12th India - U.S. Track II Dialogue on Climate Change and Energy
April 17-19, 2023 | Washington, D.C.

Meeting Summary

On April 17-19, members from the U.S. and Indian Delegations of the Track II Dialogue on Climate Change and Clean Energy met in person in Washington D.C. for the 12th meeting of the Dialogue. This year, the Track II Dialogue engaged on key issues related to India's and the U.S.'s bilateral climate and energy relationship, including how the two countries can yield significant benefits on the topics of climate finance, hydrogen, climate-resilient solutions, supply chains and critical minerals, and cooling.

The Track II Dialogue, co-convened by the Aspen Institute Energy and Environment Program and Aspen Ananta Center has for the last 12 years provided a necessary medium for non-partisan, independent, and open discussion among distinguished representatives from academia, research institutions, civil society, and industry. The U.S. and Indian delegations sit in a uniquely impactful position in their capacity to feed recommendations into Track I, inform policy decisions, and influence the private sector. The following summary offers a high-level, not attributed review of the discussions held across the three days.

Over the course of three days, the delegation also heard from several high-level government officials. Speakers and delegates repeatedly referred to this as the decisive decade, and there was a sense of hope that through India's G20 leadership and its government's increased emphasis on hydrogen, for instance, as well as the new ambassador to India, Eric Garcetti, the implementation of historic U.S. climate legislation, and significantly more, there is a huge opportunity for the U.S. and India to jointly advance climate action.

Summary of U.S. State of Play

From the U.S. state of play session, there was a sense of real positivity that domestically, the U.S. has finally positioned itself to reach net zero and has defined a clear and plausible way to get there. Internationally, however, the U.S. still has a long way to go in terms of its policy, as it relates to climate finance and finding solutions to help developing countries avoid major growth in their emissions. The U.S. commitment to helping developing countries navigate this transition is still missing, leaving countries experiencing significant debt burdens with the unrealistic task of also investing in new economic paradigms for green growth without the necessary support.

On the U.S obligation to developing countries, it was also suggested that while U.S. leaders have been vocal about reminding those countries that they will benefit from technologies, there is more to be done

in terms of engaging with peers in those countries and supporting them to build capacity as technology takers and developers and participate more fully in the transition.

U.S. emissions peaked in 2007, and have since bumpily, but steadily declined, while India has now surpassed the EU and its emissions continue to be on an upward trajectory. As these emissions will likely stabilize and plateau, the U.S. still tops the world with per capita emissions (17.7t vs 2.4t in India). The impacts of climate-induced disasters have also increased in the U.S. with three hurricanes in 2022, with damages exceeding a billion dollars, massive heatwaves, and wildfires. India has also experienced record heat in the past month, alone, with the estimated impacts from climate-induced disasters coming to $200 billion over the last decade.

The big policy focus in the U.S. has now turned toward implementation, with the Infrastructure Investment and Jobs Act (IIJA) of 2021 allocating $62 billion for climate (including hydrogen and direct air capture hubs, electric vehicle charging stations, and broadband), the Inflation Reduction Act (IRA) of 2022 allocating $369 billion for climate (for industrial policy and incentives to deploy clean energy, though few disincentives for fossil energy), and the CHIPS and Science Act of 2022 which allocates $54 billion for climate (semiconductors, clean energy RD&D, artificial intelligence, and biotechnology). Totaling $485 billion, these laws authorize a historic amount of new investment over the next ~5-10 years and there was a sense of confidence that the U.S. can be on track to meet its emission reduction goals with further executive action. There was also a recognition that the actual size of federal investment is potentially much larger, closer to $1.2 trillion due to multiplier effects.

It was shared that the sequence of laws started with solid infrastructure, and in doing so and emphasizing the jobs that this climate strategy would create, created enormous opportunities focused around economic growth. It was also shared that there was a concern that states would not spend the federal money but sit on it, as they did with COVID funds, especially red states, but through the focus on infrastructure, this has not been the case at all. That being said, it was also raised that there remains a constituency of those that don't believe in climate change and it remains a concern how we maintain progress around climate goals despite potential political changes.

It was noted that the U.S. portfolio of RD&D investments is very diverse and has largely decarbonized – a leading indicator of where the U.S. wants to go. India's portfolio is less diverse, having made a huge bet on nuclear, and investing predominantly in thorium reactors.

Challenges to implementation in the U.S. include: data collection and reporting transparency; siting and permitting efficiency for interstate transmission; ensuring procedural equity in planning and siting new infrastructure; local and regional infrastructure planning and local economic structural reform; workforce readiness; and community acceptance and support. Further, the IRA is primarily a carrot-only approach with no sticks to impose discipline. Finally, most local communities need support for writing grants and doing infrastructure/economic planning, including educational, workforce, and public engagement programs to achieve the transition goals which have been determined federally. Such support will be key to overcoming the challenges associated with implementing the transition on the ground.

