IPVF

WE ARE IPVF :
INSTITUT PHOTOVOLTAÏQUE D'ILE-DE-FRANCE

OUR HISTORY: **BUILDING PV R&D « équipe de France »**

An **ambitious** initiative born out of the French State's desire to create a European industry…

IPVF (Institut Photovoltaïque d'Ile-de-France) was launched at the initiative of the French government in 2013.

We are a **global collaborative research platform** specializing in solar photovoltaic technologies, born out of a public-private partnership.

OUR HISTORY

… relying on the union of excellent academic laboratories…

The IPVF brings together research efforts from complementary units: IRDEP, with EDF and CNRS, and LPICM teams, with X and Total. **They give access to breakthrough technologies.**

By collaborating with 10+ laboratories (a.o. FedPV, CEA-INES) throughout the country, we can call on **a very wide range of skills**.

IPVF

OUR HISTORY

… and private partners, covering most of the photovoltaic value chain.

The IPVF has on board **leading energy companies**, industrial gas specialists, equipment manufacturers and project developers.

These partnerships bring together **industrial and academic research teams**, with the ambition of contributing actively to the European leadership in the photovoltaic sector.

IPVF

IPVF

So what is the job to do for IPVF ?

1. Scientific excellence
2. Value creation for the EU solar PV industry

OUR 6 RESEARCH PILLARS

IPVF RESEARCH

P1. TECHNO-ECONOMIC ANALYSIS AND OPPORTUNITIES

P2. INDUSTRIALIZABLE TANDEM MODULE PEROVSKITE ON SILICON

P3. LOW COST III-V TANDEM CELL ON SILICON

P4. CHARACTERIZATION, MODELING AND RELIABILITY

P5. SOLAR TO FUEL

P6. AT THE FRONTIERS OF PHOTOVOLTAICS

PhotoVoltaic

EUROPEAN TECHNOLOGY
& INNOVATION PLATFORM

STRATEGIC RESEARCH
& INNOVATION AGENDA (SRIA)

OVERARCHING CHALLENGES

Making the energy transition a European success, with PV as a key building block, by:

- Further **reducing the levelized cost of electricity - LCOE** in a sustainable manner to keep/make PV competitive in all parts of Europe while allowing for (the additional cost of) energy system integration and integration in the living environment;
- **Making PV available for a wider range of applications**, with emphasis on flexible integration (buildings, infra, etc.) and dual functionality (agro-PV, etc.), as well as floating systems;
- Making PV components and systems **circular**.

(Re-)building the strategic value chain for PV, by exploiting Europe's technological leadership for:

- **Manufacturing** of high-performance, circular products;
- **Large-scale deployment** in a wide range of applications;
- **Energy system integration**.

CHALLENGES

1

PERFORMANCE ENHANCEMENT & COST REDUCTION

2

LIFETIME, RELIABILITY AND SUSTAINABILITY ENHANCEMENTS

3

NEW APPLICATIONS THROUGH INTEGRATION OF PHOTOVOLTAICS

4

SMART ENERGY SYSTEM INTEGRATION OF PHOTOVOLTAICS

5

SOCIO-ECONOMIC ASPECTS OF HIGH CONTRIBUTIONS OF PHOTOVOLTAICS

CHALLENGE 1

PERFORMANCE ENHANCEMENT & COST REDUCTION

"I SEE SOLAR BECOMING THE NEW KING OF THE WORLD'S ELECTRICITY MARKETS. BASED ON TODAY'S POLICY SETTINGS, IT IS ON TRACK TO SET NEW RECORDS FOR DEPLOYMENT EVERY YEAR AFTER 2022"

Dr. Fatih Birol, IEA

OBJECTIVE 1: PV MODULES WITH HIGHER EFFICIENCIES AND LOWER COSTS

This objective focuses on **improving efficiency and reducing costs of PV modules.** It covers the **various PV technologies** that have already reached industrial maturity level as well as emerging technologies.

> Roadmap 1 | Silicon PV modules

There is potential for further innovation in performance, integration and sustainability enabling large-scale deployment.

> Roadmap 2 | Perovskite PV modules

The long-term vision is that they will be produced at very low costs, be highly efficient and stable and represent a broad scope of embodiments: flexible, rigid, opaque, semi-transparent...

> Roadmap 3 | Thin-film (non-perovskite) PV modules

Module efficiencies should be comparable to current PV technologies within 5 years. Manufacturing should quickly achieve comparable costs compared to currently commercial technologies.

