



## FROM DIRECTOR GENERAL'S DESK



The recently published IPCC'S AR6 Synthesis Report was a highlight, albeit a dire one, in March. "There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all", the report findings suggest. Yet "multiple, feasible and effective options" may still be available to repair the climate change dents caused by human actions and prevent the advent of a future beyond repair.

Transitioning to a clean energy source is a universally accepted way forward. Solar has become a formidable choice with its proficient availability in most countries and the sector's innovative strides. We are today at a point where

renewables are competitive with fossil fuels. Between 2010 and 2020, the cost of solar PV fell by 15 per cent yearly, representing a technological learning rate of about 20 per cent per doubling of the installed capacity. This is amongst the highest we have witnessed. At the same time, the installed capacity has risen by 25 per cent a year. There is an interplay of these two aspects: increased deployment on the one hand and cost reductions on the other. The achievements on renewables have surpassed all projections: the pandemic served well to accelerate the growth of renewables, a trend ISA, and some other organisations, are striving to sustain through its efforts and initiatives.

March saw our capacity-building efforts raised a notch through exclusive initiatives for West African Member Countries, Member nations in Latin America and the Caribbean and the STAR C exposure visit to Germany, France, and the Netherlands. Continuing with our expanding collaborations, under the aegis of programmatic support, the International Solar Alliance and United Nations Development Programme inked a memorandum of understanding to launch pilot projects on Scaling Solar Applications for Agriculture Use in ten African Member Countries and Green Hydrogen Organisation to develop a Green Hydrogen Policy Hub under its Solar for Green Hydrogen programme. The latest issue of ISA Solar Compass Journal also offers insights into hydrogen storage materials and solar desalination.

Underlining the importance of alliances. We had the honour of hosting Dr Rajiv Shah, President of The Rockefeller Foundation, who underscored the need for high ambitions and collaborations: all-encompassing, public, private, and technology.

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The green transition has multiple benefits beyond the immediate mitigation of climate change impacts. It could create 24 million new jobs globally by 2030, according to the International Labour Organization, apart from protecting at least a billion workers in agricultural, fishing, forestry and tourism activities that rely directly on a sustainable environment. Accelerated climate action is now essential. The way forward lies in pacing up renewable energy and making renewable energy technology a global public good. The highlights and solutions laid out by the IPCC should serve as a guiding moment to course correct and to accelerate our response and our efforts.

With best wishes



**Ajay Mathur**

Director General, International Solar Alliance

## ROUNDUP

# ISA AND WEST AFRICAN POWER POOL (WAPP) CONDUCT A STUDY TOUR



## ISA – WAPP Collaboration

International Solar Alliance (ISA) and West African Power Pool (WAPP) in March 2022 signed MoU to Support Scaling up Utility-Scale Solar Parks/Projects in the West African Region.

One of the cooperation areas was to build human and institutional capacities of West African countries and WAPP Member Utilities through seminars/ webinars, training programmes, undertaking joint visits and study trips at the regional, national and local levels to foster the development and implementation of solar parks.

## About WAPP

WAPP was created in 1999 by the Authority of the Economic Community of West African States (ECOWAS) Heads of State and Government, with a vision to integrate the national power systems into a unified regional electricity market. WAPP was mandated to promote and develop infrastructure for power generation and transmission and to ensure power exchange coordination between Member States. WAPP's 2019 – 2033 ECOWAS Master Plan contains 75 priority projects, of which 28 are transmission line projects (investment requirement of USD 10.48 billion) and 47 are generation projects with an approximate total capacity of 15.49 GW (investment requirement of USD 25.91 billion); with 10.67 GW of renewable energy projects including regional solar energy projects. This reflects the conviction of the region that the development of large-scale power plants, due to economies of scale, will benefit ECOWAS member countries and their utilities and be developed at optimal costs.

## Knowledge Exchange Programme on Planning and Implementation of Renewable Solar Energy Generation

## Facilities Projects for the benefit of WAPP Stakeholders

For this training and certification programme, the WAPP General Secretariat has recruited l'Institut International d'Ingénierie de l'Eau et de l'Environnement (2iE Institute) based in Burkina Faso since October 2020 for training officials from ministries in charge of energy in ECOWAS countries and WAPP member utilities regarding planning and implementation of renewable solar energy generation facilities (Programme-1); operation and integration of solar energy production into the grid (Programme-2); and maintenance and performance monitoring of solar energy generation facilities (Programme-3). The above training and certification programme in renewable solar energy has been covered in three phases:

**Phase 1:** Design of the training and certification scheme

**Phase 2:** Implementation of training programmes and certification exams

**Phase 3:** Organisation of study trips

ISA and GRID-INDIA Limited supported WAPP in organising a study tour for





On 14 February 2023, **Shri R.K. Singh**, the Hon'ble Minister for Power and New & Renewable Energy, India & President of ISA Assembly, interacted with the delegates from the West African Region attending this knowledge exchange programme and study tour to India. He highlighted the importance of creating such opportunities to exchange knowledge between India and the West African Countries. He assured the delegates that India would always be there to support them in their goal to create a new energy future driven by solar energy for their respective countries. Heads/Representatives of Diplomatic Missions in New Delhi from Burkina Faso, Mali, Niger, Nigeria, and Togo were also present at the event. The event was also attended by Shri Dinesh Jagdale, Joint Secretary, Ministry of New and Renewable Energy, Government of India; Shri. S.R. Narasimhan, Chairperson & Managing Director, Grid Controller of India Ltd.; and Dr Ajay Mathur, Director General, International Solar Alliance.

participants from officials of ministries and utilities of the West African region for Programme-1, i.e., planning and implementation of renewable solar energy generation facilities.

Study Tour was conducted in three batches with 1 Anglophone (English-speaking) batch and 2 Francophone (French-speaking) batches; during the months of February and March 2023, covering around 60 participants from 14 WAPP countries - Benin, Burkina Faso, Cote d'Ivoire, Gambia, Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The duration of each study tour (batch) was five days. The first batch kicked off on 13 February 2023 in New Delhi, India.

#### **Batch 1 (Anglophones) | 13 to 17 February 2023**

- 16 participants attended Batch-1, with 6 participants from Ghana, 4 participants from Nigeria, one from Sierra Leone, one from Gambia, one from Burkina Faso and 3 participants from WAPP

#### **Batch 2 (Francophones) | 27 February to 3 March 2023**

- 23 participants attended Batch-2 from Benin, Burkina Faso, Cote d'Ivoire, Guinea, Liberia, Mali, Niger, Senegal, Togo and WAPP

#### **Batch 3 (Francophones) | 6 to 10 March 2023**

- 20 participants attended Batch-2 from Benin, Burkina Faso, Guinea, Gambia, Niger, Senegal, Togo and WAPP

### **Specifics of the Study Tour**

The study tour module was designed with classroom training and field visits to 2050 MW Pavagada Solar Park, Southern Regional Load Despatch Centre (SRLDC), SR REMC, Karnataka SLDC and

Karnataka State REMC. The participants were exposed to various policy, planning, and implementation-related topics about renewable energy in India, such as:

- Policy Overview for Renewable Energy in India, specifically for Solar
- Regulatory Framework for Renewable Energy in India
- Renewable Energy Certificate (REC) and Renewable Purchase Obligation (RPO) Regulations
- Basics and overview of typical grid-tied solar plant
- Electricity Market for RE-Green Term Ahead Market, Green Day Ahead Market
- Solar Policy and bidding guidelines covering incentives and Support Mechanisms
- Standards and Regulations related to RE
- First-time charging procedure and regulatory compliances
- RE-Forecasting, Scheduling and Deviation Settlement Mechanism
- Challenges for solar developers - including financing, grid connectivity



## ISA ENABLERS

# MANUFACTURING WORKSHOP FOR MIDDLE EAST AND NORTH AFRICA (MENA) REGION

ISA and our consultants, Becquerel Institute, conducted a workshop on developing a solar manufacturing ecosystem in the Middle East & North Africa region. The goal was to support private players and policymakers to build a manufacturing ecosystem in the Middle East and North Africa region. There was discussion among private and government stakeholders about the opportunities, challenges and policies to support local manufacturing in the region.

