



Grant Agreement number 842547



Actual execution of the Implementation
Plan for Photovoltaics and monitoring
the Implementation Plan's delivery

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Deliverable 2.5 - Updated map
of the national R&I facilities

Lead beneficiary: CNR

Document	D2.5 – Updated map of the national R&I facilities		
Author	CNR	Version:	4
Reference	WP 2, T 2.4, D2.5 PV Impact GA N°842547	Date:	30/5/22



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About PV IMPACT

PV IMPACT will try out a variety of approaches to stimulate PV research, development and innovation initiatives in Europe. The first part of the project will focus on inviting companies to matchmaking events so they can find partners with whom to work on future projects under EU and/or national funding schemes. The project will also target two specific industrial companies: ENEL Green Power and Photowatt. Another important part of the project will be to monitor progress in PV. Data will be collected on public spending in the EU, on private spending, on the kinds of projects being funded and on the overall performance of PV technology. Forecasts for future spending will be made according to various scenarios. The project will track whether improvements in the performance of technology are keeping pace with expectations and will make recommendations to European funding authorities.

PV IMPACT Partners



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Task	2.4 – Long-term partnership between research actors and industry
Lead author/s	Massimo Mazzer
Contributors	Italian PV stakeholders
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Document history

Date	Revision	Prepared by	Approved by	Description & status
05/03/2020	1	CNR		1st draft
26/06/2020	2	CNR	EUREC	2nd draft (update in M12)
16/07/2020	3	CNR	EUREC	Second draft updated with links to dynamic (web-based) map of the national R&I facilities, know-how and active projects
30/05/2022	4	CNR	EUREC	Final report on the map of the national R&I facilities, know-how and active projects, including the map and list of the stakeholders involved as



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				partners in the national project proposals submitted to the Italian Ministry for funding
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PU	Public	X
RE	Restricted to a group specified by the Consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Executive summary

Several national-scale project proposals were finalised thanks to the workshops and the matchmaking initiatives carried out and supported by PV IMPACT' Work Package 2. Five of these projects were directly connected to the implementation of the strategic plan contained in the White Paper (D2.6). A total of 38 R&I labs belonging to 25 independent subjects, both public and private, were involved in these 5 project proposals. This corresponds to more than 50% of the list of PV stakeholders that have been involved in the groundwork leading to the preparation of either the Italian contribution to the SET Plan (PV) Implementation Plan or the White Paper. Three of these projects have already been funded by the Italian Ministry of Ecological Transition, the remaining two are still awaiting the final evaluation.



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1. Introduction

Work Package 2 aims to strengthen the interactions between R&I stakeholders in Italy to help them realize the Implementation Plan efficiently. Tasks 2.1 and 2.2 concern the ‘Flagship’ Programmes identified for Italy:

- Italian Flagship Programme BIPV/PIPV value chain (Implan Activity 1)
- Italian Flagship Programme Innovative Technologies for Modern Utility-Scale PV (Activity 2, 3, 4)

The Italian contribution to the SET Plan Implementation Plan was a coordinated effort of the whole Italian R&I community stretching from basic research (universities and public research institutions) to industrial research and demonstration (industries).

In order to execute and further develop the plan, a national network of R&I stakeholders of the PV sector was established at the beginning of 2019 as a result of a coordinated effort by the Italian representatives in ETIP-PV, EERA PV-JP and PV-IWG (collectively defined as “Temporary Organising Committee”).

The immediate priorities of the network have been:

1. to promote and monitor the execution of the SET IP at the national level
2. to contribute to the preparation of the PV-IMPACT proposal in support of the three Italian partners of the project, that is Enel Green Power, EURAC Research and CNR.
3. to map the research projects and the research facilities devoted to R&I in the field of PV throughout the country

The network is also looking to act as a diffuse lab with a strong commitment to support the national PV industry.

This PV-IMPACT deliverable is about priority n.3 of the network and is an update of deliverable 2.4. In addition, the final version of this deliverable reports the list and the location of the R&I laboratories involved in the 5 national projects submitted for funding to the Ministry of the Ecological Transition (the calls were formerly managed by the Ministry of Economic Development). The list is a large subset (>50%) of the overall R&I laboratories included in the [PV IMPACT database \(D2.4\)](#) and involved in at least one of the initiatives organised by PV-IMPACT as part of the activities of WP2 (see [White Paper, D2.6](#)).



