



Annual Report of the Implementation Plan Working Groups 2021

Fields marked with * are mandatory.

Welcome to the **SET Plan 2021 reporting exercise**.

This survey is designed to monitor the progress made by the Implementation Working Groups (IWG) in achieving the targets and activities set out in the respective Implementation Plans. Each IWG is asked to monitor the progress of activities under the Implementation plans and feed the relevant information to the Strategic Energy Technologies Information System (SETIS). In order to facilitate the collection of information from the IWG, SETIS has created the following template. The template is based on the 2020 questionnaire, and incorporates the changes agreed during the IWGs Assembly and the bilateral meeting of March and April 2021.

Compared to previous editions, this year **Reporting Exercise** will focus on building a narrative around the progress achieved in each implementation working group. The aim is to develop a report that has a broader reach compared to previous editions, communicating the value of the SET Plan and its contribution to the European Green Deal to the SET Plan Community and broader public.

This year we will ask you to provide exemplary projects (see criteria for selection below) instead of undertaking a mapping of R&I projects at EU, National and Regional level. The scope is to reinforce the narrative on the progress of your IWG with projects that help illustrate the stride made by the IWG and associated technologies in the past years.

Before starting the exercise - please check that the information and questions regarding your IWG (especially Targets and R&I activities) are updated or if they need update. SETIS can modify the section accordingly.

The Survey is structured in the following sections:

1. General information on the IWG structure.
2. Progress and Highlights of the IWG activities in the past 3 years
3. Implementation plan status
4. Status of targets
5. Progress of activities
6. Exemplary projects
7. Synergies with other Implementation Working Groups
8. Synergies beyond the SET Plan
9. Additional suggestions for monitoring

Please complete the Survey and submit it by **Friday July 16th**.

Please note

- The template shared today covers the **13** SET Plan IWGs. Some questions are specific to you IWG, while others are more general.
- Where relevant we ask you to link the current progress of your IWG
- Please note that EU survey allows you to save the inputs and edit them at a later time, as well as download a pdf version of your input.
- Should you have any question/doubt, need assistance with a particular area of the reporting activity or see the need to modify/correct the Survey, please contact SETIS (David.MAGAGNA@ec.europa.eu / Drilona.SHTJEFNI@ec.europa.eu).

This section aims at gather information on the innovation landscape associated to the IWG.

1 Details on the Implementation Working Group

1.1 Please select the IWG you are reporting on:

Photovoltaics

Please provide relevant contact points:

* 1.2 Implementation Working Group Contact

200 character(s) maximum

Christoph Hünnekes, Project Management Jülich (PtJ), Germany (IWG PV Chair) and Wim Sinke, TNO, the Netherlands (IWG PV co-chair)

* 1.3 Email

1.4 Website IWG (if any)

200 character(s) maximum

www.iwg-pv.eu

1.5 Composition of the IWG

Please select Member State and Associated Countries that are part of the IWG

| | Chair | Member | Observer |
|-------------|-------------------------------------|-------------------------------------|--------------------------|
| Austria | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Belgium | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Bulgaria | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Croatia | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cyprus | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Czechia | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Denmark | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Estonia | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Finland | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| France | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Germany | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Greece | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Hungary | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Ireland | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Italy | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Latvia | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lithuania | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Luxembourg | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Malta | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Netherlands | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Poland | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Portugal | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Romania | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| | | | |
|---------------------|--------------------------|-------------------------------------|--------------------------|
| Slovakia | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Slovenia | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Spain | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Sweden | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Iceland (AC) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Norway (AC) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Switzerland (AC) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Turkey (AC) | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| United Kingdom (AC) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

* 1.6 Is there a Technology Innovation Platform associated with the IWG

- Yes
 No

1.7 If yes, please enter the ETIP contact point

200 character(s) maximum

European Technology & Innovation Platform on Photovoltaics (ETIP-PV), Marko Topic, University of Ljubljana (Chairman)

1.8 Email ETIP contact point

info@etip-pv.eu

1.9 Website ETIP

www.etip-pv.eu

* 1.10 Is there a Coordination Support Action Project associated with the IWG

- Yes
 No

1.11 If yes, please enter the CSA Project contact point

200 character(s) maximum

EUREC - The Association of European Renewable Energy Research Centres, Andrej Mišech (Project Officer)

1.12 Email of CSA Project contact point

misech@eurec.be

1.13 Website CSA Project

www.pvimpact.eu

* 1.14 Is there a ERA-NET Project associated with the IWG

- Yes
 No

1.15 If yes, please enter the ERA-NET Project contact point

200 character(s) maximum

SOLAR-ERA.NET c/o NET Nowak Energy & Technology Ltd., St.Ursen, Switzerland

1.16 Email of ERA-NET Project contact point

info@solar-era.net

1.17 Website ERA-NET Project

www.solar-era.net/

* 1.18 Is there an Industrial association linked with the IWG

- Yes
 No

* 1.22 Is there an additional project/group linked with the IWG (e.g. 2nd ERA-NET project) or other European coordination group.

