2021, total financial commitment made by MDBs was ~USD82 billion, of which ~USD51 billion was towards low- and middle- income countries (LMICs). Within the commitment made for LMICs, 65 per cent went towards mitigation and the rest towards adaptation. About a fourth of the commitment or ~USD10 billion was to private recipients. This was supported by co-financing of USD44 billion, 70 per cent of which came from public sources and the rest from private sources. By instrument, investment loans had a 71 per cent share of all financing to LMICs, followed by grants (9 per cent share) and policy-based financing (8 per cent share).[29]

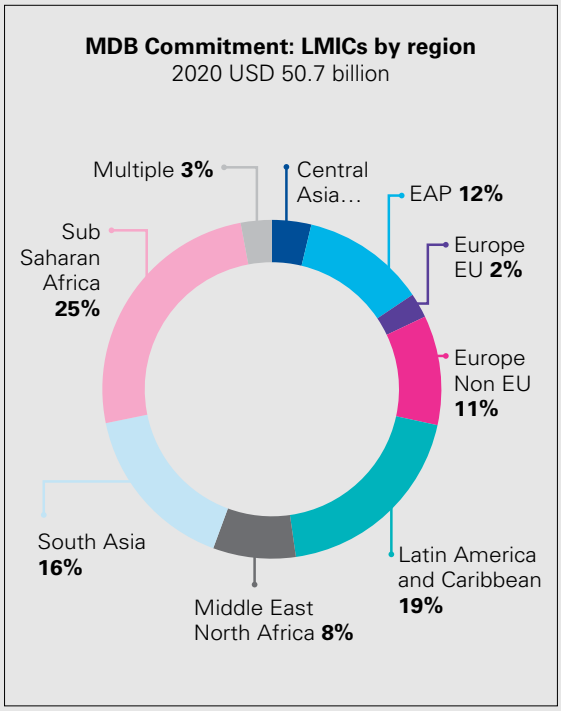
[29] 2021 MDB's Joints Report on Climate Finance/ MDB's, October 2022/ October 2022

Exhibit 10 Trends in MDB financing to low- and middle-income countries[30]









Source: Climate Finance. 2021 Joint Report of MDBs. October 2022

[30] Climate Finance. 2021 Joint Report of MDBs/ MDB's, 2021/ October 2022

Barriers to scale climate finance flows

Summing up, a scale-up of climate finance is constrained by both demand- and supply-side factors. These can be broadly traced to the following:

First, a diversity in financing needs, coupled with limited pipeline of bankable opportunities, limits a scale-up of conventional financing. From a demand standpoint, the climate agenda, barring a few segments, is not amenable to market-based commercial financing yet. Barring sectors like renewables, pathways and technologies for several high emission hard-to-abate sectors continue to evolve and present elevated risks for conventional financing to be scaled up meaningfully.

Second, policy inadequacies, fiscal limitations, institutional & regulatory weaknesses, and shallow financial markets, especially in EMDEs, stymie access to capital. These upstream challenges compound problem of affordability (EMDEs ex-China have nearly 40 per cent of share of emissions but limited internal resources) and often hinder programmatic response. At aggregate, EMDEs continue to face constraints in translating Net Zero intent, even where committed, into enabling policy, coherent long-term climate strategies and effective programmes to drive implementation.

Third, the socio-political challenges in phasing out regressive subsidies and in creating broad-based carbon pricing frameworks add to the resource crunch. Explicit subsidies around fossil fuels, agriculture and fisheries globally add to nearly USD1.3 trillion annually (including ~USD300 billion for fossil fuels and ~USD635 billion for agriculture).[31] IMF estimated global fossil fuel subsidies at 6.8 per cent of GDP in 2020 and projected this to climb to 7.4 percent of GDP by 2025 with increase in fuel consumption in EMDEs. This level of subsidies is clearly unsustainable. Coverage of carbon markets remains narrow and carbon pricing (even where they are functional) is inadequate for incentivising financing flows into low-carbon transition.

Fourth, information architecture to support climate action, including information, disclosures and taxonomies, remain work-in-progress and evolving. Mechanisms to capture, aggregate, report information around climate trends, emissions and impact of actions undertaken, and related variables needs improvement by an order of magnitude. Even though frameworks for disclosure and ESG taxonomies are improving in several regions, they continue to be constrained by weak standards, audits and mandatory disclosure requirements. COP 26 saw the establishment of the International Sustainability Standards Board (ISSB) to develop a baseline of sustainability disclosures for capital markets. The ISSB has launched general sustainability-related and climate-related disclosure requirements. A rapid adoption of harmonised standards, especially in the EMDEs will be important.