While several country excellencies shared their clean energy vision, there were several insights from the session, such as the need for incentives for manufacturers to reduce their OPEX and to be competitive from the start, also policies tying solar PV auctions with local manufacturers similar to Turkey with the need for with local authorities & government agencies to support the local

manufacturers for the solar PV industry to thrive in the region.

This session serves as a starting point for dialogue to help policymakers, manufacturers and developers create a robust solar manufacturing ecosystem within the Middle East & North African region. We thank our speaker Mr Phillipe Mace from Becquerel Institute, and all the dignitaries for giving their time and valuable inputs to the session. ISA looks forward to more such workshops to boost the sector in this region.

## TRANSFORMING SOLAR: SUPPLY CHAINS WORKSTREAM HOSTS ITS LEADERSHIP MEETING



The Transforming Solar: Supply Chains workstream held its leadership meeting at the Clean Energy Ministerial: Senior Officials Meeting in Rio De Janeiro. ISA and IRENA, the coordinators, presented the workstream plans with interventions from the United States, Australia, India, Germany, United Arab Emirates, Brazil, the United Kingdom, and the European Commission. ISA and IRENA are excited to advance this workstream to help build resilient and inclusive solar supply chains worldwide.



## SPOTLIGHT

# ROCKEFELLER FOUNDATION AND ISA CALL FOR MOBILISING SUPPORT FOR RENEWABLES TO COMBAT THE CLIMATE CRISIS



Dr Rajiv J. Shah, President of the Rockefeller Foundation, was in New Delhi, meeting Indian dignitaries and mobilising support for renewables to combat the climate crisis. At an event co-hosted by the International Solar Alliance (ISA), the Rockefeller Foundation, and Global Energy Alliance for People and Planet.

Dr Shah delivered a special lecture on 'Tackling the Climate Crisis by Dramatically Expanding Access to Renewable Technologies Across the Developing World' while Dr Ajay Mathur, Director General of the International Solar Alliance underlined 'The Inevitability of Renewables' in his opening address.

The Rockefeller Foundation and the ISA are working together to provide support to the Least Developed Countries (LDCs) and Small Island Developing States (SIDS) with the implementation of innovative solar projects and by building resilience in key sectors such as agriculture and health. The projects supported through this partnership are expected to enable faster replication across other countries.

The programme proceedings also included a panel discussion, themed, '**Accelerating Renewables Deployment**' moderated by Mr Mihir Sharma, Director, Centre for the Economy and Growth, Observer Research Foundation and featured Mr Rupesh Agarwal, CEO, Azure Power; Mr Simon Harford, CEO, Global Energy Alliance for People and Planet (GEAPP); Ms Anita George, Co-Founder, Edhina Capital; and Prof. Navroz Dubash, Professor, Centre for Policy Research as panellists. The panel emphasised that consuming electricity is pivotal for households and communities

to lift themselves out of poverty. Without abundant access to electricity, underserved homes, businesses and communities have a minimal chance of achieving a high economic and social well-being in today's increasing energy-enabled economies. Investors and investments come in when things are commercially viable and sustainable, combined with an enabling environment. Costs have, over the years, come down, but it's cut-throat on the ground. The opportunity is enormous, but project development takes time. Increasing technology access, adoption, and blended finance are some of the answers. The sector also keeps evolving, and therefore, what worked a couple of years ago will not apply in the next five. Innovations in technology have ensured the megawatt to gigawatt transition, but other vital aspects of addressing institutional and policy issues need to be resolved. A wide array of solutions and partnerships need to be aligned for a people-centric transition.

# The Inevitability of Renewables:

## Dr Ajay Mathur, Director General, ISA



We are delighted that all of you could join us on this occasion, and we look forward to hearing from you with ideas on how to enhance the cost-effectiveness and range of renewable energy deployments across the spectrum and the world.

We have seen of course, that there's a rapid transformation of the energy system that is necessary to keep warming well below 2 degrees centigrade as we promised ourselves in Paris, reinforced in Glasgow. As a result, there are many countries that have committed to achieving net zero targets as early as 2040, 2050, 2060, and 2070 in the case of India.

All these net zero targets imply mass-scaled deployment of zero carbon technologies such as solar and wind, possibly in combination with negative emission technologies which sequester the carbon emissions that are, at least today it seems would happen in any case.

I would like to give a little bit of a historical perspective all of you know that renewables have traditionally been considered to be on the more expensive side of the electricity business. We have always thought that their deployment would be possible only if there were high subsidies or carbon taxes indeed that is what made the renewable sector grow but because of this constant growth fueled by a range of issues be it climate change, be it local development. We are today at a point where renewables are competitive with fossil fuels. Between 2010 and 2020 the cost of solar PV fell by 15 per cent yearly, representing a technological learning rate of about 20 per cent per doubling of the installed capacity. Please note this number, this is amongst the highest we have ever seen. At the same time, the installed capacity has risen by 25 per cent a year. And these two things played on each other increased deployment on the one hand and cost reductions on the other.

I would like to note that before the pandemic, the kinds of projections we did about renewables fell far short of actual

achievements and the pandemic has served to accelerate the growth of renewables. In 2021 something of the order of 430 billion dollars were invested in renewables globally, approximately 200 of this went into solar alone. In 2022 it was about 499 billion dollars, with 250 going to solar. This is important but a problem has occurred, the investment has been very skewed. Yes, there are other problems also; there are problems related to the kind of pushback that has occurred from the fossil fuel lobby and continues to occur in many countries yes there is the problem that while electricity from solar or wind is the cheapest electricity it is only when the sun is shining, or the wind is blowing and hence storage both long term and short-term become our key technological challenge.

But I will argue that for us the challenge really is making this revolution this solar and wind revolution truly global that there is a geographical diversification of investments that occur. I thought of the fact that 499 billion dollars were invested in solar and wind globally in 2022 however only five per cent of it went to all of Africa. It is less than five per cent for solar, for wind it is actually lesser. This is a matter of great concern the vast amount of investment has occurred in the OECD countries, in China, where the risks are manageable. We spoke to a large number of investors and globally the amount of money that is available is huge. People already talk of the investors who are in the room talk of about a trillion dollars available. We have invested about 499 billion a year but the challenge is that investors are uncomfortable as to whether they will get their returns back.

There is a lack of confidence in the countries where investments are not occurring. We need as a community to enhance that so that skewness in development does not occur. What can we do? We believe, there are basically three kinds of things that need to be done. The first is pull in global investments and for that what we need are guarantees that can enhance the credit, that can provide confidence to the investors, so as to put in

investments, that's first. The second that we suggest is to create a large number of companies in the global South who bring about this change, so they become the

developers of projects as the Solar Alliance we are starting a Solar Facility which would provide some amount of risk mitigation finance to projects in Africa. And at the same time another programme is looking at identifying up to 20 startups this year who could in Africa be the Amazons of tomorrow. And the third thing is project preparation this is something you know like the classic valley of death project preparation is typically being carried out by companies who do not have deep pockets. They are often done by startups very locally based on the information that is needed regarding wind or solar availability. The supply chain issues, the power purchase agreement issues, and the legal

issues need to be addressed. I will argue that pushing resources in this direction is the most important issue. I would leave you with therefore these three thoughts: the first is a renewable future is inevitable, the second is while it is inevitable it can become very geographically skewed, and the third is various kinds of investment strategies can help us de-skew this investment. I thank you for your attention and would be delighted to hear Raj's view on these issues. Thank you.

