Cost-effective and innovative solar energy integration in stock and new buildings
- how to generate revenue with your building façade and roof

Standardisation / Qualification of BIPV system

SESSION II: Supporting tools to help implementation of the innovative solar solutions

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Advanced standardization schemes to support BIPV

1. Status of BIPV in current standardization schemes
2. Overcome barriers and identification of differentiating features
3. Develop and promote dedicated procedures to support BIPV
4. Results and expectations
5. Next steps to support BIPV growth

1. Status of BIPV in current standardization schemes

- Innovation and beskope elements in current standards
  - BIPV is an alien (as any innovation or tailor-made solutions from standard point of view)

  > Building part
  > Energy part
  > Any other contribution to assess ?

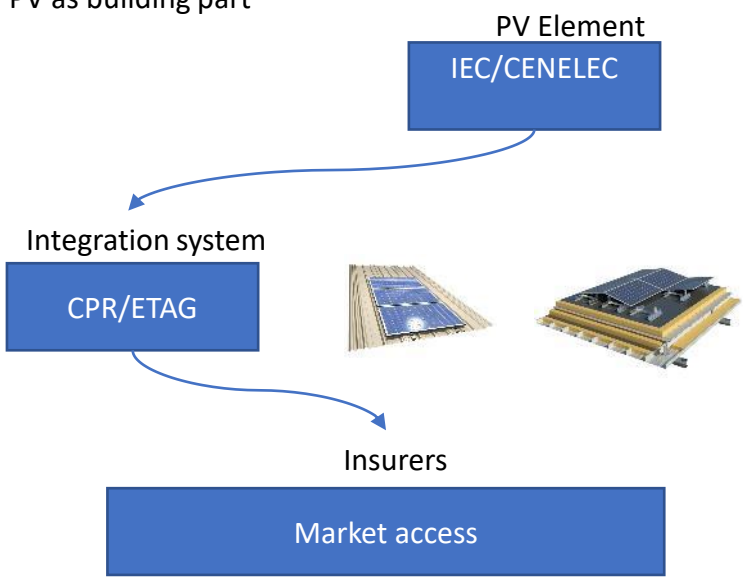
- Normative framing area
  - CPR and building codes (ETAG, national requirements..)
  - IEC 61215 / 61730 + EN 50583

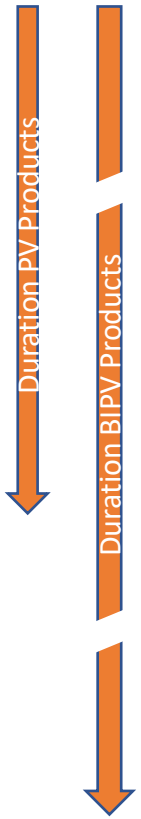
- Report of the situation
  - No “standard land” with a lack of connections
  - No harmonization