- Yes
 No

2 Implementation plan status

* 2.1 Is the implementation plan still in its original formulation (2017)?

- Original Formulation - The Implementation Plan is still in its original formulation
 Revised - The Implementation Plan has been revised with updated targets and R&I activities

- Under Revision - The IWG is currently revising the Implementation Plan, target and R&I activities.

3 Progress and Highlights of the IWG activities in the past 3 years

* 3.1 Please reflect on the key progress achieved by the IWG over the past few years. Please highlight where possible how the work of the IWG has contributed to significant learning for the sector.

1. What are the success stories / key achievement of your work?
2. What's the contribution of your IWG in meeting the goals of the 10 SET Plan Actions?
3. What's the role of your IWG in contributing to key EU ambitions - Think of the EU Green Deal, the Horizon Europe Mission, or specific EU Strategies (Hydrogen, Offshore Renewable Energy, Renovation Wave, REDII, Sector Integration, more)

Text of 10 to 1500 characters will be accepted

Since start of IWG PV in 2019:

- Continue close collaboration of TWG PV with ETIP PV (Co Chair of IWG PV is also Vice Chair of ETIP PV) to optimally align IWG KPIs and IP with the new ETIP PV Strategic Research and Innovation Agenda (SRIA; to be published Q4 2021) and reflect important PV sector developments;
- Establish close collaboration with CSA (project PV Impact) to get overview of funding landscape in Europe and funded topics/projects;
- Use above collaborations for a close exchange in the CETP SRIA process to coordinate input for a joint picture of PV innovation landscape and priority areas in Europe;
- Set up IWG PV website (work in progress) to provide an overview and contact point, especially for MS to collect and present national funding landscapes, research and innovation priorities and projects, and other relevant information.

* 3.2 Do you expect to revise the Implementation Plan in 2021 or 2022?

Yes

No

3.3 What would be the reasons for the revision?

500 character(s) maximum

Developments in the global and European PV sectors are many and fast. Since the publication of the IP in 2017, important quantitative and qualitative changes have been seen in ambitions and achievements, priorities, and more. For instance: some milestones have been achieved earlier, new technologies gain interest and markets evolve rapidly. For the IP to maintain its role and relevance as reference for implementation of the SET Plan in the field of PV, it therefore needs to be updated.

* 3.4 Please provide the reasons behind the ongoing revision of the original Implementation Plan.

- Targets and R&I activities are being revised taking into account updated Strategic Research Agendas or other key industrial developments
- Revision of the Implementation Plan to align the work of the IWG with the EU Green Deal and other relevant policies for the execution of the Green Deal
- Other (please state)

3.6 Highlights / Key results available from relevant associated initiatives [optional]

If available, please report key results stemming from associated initiatives that highlight the role and work of your IWG. For example if an ETIP / ERA-NET / CSA project is supporting your IWG and produces an annual report.

1500 character(s) maximum

www.pvimpact.eu

3.7 Ambitions of the IWG.

Please use the following box to reflect on how the updated (or soon to be updated) Implementation Plan will help meet the SET Plan targets and deliver on EU energy policy. *[optional]*

The (to be) updated Implementation Plan is foreseen to contain updated targets and KPI's, but may also to adopt an optimized overall structure in view of the alignment with the ETIP PV and CETP SRIA's.

The 2017 IP is organised along the lines of R&I Activities:

1. PV for BIPV and similar applications;
2. Technologies for silicon solar cells and modules with higher quality;
3. New technologies & materials;
4. Operation and diagnosis of photovoltaic plants;
5. Manufacturing technologies;
6. Cross-sectoral research at lower TRL.

The 2021 ETIP PV SRIA (as well as the CETP SRIA) is organised along the lines of Challenges:

Overarching Challenges:

1. Making the energy transition a European success
2. Supporting economic recovery and building the value chains for renewables.

Challenge 1: Performance enhancement and cost reduction (through advanced photovoltaic technologies, manufacturing and applications);

Challenge 2: Lifetime, reliability and sustainability enhancements (through advanced photovoltaic technologies, manufacturing and applications);

Challenge 3: New applications through integration of photovoltaics (for diversified and double-use deployment and enhanced value);

Challenge 4: Smart energy system integration of photovoltaics (for large-scale deployment and high penetration);

Challenge 5: Socio-economic aspects of high contributions of photovoltaics (to the Clean Energy Transition).