## Tackling the Climate Crisis by Dramatically Expanding Access to Renewable Technologies Across the Developing World: Dr Rajiv Shah, President, The Rockefeller Foundation



As always, we appreciate your extraordinary leadership; good morning everybody; thank you, Ajay, for your comments. It's exciting to be a part of the Solar Alliance and to be here with all of you because what you're doing is so important. Ajay, in your leadership at ISA we know how critically important that entity is as a truly Global

platform to bring people together to advance access in a more dramatic way and I'm thrilled in your comments to hear both high ambition but also a lot of clarity around the risks we face of simply not achieving the mission of equitable access to renewable energy technology if we keep doing what we're doing and therefore we need to do things differently. Our leader for doing things differently in addition to Ashvin is Simon Harford who leads the Global Energy Alliance for People and Planet. Simon is here in the front row so thank you, Simon, for being here, and of course, I thank everyone in this room, I believe everyone in the country, but certainly, everyone in this room, knows of Saurabh Kumar who now leads GEAPP India, and Saurabh is there for those of you who want to get a chance to say hi to him as well. Today's session is in a long line of conversations between the Rockefeller Foundation and entities and leaders in India. I'm always struck when I get a chance to come to visit India which I haven't had a chance to do because of Covid for the last three-plus years. And, how long back our relationship goes, a hundred years ago, we have notes of Rockefeller officers visiting and speaking with medical scientists and public health professionals and institutions here in India 60-70





**So, what is the Global Energy Alliance set up to do? The first is I think it's set up to create a high ambition, we should have a high ambition, and I know in India Simon and Sarah have a very high ambition because honestly renewable energy access is probably the single greatest chance, we have to create inclusive development in the 81 countries we're defining so high ambition.**

years ago we helped invest, of course, in agricultural research and a series of institutions and Rocky docs that help power modernisation of agricultural productivity and parts of South Asia and around the world. And in recent years we've been able to collaborate on everything from Covid vaccination access to the creation of the rapid PCR test, which they gave me yesterday and I'm negative so that's good. But in recent years, the most important new frontier we've embraced is the power of renewable energy technology to be a force for lifting humanity and addressing the inequities that really remain stark and present in India and so many other parts of the world.

So, I'm glad that we get to have this conversation today I want to mention that this concept of leveraging renewable energy technology to address inequity or to create to say it more positively truly inclusive growth in the Indian economy was a concept that was first introduced to me when I was the administrator of USAID working with President Obama, many years ago and Prime Minister Modi had just gotten elected and had come to have dinner with us at the White House, and I was a last-minute addition to the dinner, but the Prime Minister said he said and was well aware of work we were doing in Africa on renewable energy and access to technology, and he said I see what you're doing in Africa and you should be part of helping to build those same types of alliances in India because we have the opportunity to really use access to renewables to drive inclusiveness in society that far outstrips anywhere else in the world and I think that's very true and in fact, that led to some collaborations that were government to government. Government to government is always great. I'm going to try to make the case today that in order to really be successful under Simon and Saurabh's leadership we actually need public-private alliances and that's what the Global Energy Alliance For People And Planet in India will hope to build.

So, when we started this work as the Rockefeller Foundation, solar panels were hard to get, batteries were expensive, smart meters

didn't really exist, mobile payments were an idea but not kind of practically deployed in the context of bringing renewable energy to lower income settings and you have made tremendous progress just since 2010, the cost of solar PV has fallen 88 per cent, the cost of residential solar has decreased 56 per cent the cost of residential solar here in India is about 80 per cent lower than it is in the United States. So, there's a tremendous opportunity now to scale access to things that should be low cost should be high volume should be a kind of frugal Innovation context on the frontiers of the renewable energy technology revolution. The government of course has made big commitments towards a hundred per cent electrification. I think at both the village level and the household level although you are the experts as to how close to that objective the country has come, and I will just say, and I know Simon thinks about this a lot India has the potential in the development of solutions for energy storage for renewables, for metering, for energy management, battery management, and utility grid improvement in all those areas. Innovations from this economy should transform access to renewable



electrification in 80 other countries around the world because India is perhaps the only country that has the scale, the capacity in the private sector, the innovation engine, and the policy oversight to drive aggressive access to renewable electrification in the manner we're describing here and that's important because at the end of the day on a global basis, we are falling behind. 775 million people still live effectively and completely in the dark, 3.6 billion people almost half of the world's population live in 81 energy-poor countries. I mean we include India in that 81 at under the 1000 kilowatt hours per year per capita threshold that we believe is the true threshold for assessing whether energy access drives inclusive growth or not, and I know that's a different definition than the UN definition of quote-unquote energy poverty but it's the one that we believe is more instructive towards the goal of creating inclusive growth and development. And we ask ourselves well why renewable energy is still so inaccessible in so much of the world. Six per cent of solar PV and wind additions in 2021 were rolled out in 81 countries. We're describing only 0.6 per cent in Africa and I think we've concluded, although Simon will correct me if I'm wrong, they're about three reasons: the first is access to technology is still very constrained and inequitable whether it's solar PV or batteries the costs are much higher; actual access to supply is much more constrained. We're living in a world where whether it's raw mineral materials or supply chains based largely out of China some elements of the renewable energy frontier are simply not accessible at price points that are viable broadly in the developing world, the second is the cost of finance, and the Rockefeller Foundation has done a lot of work on the global economic recovery. The truth is we are currently in the midst of unwinding decades of progress against the Sustainable Development Goals because of the debt costs, food costs, fuel and subsidy costs, which have all skyrocketed for many emerging economies as a result, more than 40 countries are facing an acute debt crisis. There's no new liquidity in the public finance system and as a result, the ability to access finance and frankly the risk attributed to most emerging market currencies is much higher than it would have been in a different era five-six-seven or ten years ago. And, third government capacity remains limited, I think in India probably that's the exception here there's quite a lot of capacity but if you look around the world - the regulatory capacity, the ability to set goals, the ability to put in place the kinds of collaborations required to really break through are hard to come by and maybe in India despite the high public sector capacity I keep hearing that, particularly at the state level it's not all efficient in the deployment of that capacity towards these objectives.

So, what is the Global Energy Alliance set up to do? The first is I think it's set up to create a high ambition, we should have a high ambition, and I know in India Simon and Sarah have a very high ambition because honestly renewable energy access is probably the single greatest chance, we have to create inclusive development in the 81 countries we're defining so high ambition. The second is that we should be working hand in glove with governments to set policies, set ambition, understand the use of subsidies, understand the use of public finance, and understand how to create incentives for large-scale access to renewables. The third, and by this is I love saying this because I feel so passionately about it there's no industrial nation on the planet that's achieved universal productive energy access without deep government involvement and real public investments. So, the idea that somehow this should happen without governments is a huge mistake in my view. Third, we should make sure the right technology is accessible - that might mean pooled procurement, and the GEAPP team has done some innovative work in that space that might mean more analytics to understand what optimal target product profiles are for future grid storage technologies

etc. It might mean innovation awards and other incentives that bring those technologies online more robustly but access to technology has to be a critical component. Fourth, blended finance, this will not happen without public and private investment working together. GEAPP has amassed about 11 and a half billion dollars of blended finance, one and a half billion of that are from three foundations - the grant money of 500 million dollars each from the Rockefeller, Ikea Foundation, and the Bezos Earth Fund. We'd like to attract more grant money, more commercial investment, and more development bank commitments, but you know that's where we are now and it's what we have to work with. And, fifth is a genuine alliance mindset and I've been so impressed because I had the chance to spend time yesterday with Saurabh and a community of many of you and others and just hear about how you're addressing the challenges forward, and I just came away inspired that all the talent exists in these rooms can we really embrace an alliance mindset? And to me what that means is all of us appreciating that you are the Global Energy Alliance for People and Planet your creativity, your willingness, to share your thinking, your ability to commit your time, and your institution's capacities to working together is how we will deliver success. So, I want to say the last time I was here, just before Covid, I had a chance to visit Darni outside of Patna in Bihar, and I met with a carpenter who explained to me that before having renewable access through one of the many grids, I think that was an OMC grid. They were reliant on very unreliable government power, and he said with that alone he was not able to invest in power tools or hire people and was running a sort of very, very basic operation. Once he had access to reliable productive power even though it was a little more expensive than any of us would like to sell power at to these communities, he was able to use it able to buy power tools, able to hire three or four people and it was just good to see what inclusive development actually looks like in a village, in a shop with employees who talk about the dignity that comes with the ability to work. So, thank you for your efforts look forward to this conversation, and we'll continue to try to enable your success through the Global Energy Alliance for People and Planet. Thank you.