1. Status of BIPV in current standardization schemes

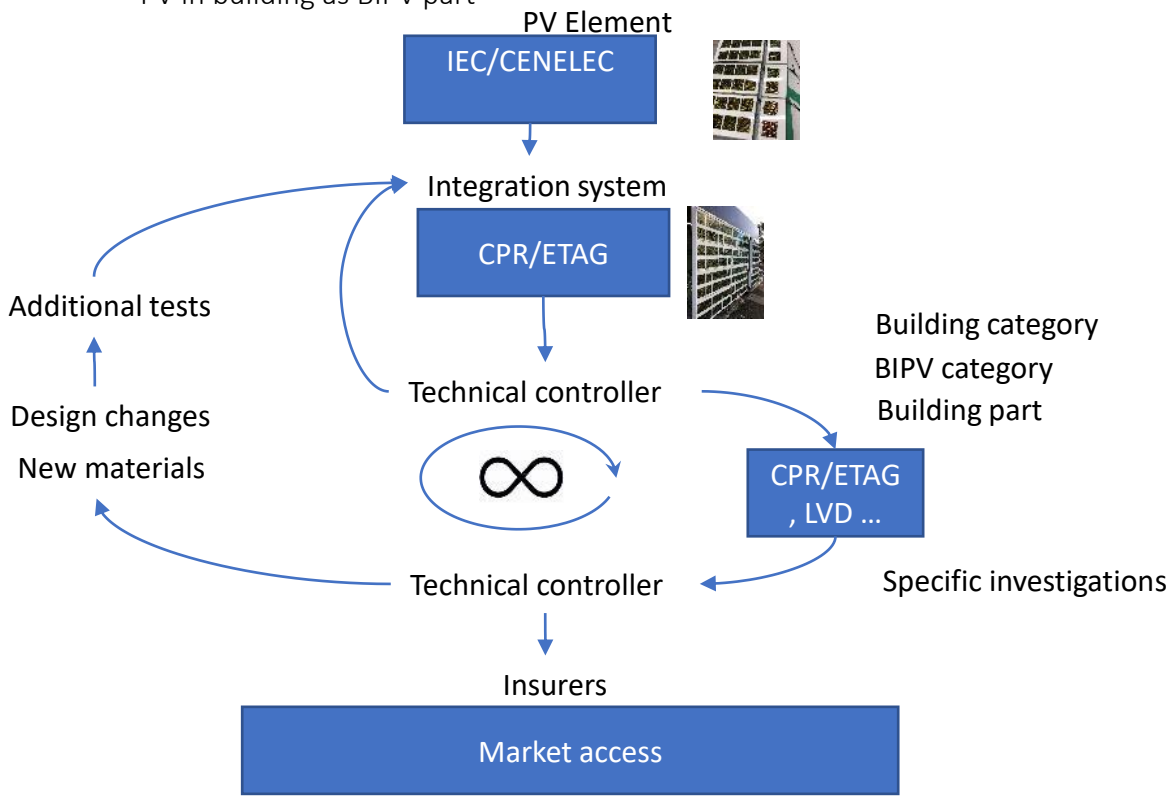
- Example of assessment approach PV / BIPV

- PV as building part





- PV in building as BIPV part

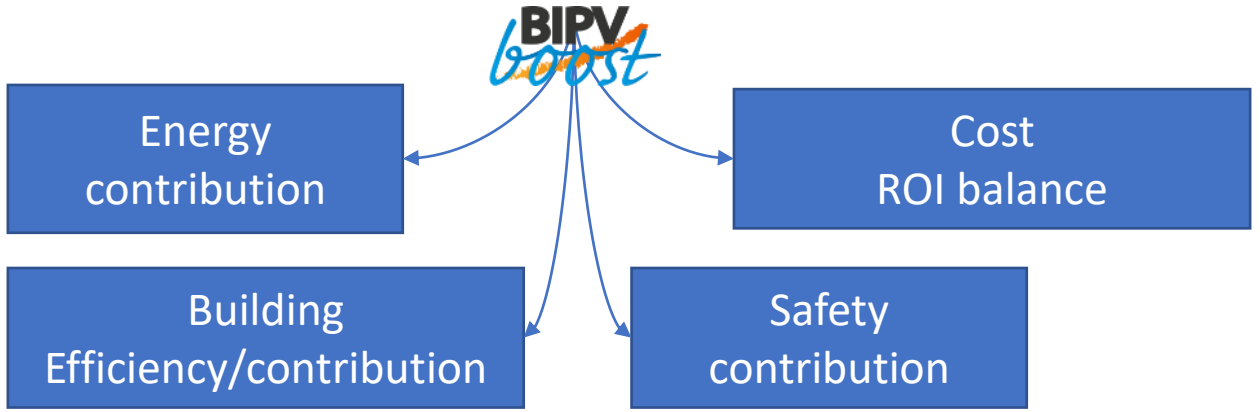


2. Overcome barriers and identification of differentiating features

- What has to be assessed, addressed by an active building part
- Primary functions to be filled