By adopting these Challenges, a clear and one-to-one relationship with EU climate, energy and industry policies is achieved, with key words: Green Deal, Fit for 55, Recovery Plan, and Industrial Strategy. This will allow close monitoring of working towards PV targets in support of these overall EU policies and ambitions.

4 Status of targets

4.6.3 *Energy Efficiency in Industry targets - Cross-cutting R&I: Systems*

| Systems | Old Target | New Target | Revision |
|--|------------|------------|----------|
| * For 2025-2050 - Target 2.1a: Development and demonstration of solutions, including the needed local logistics, enabling small and large industries to reduce their common energy consumption by 10 to 20% while striving to reduce GHG emissions proportionally. | | | |
| * For 2025-2050 - Target 2.2a: Develop and demonstrate solutions enabling small and large industries to reduce their energy consumption by 20% while striving to reduce GHG emissions proportionally. | | | |
| * For 2025 - Target 2.3a: Implementation of process control and process automation solutions in 10% of plants. | | | |

| | | | |
|--|-----------------------|----------------------------------|-----------------------|
| * For 2025 - Target 2.4a: Mapping of training and skills needs and setting up of curricula (based on knowledge exchange). | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 2.1b: ~15 real industrial symbiosis full scale hubs. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 2.2b: Optimal use of energy from biomass residues and waste residues reaching 20% share in the energy resources. Availability of digital systems to manage energy mix applications in heating and cooling of high energy consuming processes. More than 20% less energy use in capture and purification of CO2. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 2.3b: Implementation of process control and process automation solutions in 20% of plants. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 2.4b: New curricula at university/high schools (capacity building) on innovative skills and education in agreement with the SET-plan technological, advocacy and management needs. Tailor made training and skills development for in-company training based on the new needs (technical, advocacy, management) defined in SET-Plan. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2050 - Target 2.1c: > 200 real scale industrial symbiosis full scale hubs. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2050 - Target 2.3c: Implementation of process control and process automation solutions in 100% of plants. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |

4.6.7 *Energy Efficiency in Industry targets - Chemicals*

| Chemicals | Old Target | New Target | Revision |
|---|-----------------------|----------------------------------|-----------------------|
| * For 2030 - Actions 4.1-6: Demonstration projects to be launched by 2030. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2050 - Actions 4.1-6: Deployment of new technologies between 2030 and 2050. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |

4.6.9 *Energy Efficiency in Industry targets - Iron & Steel*

| Iron & Steel | Old Target | New Target | Revision |
|---|-----------------------|----------------------------------|-----------------------|
| * For 2030 - Target 5.1b: Reduction degree of iron oxide: > 90 % (KPI2a); Replacement rate of fossil carbon by hydrogen injection: > 10 % (KPI2b); Replacement rate of natural gas by H2 in the feed of the direct reduction plant: > 50 volume-% (KPI2c) | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 5.2b: Electric efficiency of the electrolytic cell: > 85% (KPI3) | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 5.3b: Decrease the use of energy per tonne of steel for clean steel making: > 10 % specific energy consumption reduction for a dedicated process (KPI9) | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |

| | | | |
|--|-----------------------|----------------------------------|-----------------------|
| * For 2030 - Target 5.5b: CO2 capture rate from process/off-gases: > 95 % from dedicated gas streams (KPI6) | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 5.6b: Re-use and recycling of solid residues co-generated during the steel production process and reduction of their landfilling rate: internal and external recycling and re-use rate > 85 % (in total) (KPI10); Low-quality scrap input share over the total scrap input increased by at least 50% or more compared to the usual practice for a specific steel quality (KPI11) | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2050 - Target 5.1-6c: Develop all relevant technologies at TRL8 to reduce CO2 emissions stemming from EU steel production by 80-95% compared to 1990 levels by 2050, ultimately leading to climate neutrality. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |

4.6.11 *Energy Efficiency in Industry targets - Pulp & Paper*

| Pulp & Paper | Old Target | New Target | Revision |
|--|-----------------------|----------------------------------|-----------------------|
| * For 2025 - Target 6.1a: Develop integral drying and heat recovery innovations. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2025 - Target 6.3a: Development and piloting of modular technologies. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 6.1b: Demonstration of integral drying and heat recovery innovations in operational industrial environment by 2030. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 6.2b: Demonstration of Process optimisation and electrification in operational industrial setting by 2030. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 6.4b: First commercial implementation by 2030. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2030 - Target 6.5b: Demonstration and implementation of innovative technologies up to 2030. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2050 - Target 6.1c: Market penetration of integral drying and heat recovery system of 40% by 2050, subject to the success of the 'competing technologies' being developed simultaneously. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2050 - Target 6.2c: Demonstration of Paper making without water evaporation technology in operational industrial setting by 2040. Successful demonstration will lead to commercial application, leading to >10 commercial scale plants in 2050. Further market penetration is subject to the success of the 'competing technologies' being developed simultaneously. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2050 - Target 6.3c: Achieve market penetration of modular technology reaching between 10% and 70% in 2050, depending on the specific modular technology and subject to the success of the 'competing technologies' being developed simultaneously. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * For 2050 - Target 6.4c: Market penetration of mild pulping technology reaching 50% by 2050. | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |

| | | | |
|---|---|---|---|
| <p>* For 2050 - Target 6.6c: Continuous development, demonstration and implementation of various new biobased products from forest biomass. The share of emerging bio-based products (other than pulp and paper) will substantially increase as to contribute to the sectors ambition of 50% more added value in 2050. (Currently 3% of European pulp and paper industry sector turnover)</p> | ○ | ● | ○ |
|---|---|---|---|

4.11 Targets - Photovoltaics - Please contact SETIS if you wish to modify this section.

4.11.1 **Photovoltaics - Targets.**

Major advances in efficiency of established technologies (Crystalline Silicon and Thin Films) and new concepts.

| | Still Relevant | Needs Revision |
|---|----------------|----------------|
| <p>* Target 1 Increase PV module efficiency by at least 20% by 2020 compared to 2015 levels</p> | ● | ○ |
| <p>* Target 2 Increase PV module efficiency by at least 35% by 2030 compared to 2015, including with the introduction of novel PV technologies(>50m) at a maximum distance of 50 km from shore with a LCOE of less than 12 ct€/kWh by 2025</p> | ● | ○ |

4.11.2 Please enter for those *Photovoltaics - Established technologies - Targets* that require revision new value and reasoning.

| | New Value of Target [numbers only] | Reasoning |
|----------|---------------------------------------|--|
| Target 1 | | The upgrade of production lines takes longer than 5 years, in particular taking into account the price competition and limited investment funds of the PV manufacturers in the last five years. Hence the target of an increase by 20% in 5 years was really ambitious. Thus, the average module efficiency did not increase by 20%, but with the transition to the new PERC Technology one can already observe modules in the market which go beyond 20% improvement. |
| Target 2 | | Currently, ETIP PV and PV Impact are discussing what technology has to be considered as Standard. Depending on this choice, IWG PV will have to either keep or update 2030 target. A revision for the next reporting period could be possible. |

4.11.3 *Photovoltaics - Targets.*

Reduction of the cost of key technologies.

| | Still Relevant | Needs Revision |
|---|-----------------------|----------------------------------|
| <p>* Target 3</p> <p>Reduce turn-key system costs by at least 20% by 2020 as compared to 2015</p> | <input type="radio"/> | <input checked="" type="radio"/> |
| <p>* Target 4</p> <p>Reduce turn-key system costs by at least 50% by 2030 compared to 2015 with the introduction of novel, potentially very-high-efficiency PV technologies manufactured at large scale</p> | <input type="radio"/> | <input checked="" type="radio"/> |

4.11.4 Please enter for those *Photovoltaics - Reduction of the cost of key technologies* - Targets that require revision new value and reasoning.

| | New Value of Target [numbers only] | Reasoning |
|----------|---------------------------------------|--|
| Target 3 | 50% | For the turn-key system cost reduction a decrease of 50% from 2015 to 2020 was observed. |
| Target 4 | 60% | The initial target is already fulfilled. the concrete new value (60% oer even more) is still under discussion. |

4.11.5 *Photovoltaics - Targets.*

Further enhancement of lifetime, quality and sustainability and hence improving environmental performance.

| | Still Relevant | Needs Revision |
|--|----------------------------------|-----------------------|
| <p>* Target 5</p> <p>Maintain proven system energy output per year at least 80% of initial level for 30 years by 2020 and for 35 years by 2025</p> | <input checked="" type="radio"/> | <input type="radio"/> |
| <p>* Target 6</p> <p>Minimize life-cycle environmental impact along the whole value chain of PV electricity generation, and increase recyclability of system components (in particular: of modules)</p> | <input checked="" type="radio"/> | <input type="radio"/> |
| <p>* Target 7</p> <p>Perform focused research and apply & progress eco-design requirements in preparation of implementing measures supporting maximum energy yield (kWh /kWp) and lowest life-cycle environmental impact</p> | <input checked="" type="radio"/> | <input type="radio"/> |