SNAPSHOT

# ISA HOSTS AN EXPOSURE VISIT TO FRANCE FOR KEY BENEFICIARIES UNDER ITS STAR C INITIATIVE

**The Exposure Visit was helpful for the participants to understand the latest solar technologies and their applications, including the innovations undertaken by INES. This helped the participants understand various technologies’ applicability in their country context.**

In developed countries where solar energy has been significantly mainstreamed, technical facilities and resource centres have played a significant role in creating and reinforcing the ecosystem for the required change by providing expertise to build technical capacity, conducive policies and attracting investments. In Germany, the Fraunhofer Institute for Solar Energy Systems; in France - Institut National de l'Énergie Solaire (INES); in India National Institute of Solar Energy (NISE) and in the Netherlands Delft University of Technology had an instrumental role in the early stages of solar energy growth trajectory.

The energy challenge in SIDs and LDCs is not limited to access but also an absence of quality infrastructure, qualification and certification of services and products. Recognising these challenges, the International Solar Alliance (ISA) and the United Nations Industrial Development Organization (UNIDO), with the financial support of the French Government, have embarked on a project to enhance the institutional, technical, and networking capacity of Member Countries by establishing the Network of Solar Technology Application Resource Centres (STAR C).

With an overall objective to establish solar energy quality infrastructure and qualification and certification resources, ISA organised an exposure visit of the project key beneficiaries (Gen Sec Centres and National Focal Points) to France in the month of February to enhance the capacity of the project stakeholders on the deployment of solar energy applications, cutting edge research, innovation, standardisation and testing of solar energy components and applications.

The delegation comprised representatives from the three Global Sustainable Energy Centres GN-Sec Centres (PCREEE, EACREE and ECREE), Focal points of the two project countries (Senegal and Bhutan) and representatives from ISA and UNIDO. The delegation visited Institut National de l'Énergie Solaire (INES) in Chambéry, met with representatives of Kilowattsol and Lyon Confluence in Lyon and interacted with French Government officials in Paris.

On day one, the delegation visited the National Solar Energy Institute (INES) in France, a centre of excellence for solar technologies based at Savoie Technolac on the shores of Lake Bourget. The delegation exchanged ideas with experts in delivering training courses covering forty-five (45) modules and training more than 1,500 trainees each year through its digital and face-to-face platforms. The delegation visited various research and development facilities, including.

**Solar PV research centre:** A research



centre on PV cell and module technology to understand the entire life cycle of raw quartz to make solar cells and modules.

**Solar Roadways:** Innovation on solar roadways to solve multiple issues in transportation and infrastructure; laying solar panels on top of existing roads.

**BIPV (Building Integrated PV):** Serving as building envelope material and power generator, BIPV systems save materials and electricity costs, reduce the use of fossil fuels and emission of ozone-depleting gases, and add architectural interest to the building.

**ECODESIGN:** The next step in photovoltaics is moving towards new recyclable and eco-composite materials, such as natural fibres and recyclable polymer resins.

**Bifacial Solar Panel Park:** Increasing energy generation and improving efficacy. These panels are often more durable because both sides are UV resistant, and potential-induced degradation concerns are reduced when the bifacial module is frameless.

The delegation also discussed various online and hands-on training on residential, tertiary, industrial and agricultural installations: connections to the electrical grid for sale of surplus or total sale, rooftop installation solutions and large ground-mounted power plants, including individual and collective solar hot water production systems and components.

On day two, the delegation visited the Lyon Confluence project, one of Europe's most ambitious city-centre urban regeneration projects. The real estate project has incorporated solar energy production, with numerous photovoltaic panels on the roofs and facades. The idea is to create a neighbourhood that makes people want to live in the city by involving the users. The delegation visited the Porche building rooftop with the community PV systems installed on the roof of the building. On the same day, the delegation visited Kilowattsol, a leading provider of solar technical consultancy in France, assisting all solar stakeholders on the importance of due diligence in financing large solar energy projects. The delegation discussed opportunities and risks in the solar project financing framework based on the project's projected cash flows rather than the project sponsors' balance sheets.

On day three, the delegation interacted with officials from the Ministry of Europe and Foreign Affairs (Divisions for Asia and for Climate and Environment), AFD and the Ministry of Energy Transition in Paris to ascertain the priorities of the French Government on renewable energy transition. The delegation also discussed the key outputs and outcomes of the project funded by the Government of France, including the key activities planned for execution in 2023.

## Key Learnings

The Exposure Visit was helpful for the participants; in particular, the focal points of the two project countries and the GN Sec Centres were exposed to the latest solar technologies and their applications, including the innovations undertaken by INES. This helped the participants understand various technologies' applicability in their country context. The participants understood the training framework being delivered by INES and discussed

challenges in retaining master trainers and multiple approaches to make the master trainer model sustainable. This has high applicability in the project being implemented by ISA and UNIDO. Participants were able to draw parallels to the projects being implemented by INES in Morocco and Senegal. This would help them to replicate the same capacity-building approach for the ISA/UNIDO project in their country. The participants also discussed the potential for collaborating with INES in accelerating national efforts, particularly in the three countries, through technical advisory in policy, regulations, standards, qualification, and knowledge. Future collaborations in one or two countries are expected as an outcome of this visit. The participants also discussed different approaches to address a broad range of demand and supply-side barriers to solar energy certifications and implementing successful projects like a decentralised solar resource centre for advice, pedagogical support and testing in rural areas of Senegal being implemented by Senegal. The discussion provided good insight into certification issues to the participants. It will help them to make certifications more focussed on subject areas in the project being implemented by UNIDO and ISA. The discussion with Kilowattsol on technical issues related to resource assessment of solar energy has helped the participants to understand approaches to remote solar resource assessment and planning. Discussion on solar project financing by Kilowattsol provided a good overview of making large-scale projects successful. The participants highlighted this as a critical aspect to be included in developing the training modules to be developed by UNIDO/ISA project. The model showcased by Lyon Confluence on community power sharing provided a good overview of opportunities and challenges in designing a solar community project. The participants learned to create similar projects applicable to their local country context.

OPINION

# SOLAR PHOTOVOLTAIC WASTE MANAGEMENT

In India, as on 31 Jan 2023, the installed solar power capacity stands at around 63.89 GW, and the nation ranks fourth in solar PV deployment across the globe as of the end of 2022.<sup>2</sup> With an ambitious target of reaching 500 GW non-fossil energy capacity by 2030<sup>3</sup>, solar energy is expected to contribute around 55% of the overall installed capacity numbers estimated at 280 GW.<sup>4</sup>

Since 2010, the Indian solar industry has been on a meteoric rise. With an estimated 25-30 years of life, the current waste generation from solar PV seems insignificant. Still, it is bound to have a more significant impact as the first-generation panels reach their end of life. The International Renewable Energy Agency (IRENA)

estimates the global PV waste to reach 78 million tonnes by 2050.<sup>5</sup> India will be among the top five countries regarding cumulative waste volume for end-of-life PV panels by 2050<sup>6</sup>. Hence there is a requirement to prevent this environmental degradation and create an enabling ecosystem for the PV modules' sustainable and responsible end-of-life management.