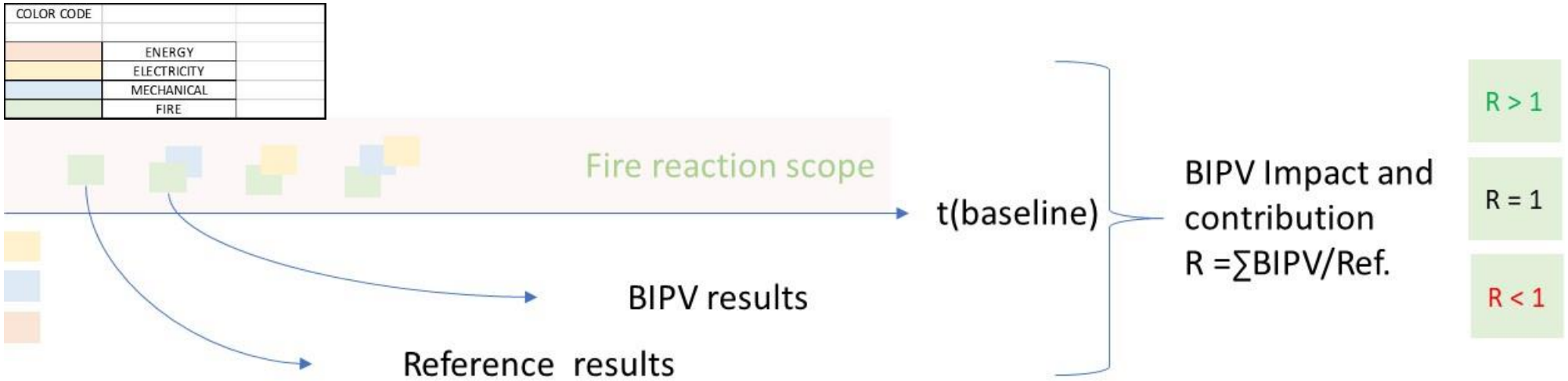
- Building contribution
  - User protection and safety
  - Mechanical stability
  - Insulation
  - Air management
  - Durability …
- Electric contribution
  - Electric safety
  - Durability
  - Energy management

- Combination of both, how to assess multifunctionality ?
  - Highlight features
  - Definition of NTP to support specific and fair value assessment
  - Usable and explicit results



2. Overcome barriers and identification of differentiating features

New working pathway to develop specific BIPV assessment solution
Validate this NTP by experimentation (indoor and outdoor)
Realistic test conditions / system wide
Most demanding requirements



3. Develop and promote dedicated procedures to support BIPV

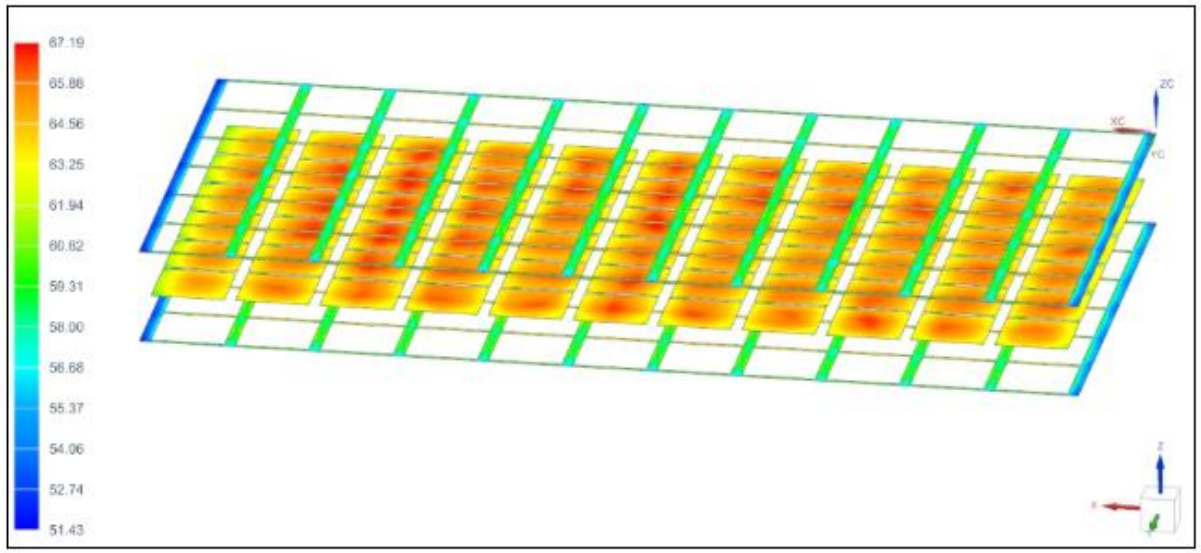
- Properly assess the differentiating elements
  - NTP appropriate and suitable for BIPV
  - Operating conditions as a key factor