In light of this historic U.S. federal legislation, there was a question regarding how much scope there is within the IRA to do joint projects with companies in India. Concerns were raised that the IRA might

make it harder for firms outside of the U.S. to compete in markets because of the law's domestic content requirements. It was clarified, however, that the only domestic content requirement in the IRA is for the EV tax credit; otherwise, firms just get a boost if they use domestic content. This confusion points to the lack of clarity outside the U.S. regarding the IRA and the huge reservations this has fostered on the Indian side. The idea was floated that a free trade agreement between the U.S. and India might be the basis for determining who can participate in the benefits of the IRA and it was recommended that, like the Europeans, Indians should be vocal while they hold the G20 chair to advocate for its firms to play a significant role in the market being supported by the IRA.

It was also pointed out that Biden framed the IRA around domestic economic growth, in part to ensure it was passed, but this framing has created confusion about the role of the international community and created a sense of explicit or implicit protectionism. The U.S. should now look to change this narrative to broaden beyond just the U.S. and highlight provisions that allow for the external flows of funds. On this thread, it was also warned that while every political leader in the U.S. is going to want to create local jobs, we have to wrestle with how permissive we are about domestic job creation while still promoting participation in global markets, because if we get more and more protectionist to sustain political transitions, we will risk going backward and losing out on global participation. Concrete projects (not just policy) would also help surmount massive concerns from the Indian side.

There was also discussion of how we use the U.S.-India relationship to creatively shape China's trajectory in a way that is consistent with its climate goals. The U.S. and India can also partner around critical minerals and other clean technology components - aspects of which will be covered in depth in later sessions.

In discussing states, there was a sense that state-to-state collaboration between the U.S. and India would continue to be greatly helpful. There was also discussion of durability and the significant gains made in job development in domestic local markets. For example, the Taiwanese semiconductor is ten years ahead of everyone else.

Summary of Indian State of Play

India has taken advantage of a number of international climate leadership positions, with its G20 presidency, leadership in the Clean Energy Ministerial, the International Solar Alliance, the Coalition for Disaster Resilient Infrastructure (CDRI), and the upcoming Summit for a New Global Financial Pact in June.

In 2021, Prime Minister Modi pledged that by 2030, India would: increase its non-fossil fuel energy capacity by 500 GW and 50% of its energy requirements would come from renewable energy sources; reduce its total projected carbon emission by one billion tons; reduce the carbon intensity of the economy to less than 45%; and be carbon neutral and achieve net zero emissions by 2070.

One of India's key initiatives, LiFE, or Lifestyle for Environment, is focused on bringing individual behaviors to the forefront of the global climate narrative. India is also focused on looking at value chains and development programs that deeply affect people and might not surface on the policy side. In the

case of agriculture, for example, where farmers in some cases have lost 30% of their chicks to heat stress alone, these climate costs are much more massive than are being measured and people are being significantly impacted.

At COP27, India also submitted its Long Term Low Emissions Development Strategy (LT-EDS), which focuses on biofuels, electric vehicles, green hydrogen (including its national hydrogen missions), increased urbanization, smart city initiatives, and India's industrial sector.

In India, coal still accounts for 55% of its energy, and consumption has increased by 700% in the last four decades. India's total renewable energy capacity, excluding large hydro and nuclear plants, however, reached 122 GW in Feb 2023. It was suggested that India should also push for decentralized renewable energy, not just rooftop solar. It was added that while just 2% of India's electricity is currently from nuclear, they have wanted to develop it for decades, demand has just been outpacing nuclear build-out.

With Indian industries not spending nearly enough on R&D and India importing large amounts of industrial subsystems from China and in the face of an increasingly strained relationship, the Production Linked Incentive (PLI) scheme was discussed as a solution that aims to incentivize and subsidize industry build-out in India.

With regards to decentralized renewable energy and Power Africa, it was suggested that India and the U.S. could better coordinate to define projects with long-term sustainability in mind. For example, in the case of Power Africa, many Africans are losing confidence in solar power with the program's poor execution. Specifically, it was recommended that DOE's Living Labs, which provides innovations in sustainable energy for reservation lands in the U.S., could work with Indians in rural areas to share more sustainable solutions. It was also flagged that while private philanthropy is also changing the paradigm of how sustainable energy can be used, "donor colonization" is the antithesis of what we're working toward and should be avoided.

It was suggested that investments in India need to be made in vocational schools and local enterprises that can train local technicians and establish centers for innovation – this local approach was suggested as more valuable than investments in Power Africa and the Cybersecurity and Infrastructure Security Agency (CISA).

For India, climate change was described as playing out in three particular dimensions: heat stress (extreme heat putting increasing demands on cooling systems), water-related variability (translating to terrible seasons for farmers), and disasters (increasing hotspots for extreme climate events). Part of the response to these challenges has been a big push for sustainable agriculture, particularly with India pushing for millets to increase food security (millets have also played a big role in African, Japanese, and Chinese food security) and a potential global green revolution around a more resilient crop. India remains a largely agrarian economy, and supply chains are a concern (i.e., energy for milk production plants, water/land for ethanol, and power plants use water), and so these issues and solutions are of great significance.