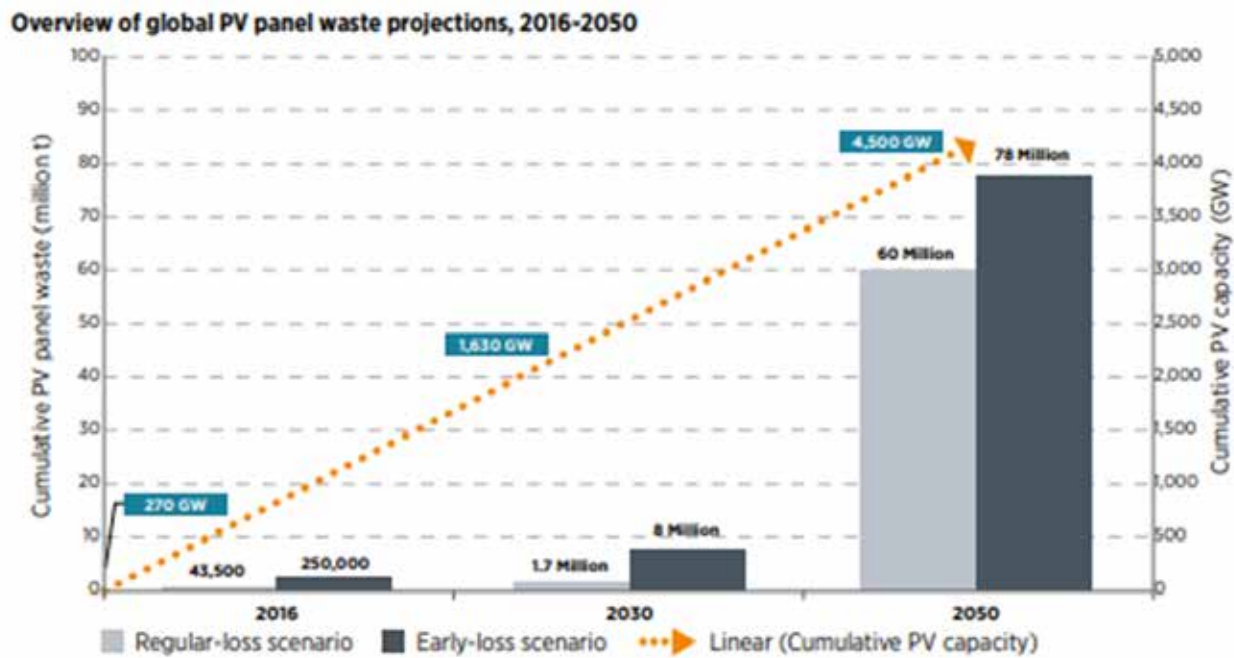
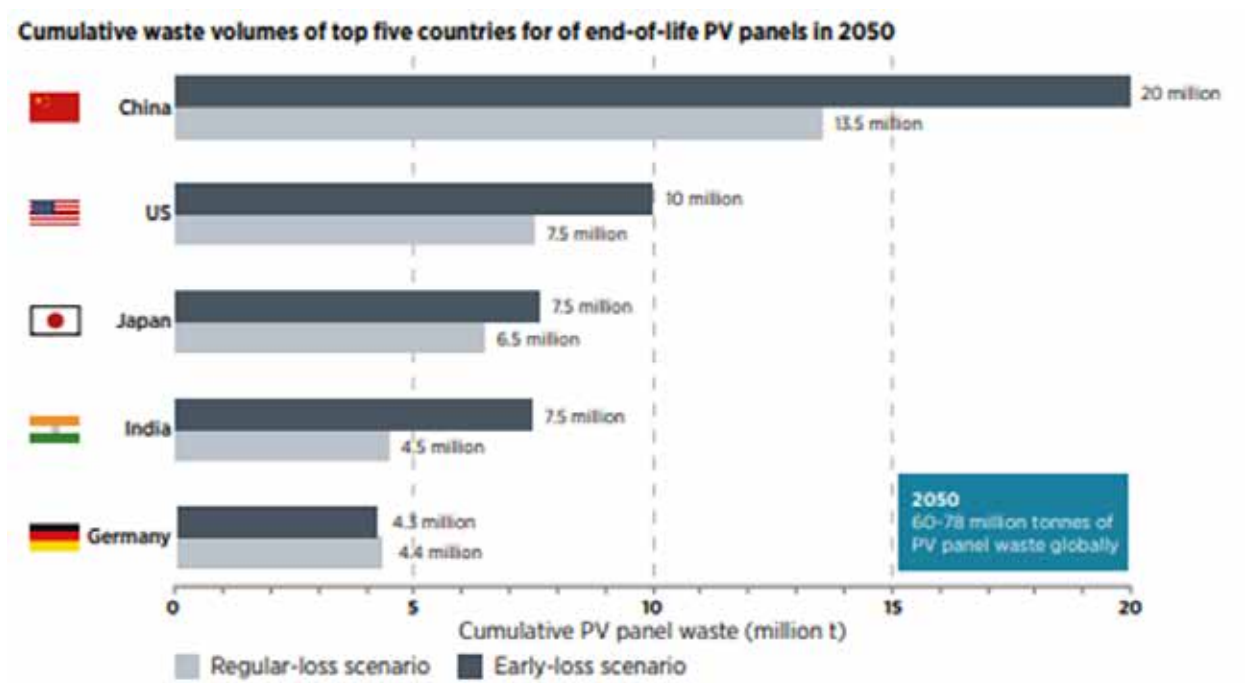


Figure 1: Overview of global PV panel waste projections, 2016-2050 (Source: IRENA)