- complete/renew procedures adapted to new components Results and expectations
  - Address specific contribution of BIPV
  - Take into account of fields not yet evaluated
  - Close ties between building/electrotechnic parts (to not start from scratch)
  - More demanding procedure to validate all cases (worst case tested)

3. Develop and promote dedicated procedures to support BIPV – Energy Economy (Tecnalia)

Achievements:

- NTP EE01: Determination of thermal transmittance (**U value**) for BIPV glazed components depending on temperatures, JB
- NTP EE02: **SHGC value** of BIPV glasses depending on electricity extraction, solar cells transmittance/density, JB
- **Maximum temperature** in PV-IGU

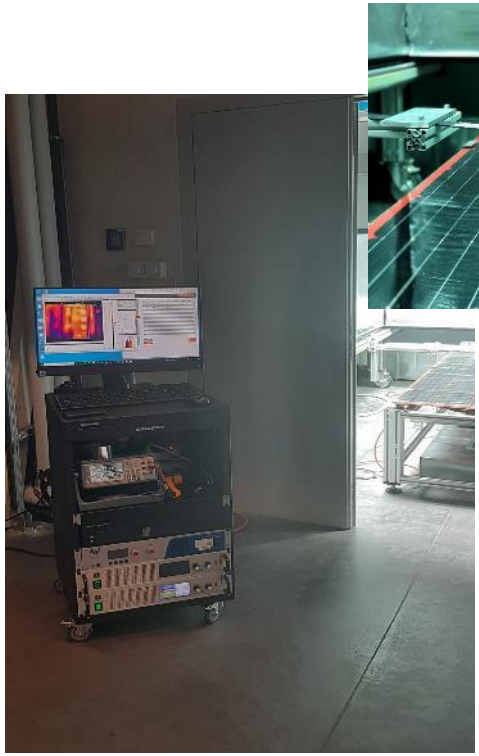


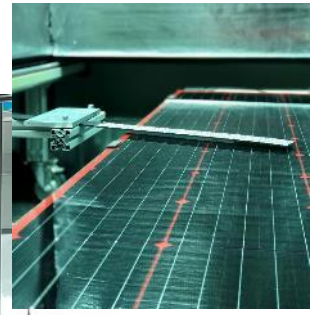
> BIPV contribution on building energy management

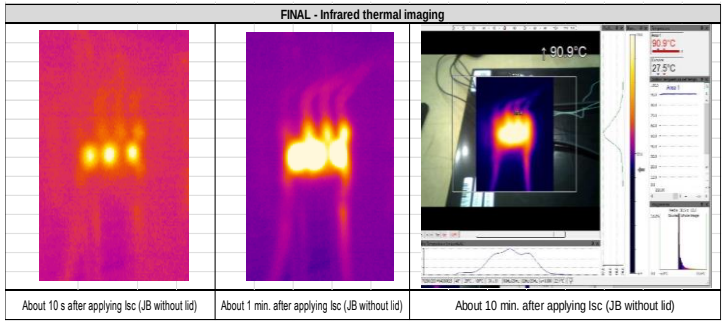
3. Develop and promote dedicated procedures to support BIPV – Electrical safety (Supsi)

Achievements:

- NTP EL01: Determination of BIPV **maximum temperatures** in non-conventional scenarios and shadowing effects
- NTP EL02: Electrical insulation monitoring **under ageing stress and time reduction** in main ageing tests
- NTP EL03 : Test adequacy of the **thermal design** and long-term reliability of the **bypass diodes**