On ethanol, it was described as both a water and land use issue, with one acre of land for ethanol growth generally less productive than the same land being used for solar or renewable energy generation, but in India, there might be land on which the argument for ethanol might make sense. The waste byproducts from sugarcane could also be used for ethanol production. In Brazil and certain African countries, with limited money for EV charging, ethanol has also been proposed as an alternative fuel and transition pathway.

It was also pointed out that India would benefit from bundling all of its mitigation activities into one legislative package. Compiled, it would total 550 billion USD in investment opportunity and would serve to better attract American companies to the Indian market.

At the G20, it was said that renewable energy supply chains and critical minerals will be front and center, and China will be present. The challenge of coal was raised, as many plants in India are dead and being run on compassionate grounds, but transition finance could support repurposing those plants. Within India, it was also suggested that there is huge potential to increase women's participation in the workforce of the future. Decentralized energy could be a growing industry for women to join. On the topic of workforces, it was also raised that the jobs story (growing workforces in renewables, sustainable cooling, and hydrogen) is driving state action within India as states position themselves as the electric vehicle manufacturer, etc.

In terms of potential collaboration, it was raised that the green hydrogen and the water requirements for hydrolysis could offer opportunities for technological cooperation (the availability of freshwater is a major problem for electrolysis, and start-ups working on this issue could collaborate), as well as waste and a carbon market – all of which were discussed further in later sessions.

Summary of Supply Chains & the Necessary Minerals Session

Politically in India, it has not been advantageous for politicians to support mining, with the implications and unpopular prospect of moving farmers from their land. Further, under Indian law, all minerals underground are owned by the government, not the farmer who owns the land, making it even more unpopular among farmers whose land is at risk of being destroyed without any financial reward.

The present Indian government has been working to engage the private sector in mining (currently ⅔ of mining in India is operated by state-owned enterprises) and have begun the process of genuine exploration (barely 10% of India's land has had full geological exploration). The lack of processing facilities within India, however, remains a gaping hole in Indian policy, which creates a dependence on Chinese processing facilities. Processing is also limited within the U.S. - though this challenge will not be easily overcome as developing processing capabilities take time to be built. The trajectory of critical mineral policy is changing because of rapidly deteriorating relationships with China, increasing demand, and military needs.

Mining in the U.S. has been a similarly challenging story, beginning with the gold rush and stained with a legacy of contamination. The IRA incentivizes domestic critical mineral production or production with free trade agreement partners through its clean vehicle tax credits. It also promotes domestic production

through bonus incentives in the Investment and Production tax credits. By 2025, if any of the battery components or critical minerals in a vehicle come from a "foreign entity of concern" (e.g., China), the tax credit will not be available, however. The U.S. does remain net import reliant for most critical minerals. There are opportunities, however, around permitting, workforce training, offering a clear message from the administration to encourage domestic mining exploration, exploring new free trade agreements, and advancing the Mineral Security Partnership and the Critical Minerals Mapping Initiative (bringing together geological societies to do more complete mineral exploration) to improve domestic mining.

For both countries, they are aware of China's dominance in both processing and mining (even owning mines in other countries). In the case of solar photovoltaics, China's dominance lowered the price by 85%, making them way more accessible globally, and offering a model to the U.S. of the benefit the IRA tax credits can have in bringing prices down. China's dominance, however, also has been associated with poor labor practices and both India and the U.S. should seek to avoid any such legacy of extractionism and consider different models that can be offered to the global south. Other challenges include and will continue to affect both countries around the challenges of relocation, procedural equity, and ensuring there is community buy-in from communities.

The following collaborative suggestions were shared: the U.S. could benefit from knowledge-sharing from India on recycling and reusing batteries (as part of a circular economy at scale); India could join the Mineral Security Partnership; the Track II Dialogue could support an initiative around skills development; there could be opportunities for collaborative work on critical minerals/battery recycling around the CHIPS and Science Act with the U.S. Department of Energy; and a focused task force could be established to deconstruct component by component, what a reliable supply chain would look like.

Around supply chains more broadly, there were several issues raised. The U.S. Department of Energy has been working on stockpiling components beyond critical minerals, but there can be massive delays with the current level of reliability. There are also concerns about permitting and substitutability. The QUAD and other partnerships should look to diversify supply chains and help developing countries to process and manufacture the components they need.

It was suggested that more should be spent on R&D to find alternate battery solutions and approaches to mining as there is currently an inadequate amount of research to find viable alternatives to lithium-ions (i.e. sodium), and a joint research initiative between the U.S. and India might be helpful. ARPA-E has funded a lot of programs on these innovative approaches to mining and making mining more efficient. There is huge potential for innovative programs to work on the alternatives.

It was concluded that a working group and partnership between the U.S. and India would make these issues more visible and help to cut through geopolitical challenges.