> Roadmap 4 | Tandem PV modules

For 2030, these should reach a market share of more than 5% and should successfully transition to mass market applications, while demonstrating long-term performance comparable to the single-junction technologies, clear advantages in terms of LCOE and in the environmental footprint.

CHALLENGE 1

PERFORMANCE ENHANCEMENT & COST REDUCTION

OBJECTIVE 2: SYSTEM DESIGN FOR LOWER LCOE OF VARIOUS APPLICATIONS

This objective focuses on R&D needs **beyond the PV module**, and on improving the energy yield of systems.

For the past decades, the focus of cost reduction & efficiency improvements has mostly been on PV modules, as they have traditionally been the costliest component of a PV system. With the strong reduction of their prices, other parts of the value chain become more important for lower LCOE.

> Roadmap 5 | Balance of System (BoS) and energy yield improvement

Focusing R&D on other components and activities, such as installation, operation, maintenance, decommissioning, etc.

OBJECTIVE 3: DIGITALISATION OF PV

The digital transition presents key opportunities for the PV sector: not only can new digital technologies allow for the emergence of new solar business models and for the improvement of existing models, they can also be used to reduce costs and increase performance at almost every point of the value chain.

> Roadmap 6 | Digitalization of PV manufacturing

Introducing digital technologies to reduce cost and increase the quality of PV value chain manufacturing

> Roadmap 7 | Digitalization of PV systems

Introducing digital technologies to increase energy yield, and to make PV technology suited for all emerging new applications and a dependable component of the energy system of the future

CHALLENGE 2

LIFETIME, RELIABILITY AND SUSTAINABILITY ENHANCEMENTS

OBJECTIVE 1: SUSTAINABLE AND CIRCULAR SOLAR PV

This objective focuses on reducing PV's impact on our environment, across the entire value chain (production, transport, installation and operation of PV systems).

> Roadmap 1 | Reduce: Low environmental impact materials, products, and processes

Improving PV technology over the entire value chain, with regards to consumption of materials, energy demand and carbon emissions.

> Roadmap 2 | Reuse: Design systems and O&M for reuse

Diverting PV "waste" from the recycling path.

> Roadmap 3 | Recycle and recover:

> Roadmap 4 | Technologies for sustainable manufacturing

Investigating ways of reducing both the energy and GHGs in PV production.

> Roadmap 5 | Eco-labelling and energy-labelling

Focusing on accurate, and up-to-date, life cycle inventory databases, including the Eco-Invent Database, GABI database and the European Commission Life Cycle data information system.

OBJECTIVE 2: ESTABLISHING A LIFETIME-RELEVANT QUALITY ASSURANCE ALONG THE WHOLE VALUE CHAIN AT COMPONENT AND SYSTEM LEVEL AND BANKABLE PV

The most effective strategy for reliable and bankable solar PV is to **prevent the occurrence of failures** and by reducing the impact of failures once they become evident.

A **yield assessment** with reduced uncertainties can lead to a much more favourable business model. **Procurement** is the next important step where extended testing beyond what is prescribed by the standards can increase the confidence of the right choice of PV components.

> Roadmap 6 | Quality assurance to increase lifetime and reliability

> Roadmap 7 | Increased field performance and reliability

Novel technologies make the increased reliability and field performance a continuous industry demand. Solutions available on the market will need to be updated to capture innovation trends.

> Roadmap 8 | Bankability, warranty and contractual terms

> Roadmap 9 | Interoperability and communication standardization,

CHALLENGE 3
NEW APPLICATIONS THROUGH INTEGRATION OF PHOTOVOLTAICS

OBJECTIVE 1: PHYSICAL INTEGRATION OF PV INTO THE BUILT ENVIRONMENT, VEHICLES, LANDSCAPES & INFRASTRUCTURES

The inherent **modularity of the PV** enables it to be **integrated seamlessly into many different objects**, allowing space to be used efficiently.

IT WILL SOON BECOME A PRIORITY IN CITIES TO PUT PV ON EVERY ROOF AND FAÇADE, STARTING WITH THOSE WITH THE BEST ORIENTATION.

PV-enabled products must meet the requirements of the original product, with EU-harmonised rules to create markets large enough to address cost-efficiently. As most of 'IPV' value chains are in Europe, **the integration of PV creates huge opportunities for European value and job creation.**

> Roadmap 1 | PV in buildings
Nearly zero energy buildings are promoted as a decarbonisation solution by regulators, and require the integration of renewable energy systems.