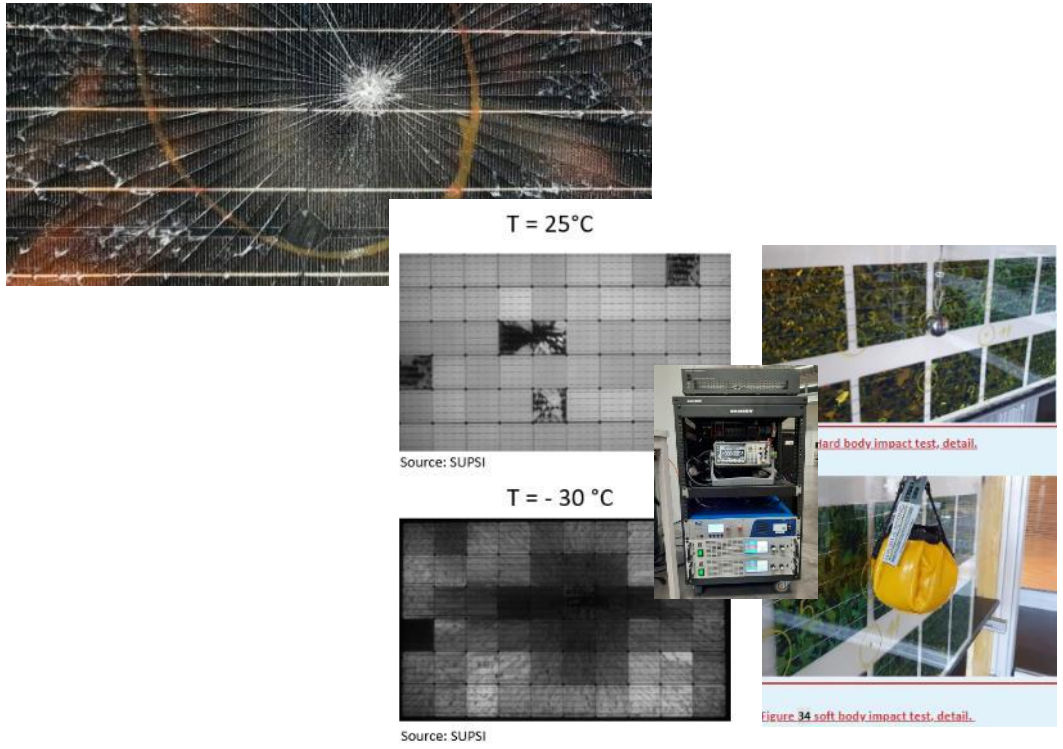






> Reduce number of samples, tests simplification, reduction of test duration

3. Develop and promote dedicated procedures to support BIPV – Mechanical safety (Supsi)



Achievements:

- NTP MECH01: Determination of BIPV impact resistance under **temperature stresses**
  - Procedure for different product families
  - Gathering of effects on different product classes and temperatures (cells/glass breakage, insulation)

> Different product families, climate influence on mechanical resistance

3. Develop and promote dedicated procedures to support BIPV – Fire safety (CSTB)

Achievements:

- NTP FR01: Determination of BIPV fire resistance **ROOF** under severe condition
- NTP FR01: Determination of BIPV fire resistance **FACADE** under severe condition

Demonstrate BIPV performance threshold as traditional building component with electricity load stress applied on each BIPV category.

> No additional fire risks under severe conditions, increase confidence in BIPV

3. Develop and promote dedicated procedures to support BIPV – Fire safety (CSTB)

3. Develop and promote dedicated procedures to support BIPV – Fire safety (CSTB)

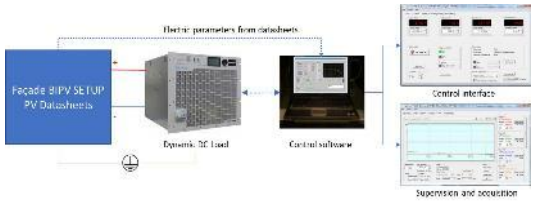
- From Fire point of view

	Av.(R_0)	Av.$_{load}$.(R_1)	Std.dev.
FIGRA(0.2) W/s	1161.3	1017.3	-101
THR(600) M	21.3	14.7	-4.6
SMOGRA cm2/s2	27.1	18.4	-6.2
TSP(600) m2	61.5	35.8	-20,7

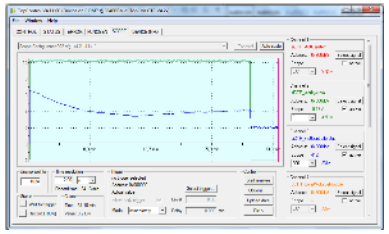
Potential classification	Av.	Av.$_{load}$	Trend
Class	E	E	=
Smoke production	s2	s1	^
Flaming droplet/particules	d2	d2	=