Summary of Climate Finance Session

Several questions were raised around the failures and possibilities of climate finance as it affects the U.S.-India relationship. Will the IRA distract institutional investors from thinking about emerging markets? If the incentives are strong to invest at home, would U.S. companies invest abroad, and why

bother with de-risking? Will a series of new legislation in India prompt the country to finally double down on its power sector problems?

The next major political moment is the Summit for a New Global Financial Pact in June (followed by G20 and COP28), and forming the backdrop for this meeting, several market failures need to be solved for when it comes to finance: a lack of insurance and the difficulty of insuring against non-linear climate risks; the need to de-risk large scale renewable energy; and underpricing a range of externalities (not just carbon, but land, water, biodiversity, etc.). Politically, growing signs of protectionism were discussed as a challenge, as well as the lack of energy security architecture for the future, and identifying the financing sources for the loss and damage fund.

The scale of climate finance necessary is still off by a factor of thousands, globally. There is skepticism about whether the U.S. will deliver on its commitment - potentially finding itself at a shortfall of $25 trillion. Other alternatives are also falling short, with the World Bank's leverage being fairly modest. Meanwhile, a 10:1 leverage ratio was suggested as necessary to transform the system.

There was continued talk of how to reform national development banks. There are currently no guidelines for inserting green development programs into traditional development banks – an area ripe for additional consideration. Sovereign wealth and pension funds were also raised - with opportunities to better dedicate pieces of resources to green assets and green finance, and their constraints related to risk.

At the Summit for a New Financial Global Pact, there will be discussion of restoring the fiscal space, fostering private sector development (i.e., how to bring down risk in developing countries, recognizing that it can't be brought to zero as private companies want), investing in green infrastructure (noting that resilience and adaptation, especially, require much more active conversation), and innovative finance for vulnerable countries (i.e., discussing the potential for the Barbados structure to be applied to Mumbai, with some skepticism that this model scales).

On these topics, the group shared several ideas of their own. While the Bridgetown Initiative has been criticized, several key components were considered to be very important, such as natural disaster and pandemic clauses (i.e., that countries should not be paying back debt while recovering from a natural disaster). The sense was that this initiative is important but not sufficient and in combination with other models, it should be pushed forward.

Participants also identified an opportunity to take public dollars, de-risk to a reasonable level, and couple with other funds from Development Finance Corporations (DFCs), private equity, or hedge funds, such that the private sector is comfortable investing.

While the South Africa Just Energy Transition Partnership (JETP) was recognized as providing a short-term solution, there was only some support for JETPs as a potentially useful model but also skepticism around their scalability. It was suggested that we are repeatedly looking at these issues from the supply side with a focus on renewable energy programs, but that if we instead look at institutional financing, it might be more effective. It was suggested that almost no money has gone out the door with the JETP because

of a lack of consistency in government and high turnover, the environment is not conducive to making a deal.

A counter perspective was offered that the focus shouldn't turn too much to the private sector because they are risk/reward oriented and so scaling will be difficult, and the governments shouldn't be let off the hook. The World Bank's Development Finance (DFi), the Green Climate Fund (GCF), and the International Monetary Fund (IMF) were raised as better suited to scale quickly (and that generally, we'll benefit from considering financing from places that are sometimes overlooked). The government can also play in a combination of capital and regulations, and the U.S. can push jointly to open doors to substantial investment. In China, for example, they have structures for red- and green-lighting certain types of finance, and India and the U.S. might work on building these same regulatory taxonomies in the context of G20.

A challenge and an opportunity identified in India is the current lack of subnational capacity to put together blended finance. There might be an opportunity for this forum to support increased subnational capacity on blended finance.

While it was concluded that there is no one grand package for climate finance, there were several large takeaways from the discussion. Debt is now a climate-derived risk, and resilience cannot be an afterthought especially given that resilience packages that have been delivered thus far haven't served the purpose. There should be the pooling of climate risks across different countries, which would automatically lower the risk profile of any one country. For JETPs, the formulation is reminiscent of an IMF stabilization package from the 1990s and is not designed to deliver on renewable investment, and the focus should instead be on getting capital into renewables. With regards to "blended finance" across different geographies, there also won't be one single solution and there needs to be major reform in the World Bank, a facility for renewable energy distribution in sub-Saharan Africa, and more nimble institutions that can deliver credit quickly.

Throughout the conversations, it was also noted that were the U.S. to honor its climate finance commitments internationally, it would help rebuild trust and help mobilize the private sector internationally. Additionally, with both countries pivoting from China, the U.S. and India must coordinate via the private sector. And it was also suggested a common definition of "climate finance" would be useful.

Summary of ESG Session

The U.S. Securities and Exchange Commission (SEC), has proposed a rule that will standardize climate-related exposure and would require the disclosure of direct GHG emissions, indirect emissions, and Scope 3 emissions. The strongest pushback has been in response to Scope 3 emissions as companies argue that they do not have control over that information or emissions, however, the rule does allow good faith estimates and provides a generous safe harbor.