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2. Objectives

The objectives of the survey that generated this deliverable were:

- to update the map of all the organisations (public and private) involved in R&I activities in the field of PV
- to update, detailed information about the facilities devoted to such R&I activities in order to maintain a clear picture of who is doing what at the national level
- to monitor the overall investments and public funding supporting R&I projects in each one of the two national flagships (Utility-scale PV and BIPV/PIPv)
- to make this information available to the “Temporary Organising Committee” of the National Network for the sake of preparing strategically-sound national projects as defined in the Set Plan Implementation Plan

The updated information collected in this survey has been used for the preparation of the first draft of the [“White paper of the R&I priorities in the Italian PV sector”](#)

3. Target groups and stakeholders

The main target of this action coincided with the stakeholders of the Italian PV sector who are actively engaged in R&I activities. Both public research institutions and industries were included in the survey and the same form was used to collect the information described in the previous paragraph.

There was a strong agreement among the national stakeholders about the need for this action and its objectives.

The main reason was the persistent and significant gap between the results of the R&D activities carried out by public research organisations and the actual R&I demand by the national PV industry.

The most important aspects of this gap are:

1. the lack of facilities devoted to industrial prototyping activities (TRL 4-5 to TRL7-8). Even the most promising R&D activities stop short of TRL 5, that is at the entrance of the so called “death valley of innovation”. No individual organisation can usually find the resources to move further along the TRL scale.
2. a very high level of fragmentation and superposition within the public research sector both in terms of R&D topics and, most of all, in terms of lab facilities. The absence of both a



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coordinated action and a clear strategic plan, have so far undermined the impact of these organisations on the innovation plans of the national PV industry.

This information was also made available to the Italian Ministry for Economic Development (MISE) and to the Italian Ministry of University and Research (MUR), who manage the national R&I funding programmes.

4. Methodology and results

The information was collected by means of a spreadsheet (see [Annex](#)) preloaded with the information each stakeholder provided in 2017 and 2019.

The following are the main fields to be filled for each lab facility in the main worksheet:

1. Description of Equipment/Facility
2. Knot name (top level)
3. Lab Name
4. Lab Address
5. Position in Value Chain
6. Main PV Application
7. TRL of Main Application
8. Secondary PV Application
9. TRL of Secondary PV Application
10. Unique Selling Points (of facility): why is this equipment peculiar/unique with respect to standard equipment?
11. Machine-time Allocated to PV R&I activities
12. Definition of (main) Unit processed by the equipment (example: Silicon Wafer)
13. Max Unit size
14. Max Throughput

The worksheet is organised in such a way to highlight the combined contributions of research organisations and other photovoltaic stakeholders to the key R&I activities as identified by the Implementation Plan of the SET Plan.

Each facility is linked to its current PV applications, to the maximum TRL achieved so far and, most of all, to its unique characteristics (specific expertise of the operators and/or characteristics of the equipment), with respect to standard equipment available on the market.

Additional data about key technical characteristics of the equipment, such as the maximum size of the “processed units” (lab samples, wafers, solar cells, modules, inverters, systems, plants, etc) or the maximum throughput and/or overall capacity of the facility have also been collected.

These are the PV applications proposed in the survey:



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- New PV Materials
- Crystalline Silicon Solar Cells
- Inorganic Thin Film Solar Cells
- DSSC
- Organic Solar Cells
- Perovskite/Hybrid Solar Cells
- Tandem Solar Cells on Silicon
- Concentrator Solar Cells
- Light management solutions (incl. Luminescent Concentrators)
- PV flat panels
- BIPV/PIPV modules
- PV embedded in Fabric & Wearable PV
- Advanced manufacturing machines and production lines
- Combined Heat & Power Generation
- Power Electronics
- Control Electronics
- Characterisation/Test/Monitoring Tools
- Concentrated Photovoltaic Systems
- Smart PV Systems (IOT)
- Building-scale PV systems
- Utility-Scale PV Plants
- PV as Ancillary Service to the Grid
- Solutions for O&M/upgrade/decommissioning of PV plants
- Smart Grids
- Other Applications

A second worksheet is devoted to the key information about the organisation and its more recent involvement in R&I projects on PV funded by either public institutions or private companies.

These are the main fields:

1. Institution/Company Name (top Level)
2. Reference Person
3. Position
4. E-mail
5. R&I Priorities of the Institution (2017)
6. R&I Priorities of the Institution (2019)
7. Full Time Equivalent (person-months) allocated to PV in 2019
8. Total budget allocated to PV-R&I activities in 2019 (k€)
9. Share of the total budget devoted to BIPV/PIPV (Nat. Flagship 1)
10. Share of the total budget devoted to Utility-Scale PV (Nat. Flagship 2)
11. Contribution (% of the total budget) from Public National/Regional funds
12. Contribution (% of the total budget) from European (EC) funds



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13. Contribution (% of the total budget) from Private funds

The full database is constantly updated and is contained in an Excel spreadsheet maintained by the “Temporary Organising Committee” of the Network of R&I stakeholders of the PV sector.