Potential classification	Av.	Av.$_{load}$	Trend
Propagation time	Tp > 30 min	Tp > 30 min	=
External prop. time	TE = 30 min	TE = 30 min	=
Classification	B ROOF (t3)	B ROOF (t3)	=

COLOR CODE	
	ENERGY
	ELECTRICITY
	MECHANICAL
	FIRE



- From electric point of view



$$R_{fr} = \frac{R_1}{R_0} > 1$$

No discontinuity
No electric arc

Passed test
Validated methodology

4. Results and expectations

- Goals identification, Problems to be solved and solution
- Investigation on useful results
  - *Test procedure*
  - *Equipment description*
  - *Test execution and main results*
  - Pass/fail tests validated

Labs can tackle fully BIPV elements and perform tests

Test combinations require extension accreditations

- Time and cost saving by conducting combined test at a single place
- Tie linked and based on current standards

- Joint group to handle these progress in normative revisions

4. Results and expectations - demonstration

• Bifacial canopy

• Si and CIGS veture kit

• Curtain walls / Façade kit

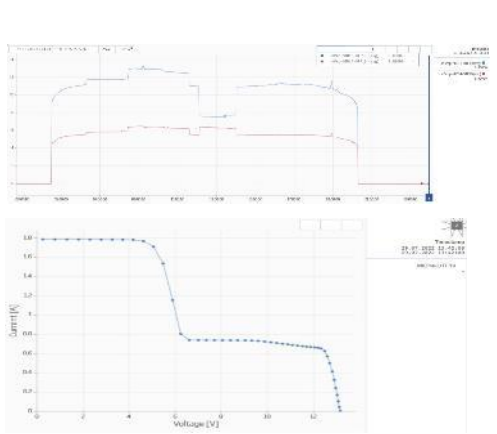
• Bifacial balustrade

• Roof tiles

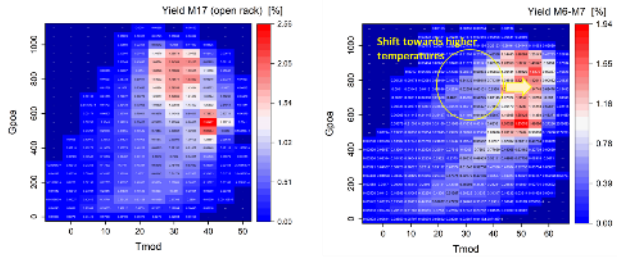
4. Results and expectations

Mockups to validate in the field results and demonstration

- **Bifacial balustrade**
  - Analysis of self-shading
  - effect on bypass activation and yield
- **Veture kit**
  - Analysis of temperature profiles (including JB due to shading)
  - Monitoring of moisture conditions in different solutions
- **Roof tile**
  - Electrical performance and yield analysis



(1) Yield matrix façade modules (M6-M7)
(2) Yield matrix open-rack module (M17)



Notes
The façade module has a 9.0% lower Energy Yield in kWh/Wp compared to the fully ventilated module, which due to the up to 20°C higher temperatures of the BIPV modules.

4. Results and expectations

- Indoor tests validation
  - NTP carried out and results analyzed to characterize BIPV-specific behaviors
  - Compliancy with demo case requirements and local building codes or licenses
- Outdoor tests and monitoring activity
  - Mounting and operating condition check
  - In service performance measurement to support manufacturing
- Pass/fail tests validated
  - NTP developed in the current framework
  - Test-like standards (not a revolution)
  - Labs appropriation and interest (extend market share)

EU projects / IEA PVPS T15 / JWG 11 / Revision groups and new emerging projects

- Joint group to handle these progress in normative revisions (from national to international network)
- Dissemination !! Contribution to provide inputs in as large as possible network dealing with BIPV
  - Scientific dissemination
  - International network
  - Standardization groups

5. Next steps to support BIPV growth

- To go ahead to finalize and to consolidate NTPs for:
  - attesting to sustainability
  - attesting to reliability
  - prove the positive contributions made by BIPV
  - Trust in multifunctionality brought by BIPV components
  -
- NTPs have to cost and time saving in consideration for lab appropriation
- Insurance validation as a key point
- Stakeholder recognition
- Standard implementation (currently // work conducted by many experts involved in this project)

Thank you

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