18 U.S. states have pushed that climate and ESG risk factors are not the responsibility of the private sector. They argue that the SEC and companies shouldn't dictate how Americans can invest and in fact,

companies that abide by this “woke capitalism” should be banned/divested from. The counterargument is that financial actors cannot ignore climate-related risks and unsound corporate practices. The SEC’s rule on this is expected in the next few months, with scope 3 emissions potentially to be watered down by court challenges.

In India, the ESG framework has focused on being oil-free, but standardization is the only way forward and cannot happen in isolation. The Exchange Board of India has come up with a new guideline standard, including a phased approach, requiring that by 2026, top companies will have to disclose based on reasonable assurance (similar to the European mandatory disclosure plan). The reaction has been generally positive, as any standardization will help increase confidence from investors in the global south and Indian companies have generally welcomed disclosure.

The Europeans have a broader mandate as culturally they are more comfortable telling companies how to act. And as a result, the EU and UK are developing mandatory corporate transition plans that will become important regulatory tools.

Three key risks were raised: (i) Even as regulatory standards are being designed, there is a multiplicity of standards and protocols for businesses to cherry-pick, creating a lot of confusion about the right way to go and how to best align; (ii) There is no way we will have the capacity to measure Scope 3 emissions in the next few years; and (iii) Whether regulators can make companies comply and build their credibility. Without clear government oversight, this confusion will persist.

There was an observation that ESG trends in India are also changing actions and companies are adopting practices and innovations, as well as inspiring young people to adopt behavioral changes and stances. In the U.S., the values and image of a company have also proven to be key to their recruiting efforts (i.e. Monsanto, Mars).

Summary of Cooling Fund Session

The world’s cooling demand is predicted to triple by 2050, contributing to 7% of global greenhouse gas emissions (more than the entire Indian nation). 100 gt of CO2 emissions can be avoided if this challenge can be addressed and this session aimed to investigate whether a particular project on cooling between the U.S. and India could be part of driving the solution. There was consensus that a partnership on cooling would be immensely valuable.

While the Global North is also seeing heat increasing this increasing cooling demand, this impact will be especially pronounced in India, where they’re already experiencing previews of this heat emergency and where it is currently estimated that by 2050, 45% of peak energy demand will go to cooling. In March 2022, an unusual heat wave in northern India resulted in an immense increase in the use of coal to power cooling, which then led to a national coal shortage. There were a multitude of factors at play in this incident, including the geopolitical crisis that eliminated importing coal as an option, the following scale-up of internal production of coal, and the resulting power outages.

At present, 50% of India's GDP is exposed to heat stress, with cooling key for agriculture and food cooling, impacting workers ability to work, 25% of vaccines going to waste each year in India because they cannot be kept cool, among other impacts. These vulnerabilities, among others, present huge investment and job opportunities in India. India is a likely place to develop cooling technologies. The country's manufacturing capacity, domestic demand, and incentive to take action are competitive enough to compete globally. This could also present the opportunity for the U.S. to invest.

Discussants also examined what a joint project on cooling between the U.S. and India and a potentially larger cohort might look like. JETPs were compared as the current closest approximation to a joint project of this sort, though their language falls short and they are fundamentally normative by having an outside player dictating another country's development pathway. A joint vision is needed regarding cooling bilaterally and across the global community and the Track II has a unique opportunity to carry this forward.

Korea is another potential big partner in cooling, due to the success of LG, the nation's energy-efficient company. Benefitting countries worldwide, a cooperative venture between the U.S., India, and Korea would reduce costs and provide the capacity in scale we need to meet global demand.

It was noted that a cooling fund is within reach of available capital, and $10 billion would buy the entire cooling program, including upfront investment, technical investments, and development, market assessments, and production facilities.

Further recommendations during the dialogue included adding storage to cooling systems, especially increasing load capacity near urban centers, and the feasibility of generating "coolness" at times when power is abundant and stable, and releasing when demand is at its peak, usually in the evenings. The use of phase-change materials (PCMs) to store thermal energy via the latent heat of phase transitions was also debated, as PCMs can be used to provide district cooling (sub-ambient transition temperatures), to buffer thermal swings in buildings or shipping containers (near-ambient transition temperatures), and to store solar thermal energy for short-term or seasonal applications (higher transition temperatures).

The creation of a "Cooling Collaborative" was considered, and members agreed that it would be beneficial for this collaborative to ensure cooling progress is moving in both the U.S. and India, while ultimately adding additional countries to the effort. The collaborative could also generate cooling action plans worldwide, effectively building political momentum and potentially promoting these efforts at succeeding COPs. Hypothetical cooling action plans would therefore detail examples of making adaptation financeable, innovative methods of combining adaptation and mitigation, and mobilizing finance.

In addition to international engagement and commitment, three domestic verticals would exist under this cooling initiative, including marketing cooling as a product, service, and public good. As a product, efficient cooling should be a priority, and eliminating current prevalent cooling trends, such as building codes and materials like tin roofs that are designed to warm rather than cool and lackluster ceiling fans installed in many residences. The switch to better building codes, super efficient ceiling fans, and ACs should be emphasized, while acknowledging the last two points would require end consumer financing

and the focus should be directed at replacement and not on new sales. Regarding building codes, voluntary green building has moved rapidly, but none of the cities have mandated green buildings. While voluntary works well, some of the code revisions will have to be mandated, including government-owned buildings.