Fifth, cross-border flows from developed economies into EMDEs remain inadequate. Despite a reiteration of commitment by different countries, the promise of USD100 billion of climate finance flows to the developing world remains unfulfilled. Climate finance from developed countries reached only USD83.3 billion in 2021, and even this figure is contested by developing countries in terms of not being 'additional'. Even as the USD100 billion is well below the levels of international support needed, missing to even reach there makes the task doubly difficult for the developing world. And while other forms of support hold promise, little is getting translated into actual flows. For instance, although annual philanthropic spending increased in 2019, only less than 2 per cent (or USD6 billion to USD10 billion) went into climate change mitigation agenda.[32]

Finally, near-term headwinds, including inflation, currency volatility, debt overhang and rising interest rates are adversely impacting resourcing and elevating risk profiles of EMDEs. The twin shocks of the COVID-19 pandemic and the ensuing Ukraine crisis have left EMDEs reeling under pressure and exacerbated their vulnerabilities. The public debt overhang restricts a meaningful scale-up of public financing which is so vital to crowd-in private financing. At the same time, inflationary pressures and rising interest rates increase investment risks and dent cost competitiveness, even in segments like renewables which had seen a surge in cross-border FDI and green bond flows. These near-term challenges, if not tackled and resolved expeditiously, could have adverse ramifications and knock-on effects on the medium-term climate financing trajectory.

[31] Achieving Climate and Development Goals: The Financing Question, 2022/ IMF and World Bank, 2022/ October 2022

[32] Top Climate Change Funders/ Inside Philanthropy/ October 2022

Transformation pivots

Bridging the climate financing gap is among the pressing development imperatives of this decade. Tackling this will call for action on five pivots.

PIVOT 1 **Sharper prioritisation and configuring differentiated financing pathways.** Given the diversity of the climate agenda and financing limitations, a sharper prioritisation based on the impact potential and distance to commercial viability will be crucial to configure appropriate and differentiated financing pathways.

Renewables are tuned for a sharp scale-up of private investment. On the other hand, low carbon hydrogen, electric vehicles and storage will require policy thrust, incentives, viability support and risk sharing mechanisms to usher in private capital. R&D spending needs to be incentivised as well. By some estimates[33], a third of emission reduction targets for 2050 are contingent on technologies in prototype or demonstration stages. With over USD200 billion invested in climate-related technology firms between 2013 and 2021, venture capital flows have been promising, but still short. Adaptation will require higher levels of public spending and blended finance flows. Varied resourcing pathways are needed to deal with the heterogeneity of financing demand. Categorising high-impact initiatives based on their financing readiness could enable better matching of financing demand-supply and in configuring appropriate financing pathways in terms of sources, instruments, scale and timing. Refer Exhibit 11 for a high-level generic illustration of this point.

Exhibit 11 : A possible segmentation to configure differentiated financing pathways

Mature technology – Developer ecosystem – Largely bankable, reaching commercial viability

Renewables: Renewable energy programmes are amenable to commercial private financing. There is a wealth of experience globally on the know-how around conceptualising and delivering renewable energy programmes at scale. Critical ingredients to spawn financing flows include stable energy policy, institutional & regulatory strengthening (credit worthy discoms, committed offtake, cost reflective tariff), and building technical foundations (including grid stability, hybrids and storage to deal with intermittency).

Source and instruments: Private (developers, institutional investors). Mature financing ecosystem in place with equity, debt & green bonds and mezzanine structures.

Electric vehicles: Despite their relative infancy, EVs especially light passenger vehicles meet pre-requisite conditions for private financing. True, viability gaps and supply chain challenges (resources for batteries and charging infrastructure) remain, but there is evidence especially from China and Europe that pro-active regulation, together with incentives and private sector ingenuity, can spur productivity spike, scale economies and commercial viability.

Source and instruments: Predominantly private (developers, institutional investors) with subsidies / incentives to tackle early-stage viability gaps. Incentives to boost technology and R&D spending will also be crucial.

[33] Energy Technology Perspectives 2020/ International Energy Agency (IEA), 2020/ October 2022

Exhibit 11: A possible segmentation to configure differentiated financing pathways (Contd...)

Evolving technology, value chain – Potentially bankable but elevated risks, viability gaps at present

Low carbon hydrogen, industrial decarbonisation, CCUS: These segments will require proactive, and in some cases interventionist policy, including through imposing mandatory regulations to spur anchor users/target industries into action, sizable dedicated public financing through viability gap grants, tax breaks and investment incentives to support R&D and rapid build-out of capacities to drive economies of scale, wider adoption and non-linear reduction in costs.

Source and instruments: Collaborative (public, private, venture funding, impact investment, philanthropic capital) will call for diverse instruments. Early stage – grants and funding for early-stage R&D, tax break, incentives and benefits for start-ups, venture financing / high risk capital flows. Scaling mature technologies will require effective structuring, including demand aggregation and offtake commitments, complemented with strong public financing / MDB financing in the form of concessional loans, viability gap support, guarantees / credit enhancements, and pricing, securing and monetising future carbon benefits.