A subset of the database, where any direct link between each facility a specific organisation or laboratory is removed, is then used to generate dynamic tables and maps ready to be embedded in the PV IMPACT web site.

The data is processed using Microsoft PowerBI where the original Excel data are processed dynamically to generate two separate reports:

- the first, containing the **map of the Italian R&I laboratories** with the **corresponding table of all the coordinates and addresses** of each site
- the second containing the **detailed list of the lab facilities** (currently more than 380) independently of their location. Each facility is linked to its current PV applications, to the maximum TRL achieved so far and, most of all, to its “**unique selling points**” (specific expertise of the operators and/or characteristics of the equipment), with respect to standard equipment available on the market. Additional data about key technical characteristics of the equipment, such as the maximum size of the “processed units” (lab samples, wafers, solar cells, modules, inverters, systems, plants, etc) or the maximum throughput and/or overall capacity devoted to PV, are in the database but not directly accessible in this table.

The structure of the database is such that, the connection between each lab facility and the rest of the non-public information, can be easily released to specific stakeholders subject to the consent of the organisation who provided the data.

4 . 2 R e s u l t s

The information collected in this survey was key to evaluate the potential, the strength and the weakness of the National Distributed R&I Lab in view of its involvement in the collaborative strategic projects.

The industrial stakeholders can also benefit from this survey as it makes it easier to identify type and extent of the R&D partnership, the National Distributed lab can provide, particularly in the case of ambitious tasks of industrial-research included in the SET Plan Implementation Plan, such as the development of high-efficiency (>30%) tandem solar cells based on the integration of a “wide-gap” thin-film device in a state-of-the-art Silicon solar cell.

The survey clearly shows that some of the knots of the National R&I Network already act as de-facto hubs for specific topics such as “technologies for high-efficiency PV”, “Perovskite, DSSC and other thin-film PV technologies”, “PV integration in products and building components”, “PV systems for distributed generation”, “advanced O&M and upgrade of PV plants”. A strong coordination between these hubs could be the first effective step towards to establishment of a



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core R&D facility (F3) of the national distributed lab, directly connected to the rest of the R&I network (on one side) and to the national industrial prototyping facilities (on the other side).

The following are the codes containing the **dynamic links to the PowerBI reports** described in the previous paragraph:

1) Map of the Italian R&I laboratories

Code for the incorporation in the PV IMPACT Web Site

```
<iframe width="800" height="600"
src="https://app.powerbi.com/view?r=eyJrIjoiodRhOWQ0MwYtZWVjMS00MDFjLThmNzMtOTNmNGQ4ZWQ2MGZlIiwidCI6IjM0YzY0ZTlmLWQyN2YtNGVhZC1hMwYwLTEzOTdmMGM4NGY5NCIsImMiOiJ9" frameborder="0" allowFullScreen="true"></iframe>
```

Direct access

<https://app.powerbi.com/view?r=eyJrIjoiodRhOWQ0MwYtZWVjMS00MDFjLThmNzMtOTNmNGQ4ZWQ2MGZlIiwidCI6IjM0YzY0ZTlmLWQyN2YtNGVhZC1hMwYwLTEzOTdmMGM4NGY5NCIsImMiOiJ9>

2) Detailed list of the lab facilities

Code for the incorporation in the PV IMPACT Web Site

```
<iframe width="800" height="600"
src="https://app.powerbi.com/view?r=eyJrIjoizjQ5M2RkYjQtOTNjMi00OTExLWI3M2YtNzU3ZGY0NjFiYTA0IiwidCI6IjM0YzY0ZTlmLWQyN2YtNGVhZC1hMwYwLTEzOTdmMGM4NGY5NCIsImMiOiJ9" frameborder="0" allowFullScreen="true"></iframe>
```

Direct access

<https://app.powerbi.com/view?r=eyJrIjoizjQ5M2RkYjQtOTNjMi00OTExLWI3M2YtNzU3ZGY0NjFiYTA0IiwidCI6IjM0YzY0ZTlmLWQyN2YtNGVhZC1hMwYwLTEzOTdmMGM4NGY5NCIsImMiOiJ9>

4 . 3 R e m a r k s

The complete information collected through the survey is accessible by the Temporary Organising Committee of the Italian PV Network. The bulk of these data is made publicly available in anonymous form stripped down of any sensitive information. Industries or other European stakeholders interested in more specific information may access the more sensitive data only after the consent of the owner of the data is expressed in written



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The table below reports the names and addresses of the R&I labs shown in the previous map. The involvement of each lab in the two national flagships, Utility-scale PV and BIPV, is shown in the last two columns. Industrial labs are highlighted in yellow, private R&I institutions are highlighted in green, the remaining subjects are public research or high education institutions.

