On the need for education in the BIPV sector: the DEM4BIPV project

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Contents

- BIPV introduction
  - Status, outlook
  - NL case
- Dem4BiPV project
- Educational needs
  - Stakeholder survey
- Conclusion
- Future work

Definition

BIPV is a system that includes at least one functionality in the building envelope in addition to electricity generation

Solar Glazing

- SwissTech Convention Centre - Photo: Fernando Guerra

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Full-roof solution

Source: BEAUsolar

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Solar Façade

Source: ZigZagSolar

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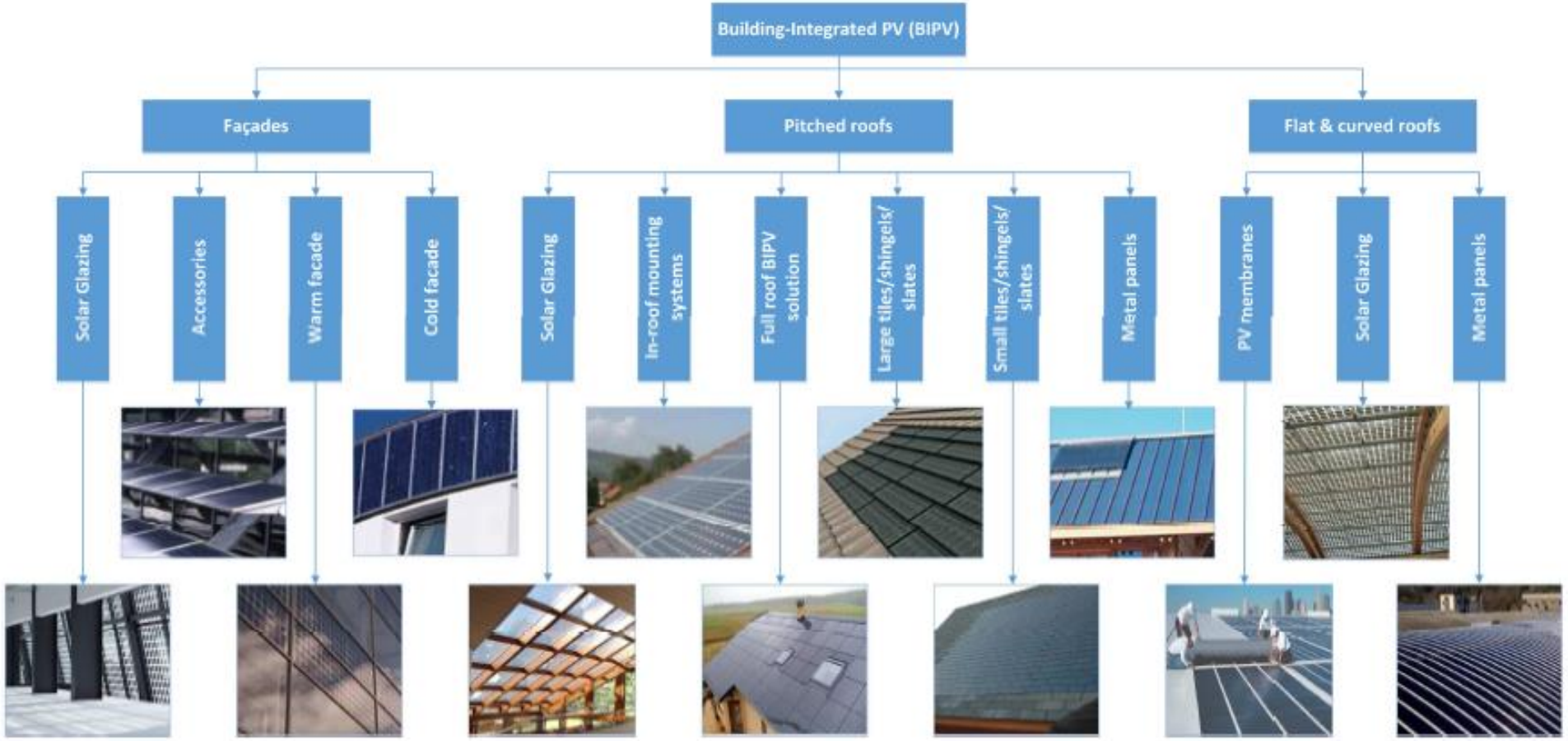
BIPV Market - Status and Outlook



Frontini, 2015

Global BIPV Market perspective and the recent past of annual installation capacity from 2014 to 2020