> Roadmap 2 | Vehicle Integrated PV
VIPV enables the electrification of transport system by converting solar energy directly on the vehicle.

> Roadmap 3 | Agrivoltaics and landscape integration
Agrivoltaics allow for the simultaneous use of land for both agricultural and photovoltaic use, while supporting the decarbonisation of the sector.

> Roadmap 4 | Floating PV
The main market driver for floating solar is the search for area in locations with a high population density.

> Roadmap 5 | Infrastructure Integrated PV
The integration into infrastructural objects such as road pavement, noise barriers, crash barriers, dikes, landfills, flyovers and road roofing.

> Roadmap 6 | "low-power" energy harvesting PV
Photovoltaic Energy harvested in low light conditions or artificial light can be used to energize sensors, internet-of-things devices and other electronics.

CHALLENGE 4
SMART ENERGY SYSTEM INTEGRATION OF PHOTOVOLTAICS

OBJECTIVE 1: ENERGY SYSTEM INTEGRATION

PV is growing strong in independent applications at all levels: on roofs or facades of buildings for both domestic and commercial use, as well as for commercial systems of various sizes. In the years to come, **PV should be looked at as active contributors of the integrated grid** utilising dependable forecasting tools for improving the reliability of the complete system.

> Roadmap 1 | More intelligence in distributed control:

This roadmap aims to add intelligence to the PV systems to be responsive to system needs.

> Roadmap 2 | Improved efficiencies by integration of PV-systems in DC-networks

The objectives of this roadmap include developing systems and solutions for which PV as the energy source is directly connected to DC driven systems to achieve improved efficiencies.

CHALLENGE 4
SMART ENERGY SYSTEM INTEGRATION OF PHOTOVOLTAICS

> Roadmap 3 | Hybrid systems including demand flexibility (PV + Wind + Hydro with embedded storage + batteries + green hydrogen/fuel cells or gas turbines etc)

The objective of this roadmap is to develop systems and solutions for which PV, as an integral contributor of interconnected systems, can offer hybrid solutions that better meet needs of the integrated grid.

> Roadmap 4 | Aggregated energy and virtual power plants (VPPs)

The objective of this roadmap is to develop systems and solutions for which PV as an integral contributor of distributed generation can be pivotal in building functional energy communities aggregated and operated through advance distributed controls in hierarchical set up with the integrated grid.

> Roadmap 5 | Interoperability in communication and operation of RES smart grids

Future inverter systems need to be interoperable from the automation/control and communication point of view and they should provide advanced services including auto-configuration of PV plant components. Current issues include the lack in the harmonization of PV plant control and the use of proprietary solutions for monitoring.

CHALLENGE 5

SOCIO-ECONOMIC ASPECTS OF THE TRANSITION TO HIGH PV CONTRIBUTION

OBJECTIVE 1: HIGHER AWARENESS OF BENEFITS THAT SOLAR PV BRINGS

> Roadmap 1 | Wide societal involvement and participation for solar PV deployment

PV is a renewable energy which can be employed by everyone. Facing the need to increase renewable electricity generation to meet the goals of the Green Deal and the Paris Agreement, it is a logical step to utilise PV technology on a wider scale.

> Roadmap 2 | Developing a PV hotbed for urban implementation

PV is the only renewable energy technology that can enable renewable electricity generation in urban and highly-dense spaces throughout Europe. Cities and urban regions will be one of the major boosters to increase the implementation of PV within the current decade.

OBJECTIVE 2: ECONOMIC & SUSTAINABILITY BENEFITS

> Manufacturing phase

If the shares of PV components manufactured increases as a result of a revival of the European solar industry, more than 100 000 jobs in the up-stream sector could also be created. The upstream sector encompasses both low educational jobs and high educational jobs.

> Installation phase

The roll out of PV installations create jobs. These jobs created in the installation phase are spread between low educational jobs, medium educational jobs and high educational jobs.

> Operation phase

In addition, the number of people needed for operation and maintenance will increase as the cumulative PV capacity grows and the age of the running PV systems increases.

SOLAR ENERGY IS THE MOST JOB INTENSIVE POWER TECHNOLOGY.

THANK YOU FOR YOUR ATTENTION

Roch DROZDOWSKI-STREHL
IPVF CEO
ETIP PV Vice-Chairman
roch.drozdowski@ipvf.fr