As a service, cooling technology would advance the agricultural supply chain, adding "cold links" to the presently over-heated chain. Discussants acknowledged potential roadblocks in this plan, including financing, as smallholder farmers cannot pay for this technology. The possibility of bringing cooling in as a service, rather than having farmers pay for cooling centers was topically explored. Finally, cooling as a public good, with investments specifically aimed at the healthcare sector, was highly recommended, recognizing that India can and should invest in itself.

Several other key points were raised. It was suggested that this partnership program needs a fund to support it where someone agrees to volume for super efficient products (replace extremely inefficient products) and support demand aggregation. Data centers especially are popping up all over India and have to change so that they require less cooling. A focus on agriculture and the tie to livelihood, will also be key to frame attention around this issue in India. Another significant challenge is that voluntary green building codes won't be enough, and there will have to be some mandates, even for government owned buildings. Evaporative cooling was also raised as formerly the only way of cooling India, as well as the huge existing load of fans that must be changed over. The government in India is a large buyer of cooling products, so this should also be considered. And finally, India contains many different geographies, and different cooling methods will be required to efficiently and sustainably cool the country.

There was consensus that there is huge expertise amongst folks in the U.S. and India and there should be a focused discussion on this, and extreme heat is causing 1 million people per year to die, thus the benefit of this to both development and health could be enormous.

Summary of Hydrogen Session

Throughout the Dialogue, it was suggested that the U.S. and India would benefit from scaling hydrogen as one of many potential fuels of the future and that joint cooperation (e.g., connecting technology partnerships) might be a key way to do so.

For India, there is increased attention to, especially among the younger generation, the benefits of switching fuels, and hydrogen will be a major growth area in India, but additional research is necessary to have a better understanding and awareness of the limitations and challenges that hydrogen production and use pose, and what to expect over the next few years.

In India, more broadly, currently proposed clean fuels are focused on productivity, reducing land expansion, and using the existing land for fuel and reforestation. A three-stage approach from the private and industry perspective was suggested and involves switching to solar and renewables and using India-U.S. cooperation to scale. Biofuels were also raised within their suite of solutions, as a safe and reliable bridge fuel amidst the wider energy transition, that would also offer a potential new livelihood to farmers as producers of the fuel.

For India, there were several common pitfalls identified to avoid in advancing these new fuels. First, silos, as existing government structures are complex and these silos can create interruptions and lead to duplication of ministries and poor communication between departments, which would be especially detrimental if a green hydrogen ministry were to be created. Bilateral pressure points on how to structure these discussions might be helpful for India to create and frame a robust hydrogen architecture absent of these silos.

Second, subsidies for transition fuels were heavily discouraged, regardless of the fuel, and instead, it was suggested that the money be used to generate demand for the fuels, which would allow the industry to scale up the technology and increase production for market consumption. This presents the opportunity for additional U.S. and Indian cooperation, which can focus on demand creation for green hydrogen, rather than subsidies.

Third, government selection of specific technologies and solutions can be a huge miss, and instead market forces should be given the chance to play out without intervention.

Specifically to hydrogen, standardization and certification, and regulation will also be key. The process of certifying hydrogen and defining green building, including labeling green steel, will be difficult but critical as we look to the end-use of these products. A “cluster approach” was recommended to ensure success, as piping all over the network is ineffective at best and destructive at worst. Therefore, hydrogen hubs will be essential although challenging, as they pose unique struggles, such as the timeline to production. To ease the ramp-up of production, focusing on use cases as early starters was advised, as India has a specific steel ministry that can provide advantageous guidance.

Technology cooperation is where theory is put into practice, and will be another opportunity for cooperation between the U.S. and India. During the Dialogue there was an emphasis on collaboration on electrolysis, as the source will become an issue at some point, and it was suggested that there be more work on R&D cooperation.

From the U.S. side, it was asked if we are approaching hydrogen with an “if we build it, they will come” mentality. Additional concerns that were presented include the question of quantity and how much hydrogen is needed, the speed at which it is needed and whether it can safely and sustainably be produced, and the specific role hydrogen will play in the transition and the purpose it will serve. From the policy perspective, there is the question of whether or not there is sufficient demand-side policy that will use it to maximize benefit. To address this concern, it was suggested that demand-side studies be conducted, specifically aimed at fertilizer companies and industrial companies to determine their perspective on hydrogen. Another question presented asked about the role of grid electricity in building for hydrogen, and if hydrogen production can truly be green if it is reliant on the grid.

When examining vulnerabilities in current hydrogen practices, safety infrastructure and social impact were highlighted as major vulnerabilities for the U.S. According to current laws, the U.S. needs to move away from gray hydrogen by 2030, however, of the 10 million tons of hydrogen produced in the U.S today, none is currently clean hydrogen. To meet this goal, policies are being implemented around hydrogen hubs and tax credits.