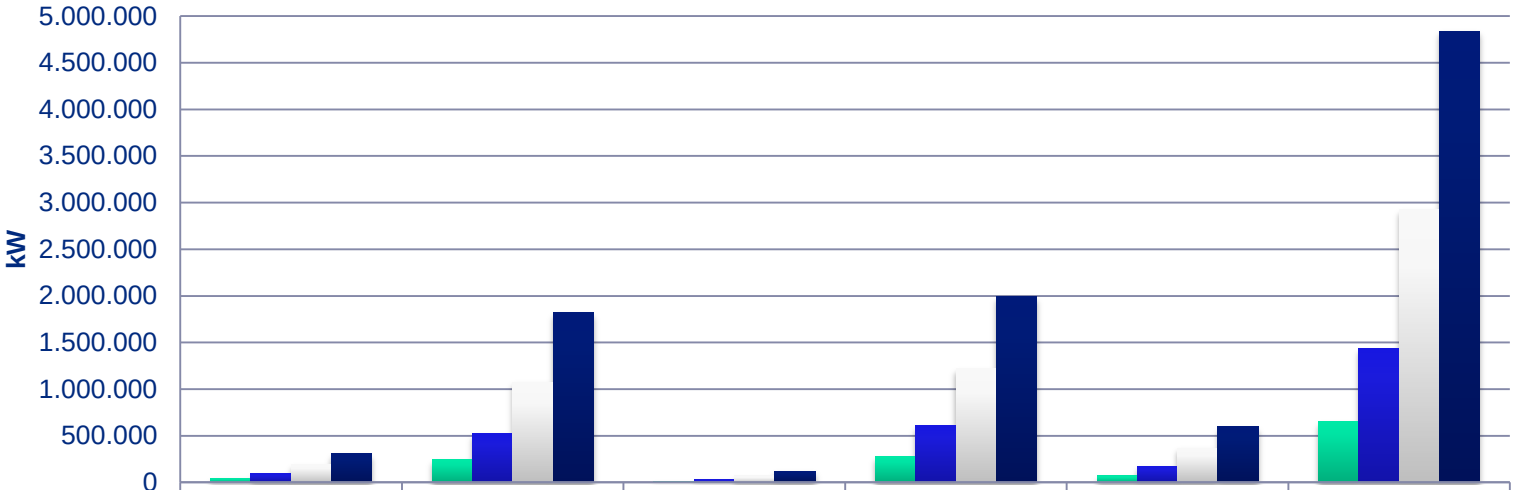
The global market is estimated **at 2.3 GW in 2015** compared to 1.5 GW in 2014.

Region/Country	2014	2015	2016	2017	2018	2019	2020	CAGR (%)
Asia/Pacific	300	492	772	1,159	1,672	2,329	3.134	47.8
Europe	650	967	1,441	2,103	2,929	3,807	4,838	39.7
Rest of world	81	125	184	263	355	451	561	37.9
USA	319	476	675	917	1,200	1,491	1,766	33.0
Canada	42	61	86	119	157	190	228	32.6
Japan	143	201	268	349	434	520	612	27.5
Total (GW)	1.5	2.3	3.4	4.9	6.7	8.8	11.1	

Source: (Global Industry Analysts, 2015)

CAGR-compounded annual growth rate

France, Germany, Italy, Spain and rest of Europe market analysis and forecast of annual installation capacity in kW for years 2014 to 2020

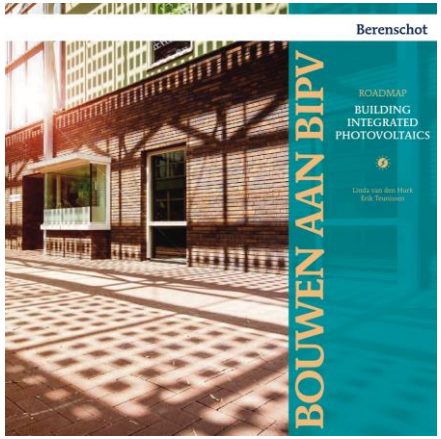


	Germany in kW	France in kW	Spain in kW	Italy in kW	Rest of Europe in kW	Total
2014	45.404	241.370	13.829	278.271	70.993	649.867
2016	96.279	523.565	33.580	611.627	175.498	1.440.548
2018	193.925	1.075.083	69.523	1.222.177	368.154	2.928.861
2020	307.277	1.822.297	121.661	1.988.281	598.584	4.838.100

Source: (Global Industry Analysts, 2015)

Rest of Europe include Austria, Belgium. Bulgaria, Czech Republic, Denmark, Finland, Greece, Hungary, Ireland, The Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Sweden, Switzerland, Turkey and the UK.
Error tolerance for the data is 10%(+/-)