4.11.7 *Photovoltaics - Targets.*

Enabling mass realization of "(near) Zero Energy Buildings" (NZEB) by Building-Integrated PV (BIPV) through the establishment of structural collaborative innovation efforts between the PV sector and key sectors from the building industry.

| | Still Relevant | Needs Revision |
|--|----------------------------------|----------------------------------|
| <p>* Target 8</p> <p>Develop BIPV elements, which at least include thermal insulation and water protection, to entirely replace roofs or facades and reduce their additional cost by 50% by 2020, and by 75% by 2030 compared to 2015 levels, including with flexibility in the production process</p> | <input type="radio"/> | <input checked="" type="radio"/> |
| <p>* Target 9</p> <p>Recognize the importance of aesthetics in the activities of the implementation of NZEB.</p> | <input checked="" type="radio"/> | <input type="radio"/> |

4.11.8 Please enter for those *Photovoltaics - NZEB and BIPV - Targets* that require revision new value and reasoning.

| | New Value of Target [numbers only] | Reasoning |
|----------|---------------------------------------|---|
| Target 8 | | The 2020 target needs to be checked quantitatively and revised. A quantitative evidence is difficult to achieve due to still not existing mature market. The 2030 target has to be checked in the light of this analysis. |
| Target 9 | | |

4.11.9 *Photovoltaics - Targets.*

Major advances in manufacturing and installation.

| | Still Relevant | Needs Revision |
|---|----------------------------------|----------------------------------|
| <p>* Target 10</p> <p>Make available GW-scale manufacturing technologies that reach productivity and cost targets consistent with the capital cost targets for PV systems</p> | <input checked="" type="radio"/> | <input type="radio"/> |
| <p>* Target 11</p> <p>Develop PV module and system design concepts that enable fast and highly automated installation, to reduce the installation costs of both ground-mounted arrays and PV building renovation solutions, by 2020</p> | <input type="radio"/> | <input checked="" type="radio"/> |

4.11.10 Please enter for those *Photovoltaics - Major advances in manufacturing and installation* Targets that require revision new value and reasoning.

| | New Value of Target [numbers only] | Reasoning |
|-----------|--|---|
| Target 10 | | |
| Target 11 | | An assessment of the situation in 2020 is needed and will be performed. Target needs revision at least in time line. |

5 Progress of activities

This section aims at assessing the progression and prioritisation of the R&I activities of the Implementation Plan; and at understanding whether the current set of activities listed are sufficient to meet the IP targets. SETIS would like to encourage IWGs to evaluate whether new activities may be required in order to understand whether to align the IP to the [European Green Deal](#) and/or to the [Next Generation EU](#) recovery instrument.

Please provide an assessment for each of the activities in the Implementation plan, by using a traffic light system:

- **GREEN** - There are projects addressing this activity
- **ORANGE** - Projects addressing this activity are ready to take-off
- **RED** - No project ready yet. Preparatory work

5.11 R&I activities Photovoltaics - Please contact SETIS if you wish to modify this section.

5.11.1 Activities of the Photovoltaics IWG.

| | Green Projects are addressing this activity | Orange Projects about to take off | Red No progress |
|--|--|---|----------------------------------|
| * 1. PV for BIPV and similar applications | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * 2. Technologies for silicon solar cells and modules with higher quality | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| * 3. New Technologies & Materials | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| * 4. Operation and diagnosis of photovoltaic plants | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| * 5. Manufacturing technologies | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| * 6. Cross-sectoral research at lower TRL | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |

5.14 IWG Review of activities

- * 5.14.1 Based on the review of the activities provided, do you believe that the activities of the Implementation Plan are still sufficient to meet the IP targets or is there a revision of activities needed?
- YES - Activities are still valid to meet the IP targets
 - NO - Activities require revision to align the plan to ongoing policy development

6 Exemplary projects

In this section we ask you to report on the exemplary projects to reinforce the narrative about the progress obtained in the IWG.

Criteria for the selection of Exemplary projects:

Given the differences between the IWG (# targets, # actions, separation in value chains / focus areas / sectors), we do not expect that all criteria will be relevant to your case.

We would like to stress that we expect 4/5 projects from each IWG, a few more or a few less is also fine.

We also would like to remind you that we do not expect projects to fit all criteria, but rather to facilitate you in your selection.

1. They fit with the narrative on the progress of the IWG. (What are the successes of the IWG, what has the IWG help achieve?)
2. They represent good examples, addressing 1 or more targets / activities of the IWG.
3. They can help substantiate the progress in achieving the targets / implementing activities.
4. They have ideally started since the adoption of the Implementation Plan (2017 onwards).
5. Where relevant, existing databases/project lists should be used. Projects can be selected among the projects mapped in the previous years by the IWG, or by other mapping activities – e.g from the associated ETIP project / CSA project.
6. There is no need to cover all of the value chains / focus areas if exemplary projects cannot be found.
7. Replication potential is important.
8. There should be a strong industrial component in the project.