In the U.S., only four hydrogen hubs currently exist, however, by the end of 2023, the U.S. is expected to have six new additions for a total of ten hubs. There are currently 33 applicants for the 10 hubs, and the evaluation criteria require 20% of the merit evaluation to be focused on community benefits and community engagement, a very new development. Hub proposals vary in size, and some cover one state while others cover up to five states. All states except for 5 would be touched by one of these hydrogen hubs if each proposal is accepted.

As additional U.S. hub proposals were submitted, the Industrial Innovation Initiative was borne out of concern around how hydrogen would be sourced, and a study was commissioned that looks at which regions are best suited for which use-cases in an effort to elevate the use-case criteria for DOE as they evaluate proposals. On the topic of hydrogen hubs, it was also suggested that hydrogen hubs could be distributed throughout India.

Discussion around tax credits touched on present competition around renewables, and how this could stall electrification. Similar to the aforementioned Industrial Innovation Initiative, the Drift coalition emerged to address the feasibility and cleanliness of using the grid to power an electrolyser. Discussants referenced the latest Energy Innovation report that says there's the potential to increase emissions if the grid isn't developed to integrate renewable energy to power hydrogen creation sources. Provisions that would counteract this increase, include having deliverability guarantees, which require using power within your grid and renewable credits from the user's local region that balance out the fossil fuels in the grid.

The conversation noted both the importance of standards and the potential pitfalls, as some discussants cautioned against standards, suggesting they may disable the hydrogen market before it is established, citing EU and U.S. circumstances, the challenges of navigating an interconnected grid, and "Islands of regulation" that would be inefficient for scaling economies.

Further challenges with standardization include the "all or nothing" approach taken on green hydrogen, with technology interpreted as either the brightest shade of green, referring to completely clean hydrogen, or zero hydrogen, referring to those solutions that are not completely clean. If we wait for all hydrogen to be completely clean before deployment, it will be too late to reap the benefits. Different shading for levels of "green" would be helpful to kickstart the industry today instead of waiting, as the more time lapses, the more traditional methods and technologies will be installed. The harmonization of standards is a key opportunity for collaboration and a joint MRV system for certification would also be important in the Indian context. If the Dialogue were to support developing standards at the global level, there are processes within the USG and QUAD to channel some of these next actions (i.e. a potential green hydrogen partnership/alliance - including Australia and Japan), and certain institutions to avoid, and our co-chairs could be champions of this.

There was alignment in the notion that demand-side studies should be conducted, specifically looking to fertilizer and industry companies for their thoughts to identify the best path forward. The proposition

that industries move to green hub locations, instead of vice versa was examined, and the feasibility of moving the industry to renewable energy and green hydrogen hubs requires further research.

Reflections on international demand highlighted the inability to create incentives for demand, as this will result in a cumbersome international situation where countries will seek to be exporters. Instead, the questions of "Where is the market?" and "What kind of potential is there for joint ventures?" need to be addressed (it is key to getting the cost of hydrogen down). Currently, the demand is greatest from the EU, driven by Russia, however, even independently of the conclusion of the war, investments in non-oil/gas will remain high. U.S.-India cooperation can focus on driving this demand creation.

Within the Hydrogen Mission in India, 63% of the plan is devoted to creating demand - a signal from the government demonstrating they realize this is important. There was also significant discussion around green steel, as the Indian Minister of Steel has formulated 13 task forces on green steel just within the last month, and the suggestion that a large-scale public procurement from the Indian government would send a strong signal to industry to go further in this direction. The auto industry are also primary users of virgin steel and can play an important role in coalescing demand for green steel - by 2030 have set a goal of 10% green.

There are 63 bilateral partnerships around green hydrogen, but areas like technology development are still ripe for coordination.

Summary of Climate Resilience Session

During the discussion, the two delegations discussed the fact that natural systems around the world are changing faster than humans can adapt. Everywhere, ecosystems are at risk but conservation is seen as less pressing than adaptation to climate change and nature is often taken for granted, even though every time there is an ecosystem breakdown, it's often followed by disease or other disaster of some sort.

Potential mal-adaptation should be avoided (i.e. pumped hydro as a substitute for battery storage in sensitive hill ecosystems and solar powers replacing agricultural lands and crucial jobs), and India should be attentive to responsible renewable energy development.

In India, there are clauses in the Constitution focused on protecting the environment but these clauses are less focused on combating climate change and more focused on preserving the nation's heritage, religion, and history. A Disaster Response Administration is emerging and is explicitly asking for nature-based solutions for resilience, instead of just disaster response.

This is building from a clear sense that both countries need to move away from solely focusing on mitigation to start focusing on adaptation and increasing resilience and there can be creative ways to combine the two to mobilize finance. That being said, there are impacts from climate change that we cannot adapt to or become resilient to – this is something that the U.S. is uncomfortable with and doesn't want to embrace but India can put on the agenda.