Mature technology but poor revenue models and bankability

Public transport and adaptation measures: These segments will need a large step-up in tax-funded public financing, including through better designed and functioning carbon markets. These markets may not be amenable for large-scale private financing. Strong public institutions and ring-fenced budgetary outlays will be crucial.

Source and instruments: Largely public finance and multi-lateral financing. Ring-fencing taxes, securing, monetising carbon benefits.

PIVOT 2 **Translating government intent to policy clarity, institutional readiness and threshold level of public finance:** Governments have a very central role to play in crowding-in financing into climate agenda. Critical items on the agenda include

1. Well-conceived programmes to translate Net-Zero intent to deliver visible impact at scale
2. Nurturing capable, well-funded public institutions that can conceptualise and deliver programmes at scale, to translate policy intent into action, will be particularly critical
3. Clear trajectory for phase-out of regressive inefficient subsidies
4. Climate-centric reporting and disclosures, and
5. Clear public financing strategy, including tapping sovereign green bond route and MDB financing.

Governments need to commit a sizable increase in budgetary outlays from the current levels, including earmarking a certain minimum threshold with a portion of that dedicated to adaptation measures. Despite a public debt overhang, finding adequate public outlays will be critical in view of evolving nature of technologies, sub-scale capacities and higher credit risk profile of climate risk investments in relative terms. This is also crucial to crowd-in private financing at scale.

PIVOT 3 **Structural reforms to deepen financial markets.** Sustained efforts to deepen financial markets while concurrently strengthening risk management mechanisms will be crucial. The proliferation of an array of financing instruments including green bonds, sustainability-linked structures, and risk sharing / credit enhancement facilities holds promise and needs policy facilitation for wider adoption. An expanding investor base that includes pension and insurance funds, private equity and sovereign wealth funds, philanthropic capital and impact investors, offers cause for cautious optimism as well. The imperative to scale cost-competitive capital flows will need to be balanced with putting in place effective risk management mechanisms. Governments and regulators will be challenged to stay ahead of the curve.

PIVOT 4 **Functioning carbon markets and harmonised ESG taxonomy and disclosures.** A wider coverage of well-designed carbon market instruments

is essential to create, monetise emission reductions that can be securitised to raise financing for climate initiatives. The implicit and explicit cost of global fossil fuel subsidies contradicts the challenges in tapping climate finance and needs to be dealt with squarely and expeditiously. Concomitantly, reporting and disclosures centered around clear ESG frameworks will help build higher order assurance among investors and stakeholders.

PIVOT 5 **Co-opting EMDEs into climate agenda. EMDEs account for two-thirds of emissions but receive a tiny fraction of climate finance flows.** They will require not only sizable financial commitments, but technology transfers, transition financing and hand-holding support to strengthen policy and institutional enablers. Developed countries need to translate their commitments into tangible actions on the above fronts. Multilateral agencies need to play a catalytical role in co-creating programmes, helping governments build capacity to deliver emission reduction programmes at scale and tailor innovative financing instruments to multiply private financing.

Abbreviations

C40: Cities Leadership Group

CAGR: Compounded Annual Growth Rate

CESL: Convergence Energy Services Limited

CO2: Carbon Dioxide

COP: Conference of the Parties

CPI: Carbon Pricing Instruments

CPI: Climate Policy Initiative

EBRD: European Bank for Reconstruction and Development

EMDE: Emerging Markets and Developing Economies

ETM: Energy Transition Mechanism

ETS: Emissions Trading System

ESG: Environmental, Social and Governance

EU: European Union

EV: Electric Vehicle

FDI: Foreign Direct Investment

GDP: Gross Domestic Product

GFANZ: Glasgow Financial Alliance for Net Zero

GHG: Greenhouse Gases

GW: Giga Watt

IEA: International Energy Agency

IMF: International Monetary Fund

IRA: Inflation Reduction Act

IRENA: International Renewable Energy Agency

ITF: International Transport Workers' Federation

JERA: Japanese Energy for a New Era

JSW: Jindal SouthWest

LMIC: Low- and Middle-Income Countries

M&A: Mergers and Acquisitions

MDB: Multilateral Development Banks

MNC: Multinational Corporation

MT: Million Tonnes

NEV: New Electric Vehicle

OECD: Organisation for Economic Co-operation and Development

PE: Private Equity

R&D: Research and Development

REC: Rural Electrification Corporation

SECI: Solar Energy Corporation of India

SCF: Standing Committee on Finance

UNFCCC: United Nations Framework Convention on Climate Change

UK: United Kingdom

US: United States

USD: United States Dollar

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Acknowledgments

Anand Madhavan
Anish De
Anvesha Thakker
Mridul Grover
Shubham Raizada
Versha Chauhan
Vikas Gaba
Vishal Sridhar

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