6.1 Exemplary Project #1

6.1.1 Project name

200 character(s) maximum

CHEER-UP

6.1.2 Project website

200 character(s) maximum

<https://cheerup708231729.wordpress.com/>

6.1.3 Please describe the scope of the project, and how its development fits the work of the IWG.

1000 character(s) maximum

Upgraded Metallurgical Silicon is an ecological alternative to solar-grade silicon in terms of energy payback time (50% less) and CO2 emissions (70% less). It also has the potential to reduce the cost of raw material (around 25%). For all this, making UMG a commercial product is an opportunity to re-build European technological leadership in the photovoltaic sector by innovating upstream in the value chain. CHEER-UP will demonstrate that UMG multicrystalline silicon is a competitive alternative for polysilicon to produce high efficiency solar cells, in terms of economics and environmental impact. This scope will be addressed with a Passivated Emitter and Rear Cell architecture (PERC) that incorporates black silicon texturization.

Related IP activities:

Technologies for silicon solar cells and modules with higher quality, Manufacturing technologies

Addressed IP targets:

Reduction of the cost of key technologies ,Further enhancement of lifetime, quality and sustainability and hence

6.1.4 Who's supporting this project (e.g. funding body)?

ERA-Net

6.1.5 Who's taking part in the project?

1000 character(s) maximum

see website

6.2 Exemplary Project #2

6.2.1 Project name

200 character(s) maximum

ANALYST PV

6.2.2 Project website

200 character(s) maximum

<https://www.imec-int.com/en/what-we-offer/research-portfolio/analyst-pv>

6.2.3 Please describe the scope of the project, and how its development fits the work of the IWG.

1000 character(s) maximum

Modern photovoltaic (PV) technologies are highly efficient and productive and can last up to 25 years and more. However, continuous maintenance is needed to keep them operating at top capacity. An estimated 30% of PV plants underperform, and current maintenance practices fall short in reliably identifying faults in PV equipment.

The ANALYST PV consortium will develop a fault diagnosis framework that relies on Internet of Things (IoT) sensors, AI-enabled root cause analysis and automatic image analysis. The proof of concept will be used to simplify practices for preventative PV asset management using the power of data.

Related IP activities:

Operation and diagnosis of photovoltaic plants

Addressed IP targets:

Further enhancement of lifetime, quality and sustainability and hence improving environmental performance

6.2.4 Who's supporting this project (e.g. funding body)?

imec.icon

6.2.5 Who's taking part in the project?

1000 character(s) maximum

see website

6.3 Exemplary Project #3

6.3.1 Project name

200 character(s) maximum

Sundrive

6.3.2 Project website

200 character(s) maximum

<https://www.imec-int.com/en/research-portfolio/sundrive>

6.3.3 Please describe the scope of the project, and how its development fits the work of the IWG.

1000 character(s) maximum

Electric vehicles (EVs) are on an exponential rise around the world. They have the potential to significantly reduce CO2 emissions – but only if charged using renewable energy in a grid-friendly way. While self-charging EVs using roof-mounted photovoltaics offer a unique solution, much R&D is still needed to cut costs and overcome performance and aesthetics-related limitations. SUNDRIVE aims to develop an efficient, reliable, high-power-density and cost-competitive integrated photovoltaic sunroof for electric vehicles.

Related IP activities:

PV for BIPV and similar applications, New Technologies & Materials

Addressed IP targets:

Major advances in efficiency of established technologies (Crystalline Silicon and Thin Films) and new concepts

6.3.4 Who's supporting this project (e.g. funding body)?

VLAIO imec.icon

6.3.5 Who's taking part in the project?

1000 character(s) maximum

see website

6.4 Exemplary Project #4

6.4.1 Project name

200 character(s) maximum

TOP

6.4.2 Project website

200 character(s) maximum

<https://www.enargus.de/search/?q=03EE1080>

6.4.3 Please describe the scope of the project, and how its development fits the work of the IWG.

1000 character(s) maximum

In order to reduce the system costs of PV, it is necessary to increase the efficiency of modules significantly. The advantage of Heterojunction solar cells is the very high efficiency of over 25%, higher yields and lower production costs due to the reduced number of process steps. However, they are also the basis for the highest levels of efficiency of silicon / perovskite tandem solar cells. One of the most cost-intensive and technically challenging processes for both cell technologies is the production of their electrical contacts, which is addressed by TOP.