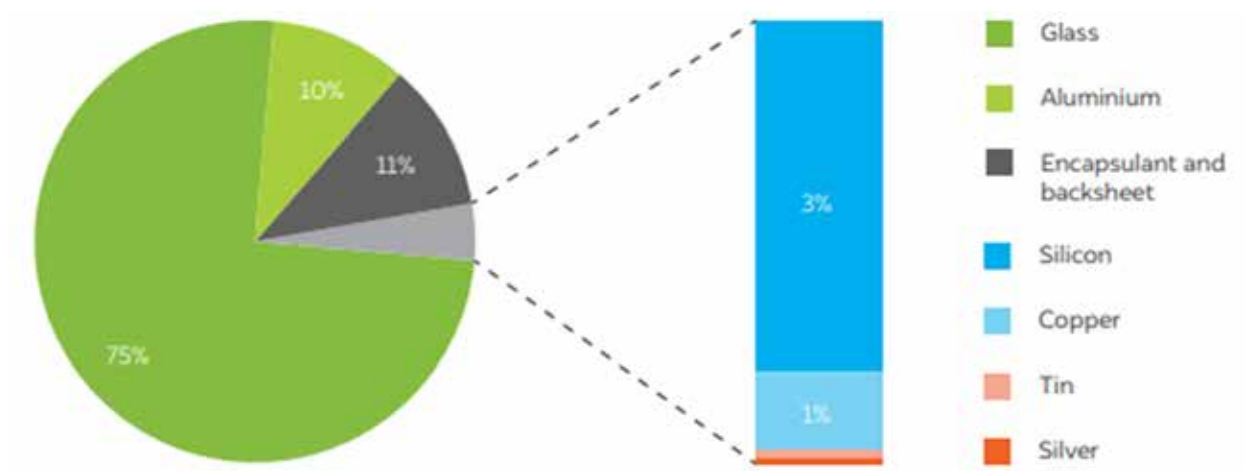




**Figure 2:** Cumulative waste volumes of top five countries for end-of-life PV panels in 2050 (Source-IRENA)

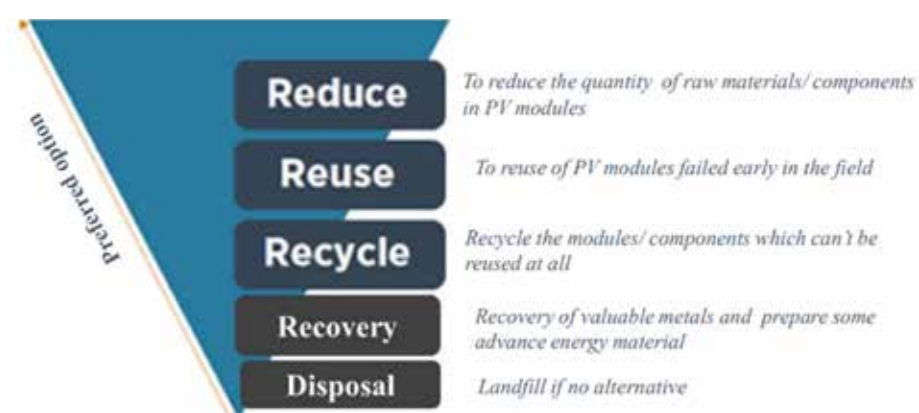
The two leading technologies in the market are C-Si (crystalline silicon) and thin film (mainly Cadmium Telluride, CdTe). Even though aluminium and silicon have relatively less impact, the use of potentially hazardous metals like lead and cadmium is an ecological hazard and carcinogen mainly when exposed to acidification (by leaching<sup>7</sup>) in the case of a landfill which can

contaminate the soil, water, and air. The polymer sheet, when incinerated, produces toxic gases like sulphur dioxide, hydrogen fluoride etc., and volatile organic compounds<sup>8</sup> as well.



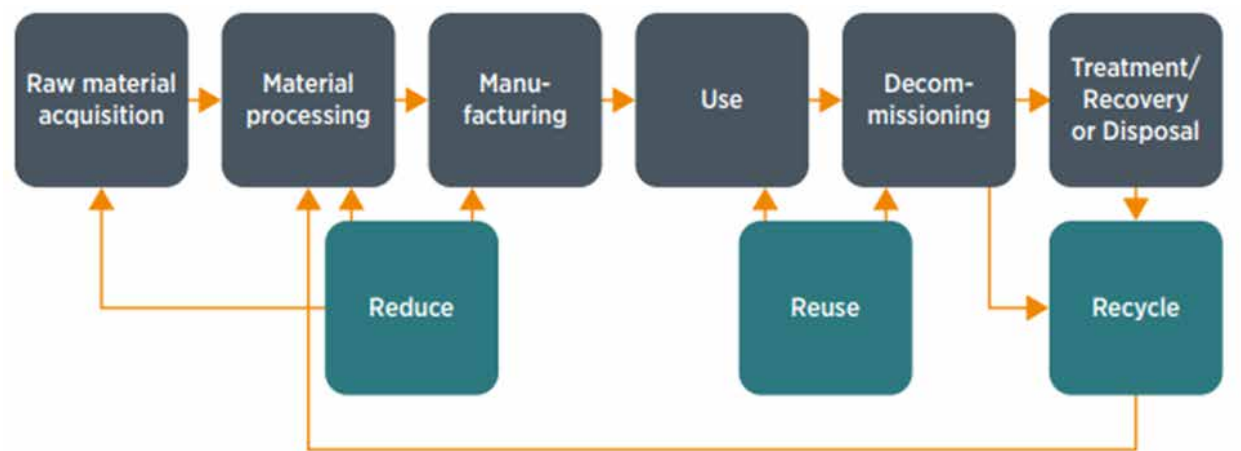
**Figure 3:** Composition of the crystalline silicon module (Source - European Commission DG ENV 2011)

The preferred principles for waste management for the PV panels could use the following approach: Reduce, Reuse, and Recycle with Recovery and Disposal. To maintain the green life cycle of a PV module, it is imperative to include recycling as a part of its value chain.



**Figure 4:** Sustainable Waste Management of PV modules

Recycling waste PV modules will result in a cradle-to-cradle recovery opportunity for strategic metals, providing socio-economic benefits in terms of additional new jobs and boosting the waste collection, transport, treatment and disposal clusters.



**Figure 5:** Process flow diagram of the life cycle stages for PV panels (Source - adapted from Fthenakis (2000))

The European Union (EU) is the front runner in tackling the PV module waste through its WEEE (Waste Electrical and Electronic Equipment) directive, which is based on an EPR (extended producer responsibility) at its core. Producers are liable through

a financial guarantee to cover the cost of collecting and recycling products, reporting, and information responsibility.

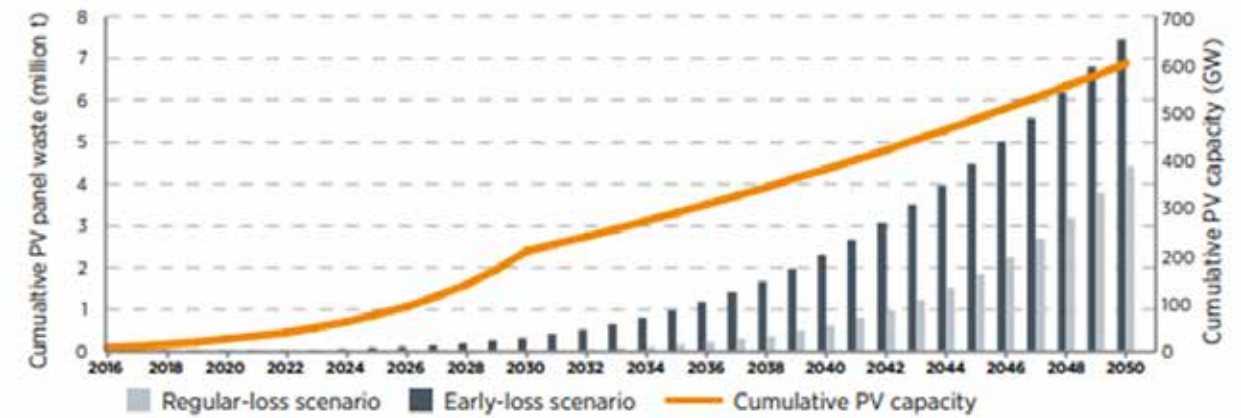
	Annual collectoin targets	Annual recycling/Recovery targets
Revised WEEE Directive (2012/19/EU) from 2018 and beyond	65% (by mass) of all equipment put on the market or 85% of waste generated <sup>13</sup>	85% recovered and 80% prepared for reuse and recycled

**Figure 6:** Annual collection and recovery targets (mass %) under the WEEE Directive (Source - End of Life Management report IRENA)

In China, their 13th five-year plan (2016-2020) states that the principle of extended producer responsibility (EPR) will be imposed on waste treatment in general. Still, a regulatory framework specific to module waste is yet to be adopted. Both Japan nor USA have no national regulations regarding PV modules waste management.

India took the stride towards PV module waste management based on MOEFCC notification on E-waste regulations 2022 on November 2, 2022, with a complete section on solar PV which will come into effect from April 1, 2023, is modelled based on the EU EPR standards. It is likely an increase in the module prices in the range of 10% -15% 9 to incorporate the cost of recycling &

compliance costs based on the EPR regulations. Reverse logistics cost also needs to be considered in the circularity. Better module designs while promoting refurbishment of modules based on a CUF, & investment in recycling technologies with policymakers introducing incentives based on recycling targets could boost all stakeholders (collection, recycling, and recovery) across the PV module waste management supply chain.