Stakeholder Name	Address	Utility scale	BIPV
University of Verona	Via dell'Artigliere 8; 37129 Verona		x
University of Padova	via Giovanni Gradenigo 6/B 35131 Padova; Italy		x
CNR Parma	Parco Area delle Scienze 37/A; 43124; Parma; Italy		x
University of Pavia	Via Bassi 6; 27100 Pavia	x	
CESI	Via Raffaele Rubattino, 54, 20134 Milano MI		x
CNR Roma	via Salaria Km 29;300 - 00015 Monterotondo Stazione (RM) - Italy	x	
University Milano Bicocca	Via Cozzi 55; 20126 Milano		x
University Roma Tor Vergata, CHOSE	via del Politecnico 1; 00133 Roma	x	
Olivotto Glass	Viale M. Gandhi, 22, 10051 Avigliana TO	x	
RSE Milano	Via Rubattino 54 – 20134 Milano		x
University of Torino	Via Pietro Giuria 7; 10125 Torino (c/o Dipartimento di Chimica) Via Quarello 15 A; Torino		x
ENEA Roma	Centro Ricerche ENEA Casaccia – Via Anguillarese; 301 - 00123 S.Maria di Galeria (Roma)	x	
CNR Lecce	c/o Campus Ecotekne – Università del Salento via Monteroni; 73100 Lecce; Italy		x
CNR Faenza	Via Granarolo, 64, 48018 Faenza RA		x



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CNR Catania	Strada VIII Zona Industriale, 95121 Catania CT	x	x
CNR Milano	Via Alfonso Corti, 12, 20133 Milano MI		x
CNR Padova	Via Francesco Marzolo, 1, 35131 Padova PD		x
IIT Milano	via Pascoli 70/3; 20133 Milan	x	
CAMLIN Italia	Strada Budellungo, 2, 43123 Parma PR		x
BeDimensional	Lungotorrente Secca, 30R, 16163 Genova GE	x	
University of Perugia	Via Alessandro Pascoli, 06123 Perugia PG	x	
University of Napoli	Via Cinthia, 80126 Fuorigrotta, Napoli NA	x	
University of Catania	Via S. Sofia, 64 95123 Catania	x	
ENEA Portici	Porto Del Granatello 17 - 80055 Portici	x	
RSE Piacenza	Strada della Torre della Razza, 29122 Piacenza PC		x
EURAC Research	Via A. Volta 13/A - 39100 Bolzano		x
CNR Firenze	Via Madonna del Piano, 10, 50019 Sesto Fiorentino FI		x
University of Siena	Via Roma, 56, 53100 Siena SI		x
Applied Materials Italia	Via Postumia Ovest, 244, 31048 Olmi TV		x
Focchi	805, Via Cornacchiara, 47824, Poggio Torriana RN		x
Politecnico di Torino	Corso Duca degli Abruzzi, 24, 10129 Torino TO		x
FuturaSun	Riva del Pasubio, 14, 35013 Cittadella PD		x
CNR Napoli	R5RP+7P Napoli, Città Metropolitana di Napoli		x
CNR Bari	Via Giovanni Amendola, 122/O, 70126 Bari BA		x
CNR Milano	Dipartimento di Fisica, Piazza Leonardo da Vinci, 32, 20133 Milano MI		x
CNR Roma	Via del Fosso del Cavaliere, 100, 00133 Roma RM	x	x



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RISE Tech	Via Monte Bianco, 18, 35018 San Martino di Lupari PD	x	
ENEA Frascati	Via Enrico Fermi, 45, 00044 Frascati RM	x	

Table 1 - Names and addresses of the R&I labs involved in the 5 national projects

The following table, also reported in the addendum of the White Paper (D2.6), contains the basic information about the five national projects submitted for funding to the Ministry of the Ecological Transition. More details are available in the latest addendum to the White Paper (D2.6)¹.