Related IP activities:

Technologies for silicon solar cells and modules with higher quality

Addressed IP targets:

Major advances in efficiency of established technologies (Crystalline Silicon and Thin Films) and new concepts, Major advances in manufacturing and installation, Reduction of the cost of key technologies

6.4.4 Who's supporting this project (e.g. funding body)?

7th Energy Research Programme of the Federal Government (BMW)

6.4.5 Who's taking part in the project?

1000 character(s) maximum

see website

6.5 Exemplary Project #5

6.5.1 Project name

200 character(s) maximum

GENESIS

6.5.2 Project website

200 character(s) maximum

<https://www.enargus.de/search/?q=0324274>

6.5.3 Please describe the scope of the project, and how its development fits the work of the IWG.

1000 character(s) maximum

The objective of the project GENESIS is the development of novel and enhanced production processes for highly efficient crystalline silicon (c-Si) solar cells with efficiencies up to 23.5 %. The development of the solar cells is based on industrial Si wafers and industrial feasible production processes. The focus is on both, mono- and bifacial solar cells.

Related IP activities:

Manufacturing technologies

Addressed IP targets:

Major advances in efficiency of established technologies (Crystalline Silicon and Thin Films) and new concepts, Major advances in manufacturing and installation, Reduction of the cost of key technologies

6.5.4 Who's supporting this project (e.g. funding body)?

7th Energy Research Programme of the Federal Government (BMWf)

6.5.5 Who's taking part in the project?

1000 character(s) maximum

see website

6.5.6 Do you want to report on 1 more project?

Yes

No

6.6 Exemplary Project #6

6.6.1 Project name

200 character(s) maximum

Symbizon

6.6.2 Project website

200 character(s) maximum

<https://zoninlandschap.nl/projecten/i219/symbizon>

6.6.3 Please describe the scope of the project, and how its development fits the work of the IWG.

1000 character(s) maximum

Goal of the project is to show how to achieve a combination of photovoltaic (PV) energy generation and strip farming that provides a positive business case for the farmer, maintains the use of the land for food production and improves ecological characteristics. The combined use of PV and agriculture will have a low density of solar panels per hectare, and thus a high kWh yield per hectare is needed.

For this reason, the combination of bifacial solar panels and solar tracking will be the PV technology investigated in this project. Solar tracking is relatively new in the Netherlands. In this project the combination of solar tracking with strip farming will be investigated and optimized with respect to finance, ecology and food production. We expect

Related IP activities:

Operation and diagnosis of photovoltaic plants

Addressed IP targets:

Other

6.6.4 Who's supporting this project (e.g. funding body)?

TSE 2019

6.6.5 Who's taking part in the project?

1000 character(s) maximum

see website

6.6.6 Do you want to report on 1 more project?

Yes

No

6.7 Exemplary Project #7

6.7.1 Project name

200 character(s) maximum

PV4.0

6.7.2 Project website

200 character(s) maximum

<https://www.eurac.edu/en/institutes-centers/institute-for-renewable-energy>

6.7.3 Please describe the scope of the project, and how its development fits the work of the IWG.

1000 character(s) maximum

Since the operating and maintenance costs of photovoltaic systems are part of the percentage of investment costs, many O&M companies are working with increasingly narrow margins in an increasingly competitive market. Reduced costs and tight margins often have a negative impact on the overall quality of a PV project. Performance evaluation and the search for reliability along the entire value chain thus take on a new dimension and require the development of innovative methodologies and solutions. The objective of this project is to develop a technological system for the management of the activities of O&M companies according to the principles of industry 4.0, in order to optimize the decision-making process, thus minimizing time and operating cost.

Related IP activities:

Operation and diagnosis of photovoltaic plants

Addressed IP targets:

Further enhancement of lifetime, quality and sustainability and hence improving environmental performance

6.7.4 Who's supporting this project (e.g. funding body)?

ERDF

6.7.5 Who's taking part in the project?

1000 character(s) maximum

see website

6.7.6 Do you want to report on 1 more project?

Yes

No

6.8 Exemplary Project #8

6.8.1 Project name

200 character(s) maximum

Rolling Solar

6.8.2 Project website

200 character(s) maximum

<https://rollingsolar.nl/home>

6.8.3 Please describe the scope of the project, and how its development fits the work of the IWG.

1000 character(s) maximum

The Rolling Solar project aims to catalyze a lasting cross border collaboration between industry, research and stakeholders on photovoltaics, materials, manufacturing, installation, grid, and road infrastructure. This collaboration includes technology development, dissemination and validation of knowledge. Goal is to technically enable local manufacturers and building and construction companies to realize cost effective integration of long lengths of solar cell materials into public infrastructure. As a result, large scale durable electricity generation without additional land use will be enabled close to point of use. For example, PV integrated in all 35,000 km of Dutch bicycle road would generate 15 TWh of electricity per year, equivalent to a CO2 reduction in the order of 5 million tonnes per year.