**Figure 7:** End-of-life PV panel waste volumes for India to 2050 (Source - End of Life Management report IRENA)





End-of-life management of PV panels will create significant economic opportunities, creating value emergence of new industries with an emphasis on the fact that solar PV waste management will become a critical component of the entire PV value chain to have sustainable long-term development. International Renewable Energy Agency (IRENA) estimates that the

raw materials technically recoverable from PV panels could cumulatively yield a value of up to USD 450 million (in 2016 terms) by 2030. By 2050, the recoverable value could cumulatively exceed USD 15 billion, equivalent to 2 billion panels, or 630 GW.<sup>9</sup>

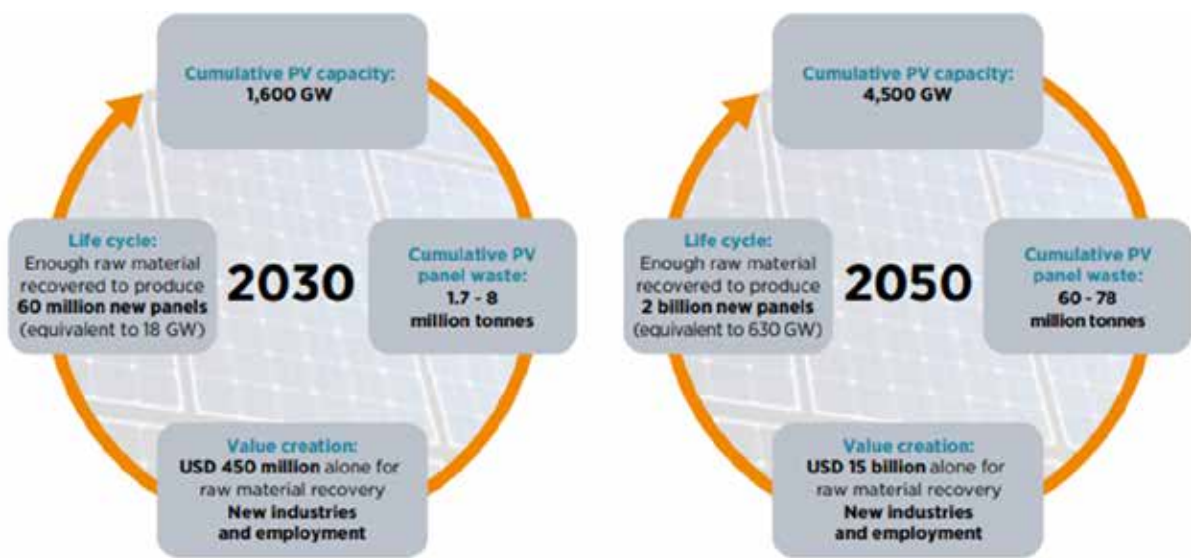


Figure 8: Potential value creation through PV end-of-life management

As a way forward, countries must brace themselves for the rising panel wastes and see this as an opportunity to ensure an enabling regulatory framework, especially for the manufacturers, promoting

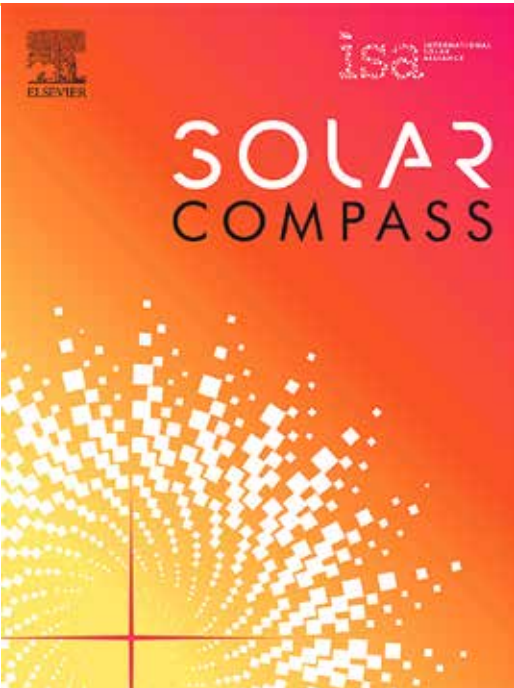
innovation while expanding the waste management infrastructure and transitioning into a sustainable future.

Author: Dwaipayan Chakraborty, Intern, ISA

<sup>1</sup> MNRE || Physical Progress  
<sup>2</sup> Current Status | Ministry of New and Renewable Energy, Government of India (mnre.gov.in)  
<sup>3</sup> <https://pib.gov.in/PressReleasePage.aspx?PRID=1795071>  
<sup>4</sup> Will India meet its 2030 Solar Mission target? | Mint (livemint.com)  
<sup>5</sup> End-of-Life Management: Solar Photovoltaic Panels (irena.org)  
<sup>6</sup> Regular-loss: Assumes a 30-year lifetime for solar panels, with no early attrition; Early-loss: Takes account of “infant”, “mid-life”, and “wear-out” failures before the 30-year lifespan.  
<sup>7</sup> European Commission DG ENV 2011  
<sup>8</sup> Liao et al. 2020  
<sup>9</sup> <https://cen.acs.org/environment/recycling/Solar-panels-face-recycling-challenge-photovoltaic-waste/100/i18>

ISA INITIATIVES

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Solar Compass is ISA’s open-access journal, providing readers worldwide with freely accessible access. And with this Call for Papers, we invite well-researched articles to help us in our mission. All articles are peer-reviewed before publication. Renowned experts plan, solicit articles, and conduct reviews before accepting the articles for publication in Solar Compass.

The current issue, the fifth volume, has an article on inventions and innovations in solar desalination. Other invited articles in this issue include:

**Recent Developments in State-of-the-Art Hydrogen Energy Technologies – Review of Hydrogen Storage Materials** – This article discusses recent developments in hydrogen production and storage. Since green hydrogen is expected to contribute significantly to our goal of net zero carbon emissions, this article will be very important to understand the possibilities of what is achievable.

**Pathways to the Use of Concentrated Solar Heat to Drive High-Temperature Industrial Processes** – Since industrial process heat is responsible for more than 25% of global carbon emissions, it is important to look at concentrated solar heat technologies to drive industrial processes. The authors present an excellent overview of pathways to achieve the goal.

**Solar Desalination: A Review of Recent Developments in Environmental, Regulatory and Economic Issues** – Future clean water supplies must come from solar desalination. While we continue the development of solar desalination technologies, it is important for policymakers to understand the environmental, regulatory, and economic issues related to solar desalination. This article gives an excellent overview of these issues.

**Inventions, innovations, and new technologies: Solar Desalination**

This article briefly reviews inventions, innovations, and

commercialisation aspects of solar desalination technology for clean water supply. It is estimated that by the year 2025, nearly two-thirds of the global population will be affected by clean water scarcity. Solar desalination is one of the most sustainable ways of facing this global challenge with emerging technological advancements.

**Economic evaluation of solar PV electricity prosumption in Ghana**

Residential and commercial facility users are looking for ways to reduce their energy bills, resulting in nano and micro solar energy production in the form of electricity prosumption in contemporary times. However, from the investor’s viewpoint, the most critical factor is the economic viability of the proposed project. Since energy economics is vital to investors, the paper seeks to analyse the economics (financial feasibility and profitability) associated with different types of prosumers in Ghana’s residential and commercial classes.