The recommendations made by the delegations on the topic of climate resilience were widely variable and covered topics including securing funds to educate the future green workforce; knowledge-sharing among farmers and around crop insurance programs and generally creating more sophisticated language around insurance; promoting climate-friendly and resilient buildings (i.e. replacing concrete with permeable surfaces to reduce flooding risk and reduce the carbon intensity of infrastructure); an emphasis on municipal bonds; utilizing air quality meters; collaboration for wildfire detection and resilience; ocean-climate action and protecting marine biodiversity in international waters; cooling action plans; building extreme heat infrastructure; reforms of international financial institutions for adaptation; knowledge sharing around community engagement and resource management (i.e. Colorado River); building solar panels on aqueducts; growing seaweed farms with offtakes going to livestock and resulting in fewer methane emissions and healthier cattle; and restoring forests to restore water resources for cities, among others, and they highlighted the many avenues for collaboration between the two countries and how the two countries can learn from one another.

Adaptive urban planning is becoming increasingly important as climate change is threatening current infrastructure and there are many different ways of constructing and designing spaces and buildings – for instance, looking at sourcing more sustainable materials for buildings like cross-timber construction and bamboo as structural support. This planning will need additional funding and so the question became how to attract private capital.

It became apparent throughout the discussion that funding and financing are key, and are historically difficult to leverage for adaptation, raising the potential for bond insurance, and other mechanisms to bring prices down and draw more investment. The conversation also turned to carbon markets but the environmental credibility of carbon credits is questionable.

When the discussion turned to carbon markets, delegates mentioned their wariness because there are so many ways to take advantage of the system, for example, buyers of carbon credits are selling for 3-4x more than what they paid for the credits. One of the delegates suggested that there could be some kind of new carbon market that oil companies cannot participate in, but then noted that oil companies currently are responsible for more than half the sales of carbon credits.

Both private and public sectors will need to play a vital role in making funding available, as there are limits to what the private sector can do and the world has struggled for decades to find a meaningful balance between public and private sectors. Moving finance at a large scale has proven extremely difficult and it's become clear that we haven't put nearly enough energy into exploring bond issues and it was also noted that we have missed the opportunity for incremental stacking.

Importantly, it was also noted that the multinational development banks are one of the biggest actors in adaptation but there need to be additional pathways for countries, especially smaller countries, to access capital. Clearly, international financial institutions are in need of reform.

As part of the conservation about finance and funding, the delegations also discussed that it's necessary to find new ways to look at insurance, which is often heralded in the U.S. as the solution to all these funding problems. The reality is, however, that insurance cannot be the solution because most of the

world is uninsured and will never be insured. It has become increasingly evident that there should be more sophisticated language around what insurance can do and its limitations.

The subjects of climate migration and immigration were also discussed, opening up questions about national security recognizing that this issue is likely to rise to the top of political agendas quickly. In fact, the U.S. recently issued a report on climate migration and immigration and is working on a strategy which means that the topic has risen from the basement to an actual conversation. The U.S. put 45 million last year into the international migration United Nations group, particularly with a climate focus. There's a lot of international apprehension around this issue, however, because if people need to be moved due to climate change, it is unclear where they'll go.

In the U.S., too, there are complicated questions about whether or not to rebuild after natural disasters, because, for instance, state revenues are heavily dominated by real estate taxes, and if you don't rebuild then states lose money, money comes out of schools, fire departments, and others. It became clear that these are important questions but there's lots to still be navigated and considered.

In India, migrations (due to floods and droughts) result in the loss of 8-12 generations or rural knowledge, and these disasters and the consequent migration have the effect of slowly de-skilling these agriculture experts.

Resources

- This working paper was published earlier today describing the green hydrogen time matching issue: https://energy.mit.edu/wp-content/uploads/2023/04/MITEI-WP-2023-02.pdf
- https://www.wri.org/research/state-research-development-electric-vehicle-battery-technology
- https://www.wri.org/research/future-disaster-risk-pooling-developing-countries-where-do-we-go-here
- https://www.ceew.in/publications/addressing-vulnerabilities-in-the-supply-chain-of-critical-minerals
- https://www.wri.org/research/corporate-science-based-emissions-targets-india-ndc-goals
- Cooling case study: https://www.wri.org/research/powering-development-climate-vulnerable-areas-role-decentralized-solar-solutions-india
- https://www.livemint.com/Opinion/3kUmycbicdhK81i4GDUuQL/Opinion--Big-data-is-way-hotter-than-you-think.html
- U.S. Hydrogen Hubs Map – Clean Air Task Force (catf.us)
- Smart Design Of 45V Hydrogen Production Tax Credit Will Reduce Emissions And Grow the Industry - Energy Innovation: Policy and Technology
- We're about to give billions of dollars to clean hydrogen. How should we define it? (volts.wtf)
- National Petroleum Council
- IndustrialInnovation.org
- DOE Hydrogen Roadmap
- Discussion of MRV and standards by RMI: https://rmi.org/all-clean-hydrogen-is-not-equally-clean/