Related IP activities:

PV for BIPV and similar applications

Addressed IP targets:

Enabling mass realization of NZEB by BIPV, Major advances in manufacturing and installation

6.8.4 Who's supporting this project (e.g. funding body)?

Interreg

6.8.5 Who's taking part in the project?

1000 character(s) maximum

see website

7 Synergies with other Implementation Working Groups

7.1 Please indicate, by ticking the boxes below, if work undertaken in other Implementation Plans has **relevance and can yield significant** for the advancement and the success of the your Implementation Plan.

Please indicate with cooperation has been established.

| | Would like to cooperate | Cooperation has been already established |
|-----------------------------------|-------------------------------------|--|
| IWG Batteries | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG CCS-CCU | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG CSP-STE | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG Deep Geothermal | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG EE In Buildings | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| IWG EE in Industry | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG Energy Systems | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| IWG Nuclear Safety | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG Ocean Energy | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG Offshore Wind | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG Positive Energy Districts | <input type="checkbox"/> | <input type="checkbox"/> |
| IWG Renewable Fuels and Bioenergy | <input type="checkbox"/> | <input type="checkbox"/> |
| Temporary Working Group on HVDC | <input type="checkbox"/> | <input type="checkbox"/> |

7.2 Please indicate the area/areas for collaboration identified *[Optional]*.

| | Collaboration area 1 | Collaboration area 2 | Collaboration area 3 |
|-----------------------------------|---|----------------------|----------------------|
| IWG Batteries | | | |
| IWG CCS-CCU | | | |
| IWG CSP-STE | | | |
| IWG Deep Geothermal | | | |
| IWG EE in Buildings | Active building skins | | |
| IWG EE in Industry | | | |
| IWG Energy Systems | The significant LCoE reduction from PV enables large-scale deployment of integrated PV applications, storage and solar P2X. Implications from this development should be reflected in Energy System strategies. | | |
| IWG Nuclear Safety | | | |
| IWG Ocean Energy | | | |
| IWG Offshore Wind | | | |
| IWG Photovoltaics | | | |
| IWG Positive Energy Districts | | | |
| IWG Renewable Fuels and Bioenergy | | | |

| | | | |
|---------------------------------|--|--|--|
| Temporary Working Group on HVDC | | | |
|---------------------------------|--|--|--|

8.1 Please provide a list of cooperation initiatives that exists beyond the SET Plan community. Please add information on the involvement of Implementation Plan Working Group members and on the relevant activities/targets addressed.

If available provide weblink and start/end year.

| | Initiative | Implementation Plan participation | Relevant targets addressed | Web link [optional] | Start year [optional] | End year [optional] |
|--------------------------|------------|-----------------------------------|---|--|---------------------------------------|-------------------------------------|
| IEA TCP | PVPS | through Member States | Integrated PV (BIPV, VIPV), Operation and diagnosis of photovoltaic plants | www.iea-pvps.org | | |
| IRENA | | | | | | |
| Mission Innovation | | | | | | |
| Clean Energy Ministerial | | | | | | |
| Other 1 | | | | | | |
| Other 2 | | | | | | |
| Other 3 | | | | | | |

9 Additional suggestions for monitoring

9.1 Please list any additional aspects relevant to the Implementation Plan that should be monitored and/or any specific metrics to measure progress.

These will taken into account for the next reporting excercise.

Please consider measures that could be implemented across the 14 IWGS.

| | Additional aspects to be monitor | Metric | Baseline | Reasoning |
|---|---|--------|----------|-----------|
| 1 | Key Performance Indicators for each activity of the IP are still under development. Issues are the availability of data and the definition of baselines. IWG PV is supported by PV Impact and EERA. | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |

Useful links

[Green Deal Communication \(https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf\)](https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf)

[Next Generation EU \(https://ec.europa.eu/info/sites/info/files/communication-europe-moment-repair-prepare-next-generation.pdf\)](https://ec.europa.eu/info/sites/info/files/communication-europe-moment-repair-prepare-next-generation.pdf)

[SETIS \(https://setis.ec.europa.eu/\)](https://setis.ec.europa.eu/)

[SETIS 2019 Report \(https://setis.ec.europa.eu/sites/default/files/setis%20reports/set_plan_report_2019_online.pdf\)](https://setis.ec.europa.eu/sites/default/files/setis%20reports/set_plan_report_2019_online.pdf)

Contact

[Contact Form](#)