ISA INITIATIVES

# INTERNATIONAL SOLAR ALLIANCE (ISA) & UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP) LAUNCH PILOT PROJECTS ON SCALING SOLAR APPLICATIONS FOR AGRICULTURE USE IN 10 AFRICAN MEMBER COUNTRIES



**Dr Ajay Mathur**, Director General, ISA, remarked, “Solar energy is Africa’s fastest-growing renewable energy source. This initiative can become the epitome of South-South cooperation and demand aggregation by employing ISA’s convening power. I applaud this achievement which showcases both popularity and impact of ISA’s programmes and, in this case, the vision of its very first programme of implementing decentralised solar applications in rural settings in the form of solar water pumping systems (SWPs) and reinforcing it with technical assistance.”



**Ms Shoko Noda**, Resident Representative, UNDP India, highlighted that “Agrifood systems account for 31 percent of the total greenhouse gas emissions globally. Expanding application of solar technologies in agriculture, especially in energy intensive areas like irrigation, will help reduce emissions while also enhancing farmer incomes. Through this partnership, ISA and UNDP will promote solar applications in agriculture across 9 countries in Africa and Pacific islands.”

ISA and UNDP announced the launch of ISA’s first programme, Scaling Solar Applications for Agriculture Use (SSAAU), in ten African ISA Member Countries: Benin, Democratic Republic of Congo, Mali, Niger, Republic of Sudan, Senegal, South Sudan, Togo, Tuvalu, and Uganda. The programme is slated to be implemented over the next two years and will be financially supported with USD 2 million, which ISA and UNDP have jointly secured.

This pilot programme will provide agricultural workers with enhanced energy access and a sustainable irrigation solution through new and innovative solar water pumping systems deployment models. The larger goal of the initiative is to help Member Countries devise and implement large-scale projects

and schemes to induct solar pumping technology in agricultural practices. This will help agriculture-based communities curb their carbon emissions and enjoy cost efficiencies.

The broad avenues of collaboration will include exploring localised and innovative deployment models, pilot demonstration, skilling programmes and trainings for technical staff to build local capacity, developing best practices documents and detailing learnings from demonstration projects.



## ISA INITIATIVES

# EU – ISA NORDIC ROUNDTABLE WITH FINANCIAL INSTITUTIONS



The EU Cooperation with International Solar Alliance participates in the three day-Nordic Roundtable Discussions across Copenhagen, Oslo, and Stockholm to introduce the ISA's Solar Facility and mobilise investments to scale up solar in Africa.

The EU Cooperation with International Solar Alliance (ISA) was invited to accompany the ISA team for a round of Nordic Roundtable discussions across Denmark, Norway, and Sweden from 1-3 March 2023. Planned in collaboration with the World Climate Foundation, the visit was aimed at introducing ISA's Solar Facility and mobilising investments to scale up solar in Africa, with the potential to expand the scope and coverage in other regions of the ISA. The participants included financial institutions and other energy/climate organisations such as Climate Investment Coalition, PensionDanmark, The Norwegian Energy Cluster, Centre for International Climate Research, Skandia, and Swedish Export Credit Corporation.

The ISA Solar Facility is a blended finance concept comprising a payment guarantee fund, an insurance fund and an investment fund that aims to catalyse solar investments in Africa's underserved segments and geographies, thereby unlocking commercial capital. Joshua Wycliffe, Chief Operations Officer, ISA, stressed the need to increase investment flow urgently and exponentially for the African market and explained ISA's focus on solar mini-grids for small communities and villages in Africa.

In that context, Neelabh Singh, the Team Leader of the EU Cooperation with ISA project, emphasised the support that the EU provides to ISA in areas of academic and B2B collaboration, financing opportunities, events organisation, along with

communication and visibility efforts. He also discussed how the European Investment Bank (EIB) participates in blended finance projects. The Nordic participants in the three roundtables had significant experience in investing in African markets. They understood the need for a facility such as the one initiated by the ISA. It was pointed out that there is a need to look at different development stages of different countries across Africa rather than club the region under one outlook.

ISA aims to address this by promoting localised ideas and solutions through the ISA Solar X Grand Challenge. Pragya Gupta, the Resource Management Specialist at ISA, explained that this challenge aims to encourage entrepreneurship and innovation and discover local solutions to meet the energy gap through solar energy solutions in the African region.

The roundtables were well received, and all agreed that a virtual forum and another round table discussion should be held soon based on EU – ISA's consultation.



# ISA INTERVENTIONS

A Visual Record of Our Ambitions, Activities, and Actions



ISA signed an MOU with Green Hydrogen Organisation to develop a Green Hydrogen Policy Hub under its 'Solar for Green Hydrogen' programme



DG-ISA met Hon. Karolis Zemaitis, Vice Minister, Lithuania and discussed areas of cooperation in scaling solar deployment and addressing the climate challenge



DG-ISA met the President of Germany, Hon'ble Frank-Walter Steinmeier, during the Berlin Energy Transition Dialogue 2023



The staff of the ISA Secretariat visited Rashtrapati Bhawan on the fifth anniversary of ISA's founding



ISA has partnered with the World Climate Foundation to work on Solar Facility to enhance solar financing in Africa



DG-ISA met with Hon. P. Harish, Ambassador of India to Germany, during Berlin Energy Transition Dialogue and discussed areas of cooperation in scaling solar deployment



ISA hosted a media delegation from Latin America and the Caribbean region as part of the familiarisation programme organised by the Ministry of External Affairs, GOI, to help the journalists gain insights into ISA's activities and ongoing projects in the LAC region



DG-ISA met Egyptian Foreign Minister Hon. Sameh Shoukry on the sidelines of the G20 Foreign Ministers Meeting and discussed accelerating the deployment of solar



DG-ISA met with a delegation of the Smart Energy Council at the Australian High Commission, New Delhi, shared insights on the ISA's ongoing initiatives, and discussed areas of cooperation in scaling solar deployment



DG-ISA met with Antoine Michon of La Francophonie in Paris and discussed initiatives like ISA's STAR C and collaborations for scaling up solar



ISA delegation met with Hon'ble Ibrahim Yacouba, Minister of Energy and Renewable Energy, Government of Niger, during ISA Mission to Niger



# ISA IN NEWS

March 2023

Mar 3



ISA & UNDP Launch Pilot Projects on Scaling Solar Applications

[Saur Energy](#)

Mar 14



Vicepresidente de India recibirá a ministro de Cuba

[PL Prensa Latina](#)

Mar 14



L'énergie solaire, grande gagnante de la transition énergétique partout dans le monde... sauf en France

[Le Monde](#)

Mar 14



lo que la transición verde de China significa para el mundo

[Milenio](#)

Mar 17



India: the diplomatic influence of solar energy

[Radio France](#)

Mar 17



Les Membres font avancer les travaux sur les questions

[L'Organisation mondiale du commerce \(OMC\)](#)

Mar 17



Les Membres font avancer les travaux sur les questions

[L'Organisation mondiale du commerce \(OMC\)](#)

Mar 17



Solar Power Congress: Bhagwanth Khuba to address industry leaders

[ET Energy World](#)

Mar 18



Experts mull energy saving measures for high energy consumers in Lucknow

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Finally, making friends, partnerships in Africa

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Energy sector leaders map growth path for renewables

[The Economic Times](#)

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Expanding access to renewable technologies is the best way to lift up people across the developing world

[PV Magazine](#)

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ISA Hosts Lecture on Deployment of Renewable Technologies in Developing World

[Saur Energy](#)

Mar 21



ISA hosts Special Lecture and Panel Discussion on Tackling Climate Challenge

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Mar 23



India-based group helping small island developing states get renewable energy funding

[Antigua Observer](#)

Mar 26



International solar alliance wants to do more for Jamaica

[Jamaica Observer](#)

Mar 28



Afrique subsaharienne: un programme de 2 millions \$ pour promouvoir le pompage solaire dans l'agriculture

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Mar 29



Alianza Solar Internacional mira a Uruguay y busca convencer al gobierno de sumarse, ¿qué pasa?

[El Pais](#)



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