	Flagship	Type	Budget	State	Partners
1.TANDEM	Utility-scale PV	Industry-led R&D action (TRL4-6)	€3M	Funded 2022-2025	Olivotto Glass, RISE Tech, CNR, ENEA
2.FOURIER	BIPV	Industry-led R&D action (TRL4-6)	€1.7M	Funded 2022-2024	CAMLIN, AMAT, EURAC, Focchi, CNR
3.GoPV	Utility-scale PV	Research action (TRL1-4)	€5M	Awaiting final assessment	ENEA, UniCT, UniNA, UniPV, IIT, UniRoma2, UniPG, BeDimensional
4.CANVAS	BIPV	Research action (TRL1-4)	€5M	Awaiting final assessment	CNR, RSE, CESI, EURAC, UniMIB, UniTO, PoliTO,
5. RdS Commissioning Agreement	Utility-scale PV and BIPV	Research and Development	€20M	Started in January 2022	ENEA, RSE, CNR Subcontractors (Universities)

Table 2 - Basic information about the five national projects submitted for funding to the Ministry of the Ecological Transition

¹ Available on the [PV Impact website](#)



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6. Conclusions

PV IMPACT's Work Package 2 provided a very significant contribution to the actual execution of the SET Plan Implementation Plan of the Photovoltaic sector in Italy. About half of the subjects, actively involved in the three-year execution plan, from the definition of the strategies (i.e. White Paper) to the preparation of the national R&I projects are in the list of partners of these projects. The successful work initiated by PV IMPACT will be inherited by a national association which is due to be formed by September 2022.



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7. Contacts

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8. Annex

FIELD	Entry
Institution/Company Name (top Level)	
Reference Person	
Position	
E-mail	
R&I Priorities of the Institution (2017)	
R&I Priorities of the Institution (2019)	
Full Time Equivalent (person-months) allocated to PV in 2019	
Total budget allocated to PV-R&I activities in 2019 (k€)	
Share of the total budget devoted to BIPV/PIPV (Nat. Flagship 1)	
Share of the total budget devoted to Utility-Scale PV (Nat. Flagship	
Contribution (% of the total budget) from Public National/Regional f	
Contribution (% of the total budget) from European (EC) funds	
Contribution (% of the total budget) from Private funds	

Figure 8-1 PV Network and facilities_template_knots input

#	Description of Equipment/Facility	Knot name (top level). (select from menu)	Lab Name Example: Department of Chemistry	Lab Address (select from menu)	Lab Address (manual entry)* Example: Bologna, Via Selmi, 2: 40126
1					
2					

Figure 8-2 PV Network and facilities_template_Virtual lab input – fragment



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Pos	Value Chain			
1	Computer Simulation/Modelling			
2	Synthesis of New Materials for PV applications			
3	Material Characterisation			
4	Thin Film Deposition & Post-Deposition Treatments			
5	Lab-scale Solar Cell Processing and Fabrication			
6	Characterisation of Lab-scale Solar Cells			
7	Development of Prototype PV Modules for Utility-Scale applications			
8	Development of BIPV/PIPV Prototype Modules			
9	Development of Prototype Modules for Combined Heat&PV-Power Generation			
10	Accelerated Lifetime Test of Prototype PV Modules			
11	Development of new BOS and Energy Storage solutions			
12	Development of Innovative Building-scale PV systems			
13	Product Certification			
14	Solar Cell Manufacturing			
15	PV Module Manufacturing			
16	Manufacturing of power electronics for PV systems			
17	Manufacturing of Products for control electronics, domotics & PV plant monitoring			
18	Test & Field Assessment of PV products			
19	Planning and Design of PV plants			
20	Installation of PV plants			
21	PV integration in power grids			
22	O&M of PV Plants			
23	PV end-of-life management			
24	Other			

Figure 8-3 PV Network and facilities_template_value chain



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Current Application	TRL
New PV Materials	1 basic principles observed
Crystalline Silicon Solar Cells	2 technology concept formulated
Inorganic Thin Film Solar Cells	3 experimental proof of concept
DSSC	4 technology validated in lab
Organic Solar Cells	5 technology validated in relevant
Perovskite/Hybrid Solar Cells	6 technology demonstrated in rele
Tandem Solar Cells on Silicon	7 system prototype demonstrati
Concentrator Solar Cells	8 system complete and qualified
Light management solutions (incl. Luminescent Concentrators)	9 actual system proven in operatic
PV flat panels	
BIPV/PIPV modules	
Advanced manufacturing machines and production lines	
Combined Heat & Power Generation	
Power Electronics	
Control Electronics	
Characterisation/Test/Monitoring Tools	
Concentrated Photovoltaic Systems	
Smart PV Systems (IOT)	
Building-scale PV systems	
Utility-Scale PV Plants	
PV as Ancillary Service to the Grid	
Solutions for O&M/upgrade/decommissioning of PV plants	
Smart Grids	
Other Application	

Figure 8-4 PV Network and facilities_template_applications