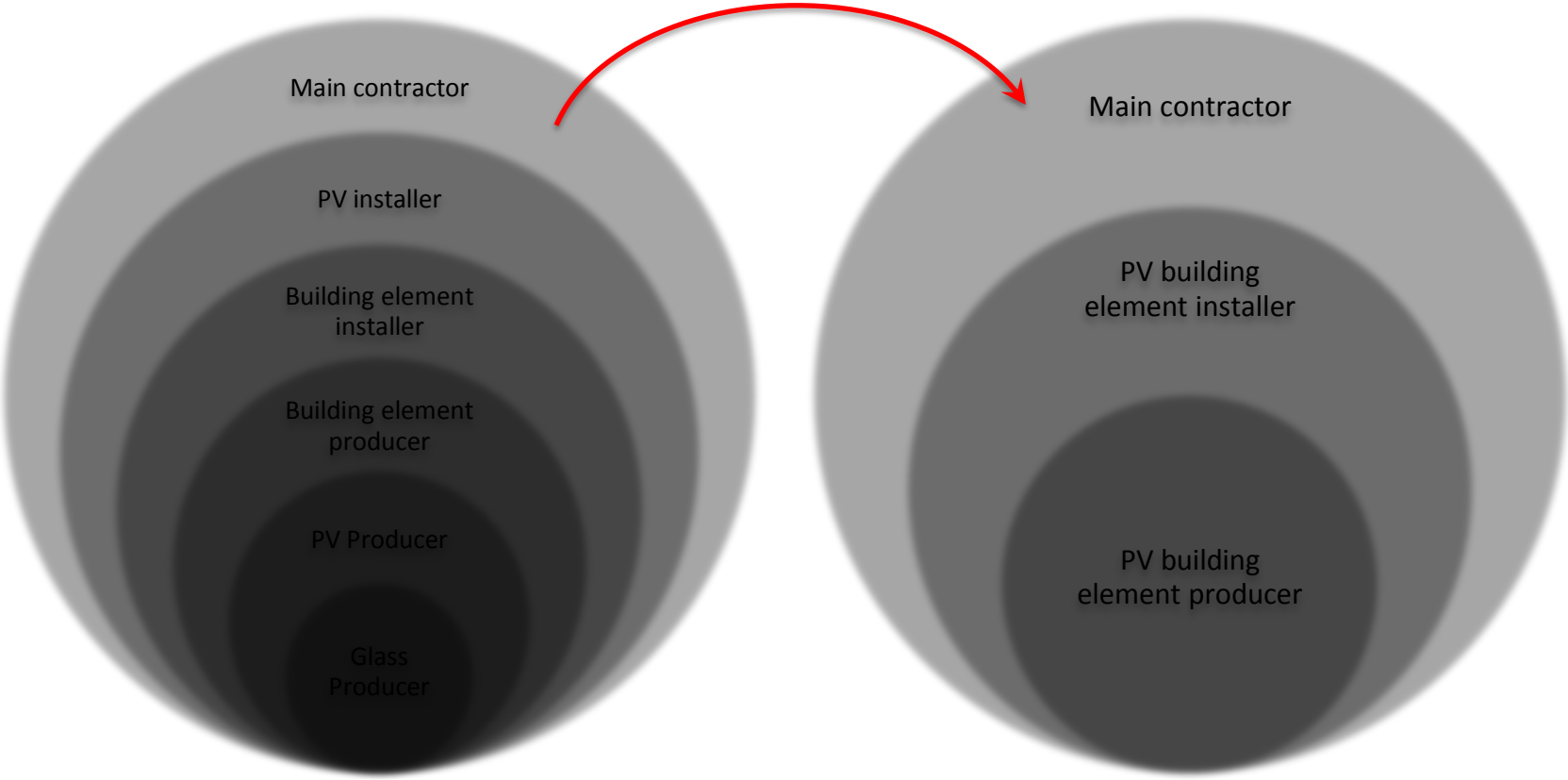
BIPV in the Netherlands



- ~25 MWp capacity (2015)
- Roadmap established to increase to ~300 MWp (2020)
- Fragmented market
- Challenge:
  to bring together building sector and PV sector, and innovate/collaborate

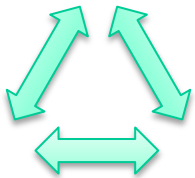
- First step: analyse the ecosystem

Market growth may/will lead to value chain changes



Recommendations for stakeholders

Academia
- **Education on BIPV**
- International coordinated R&D

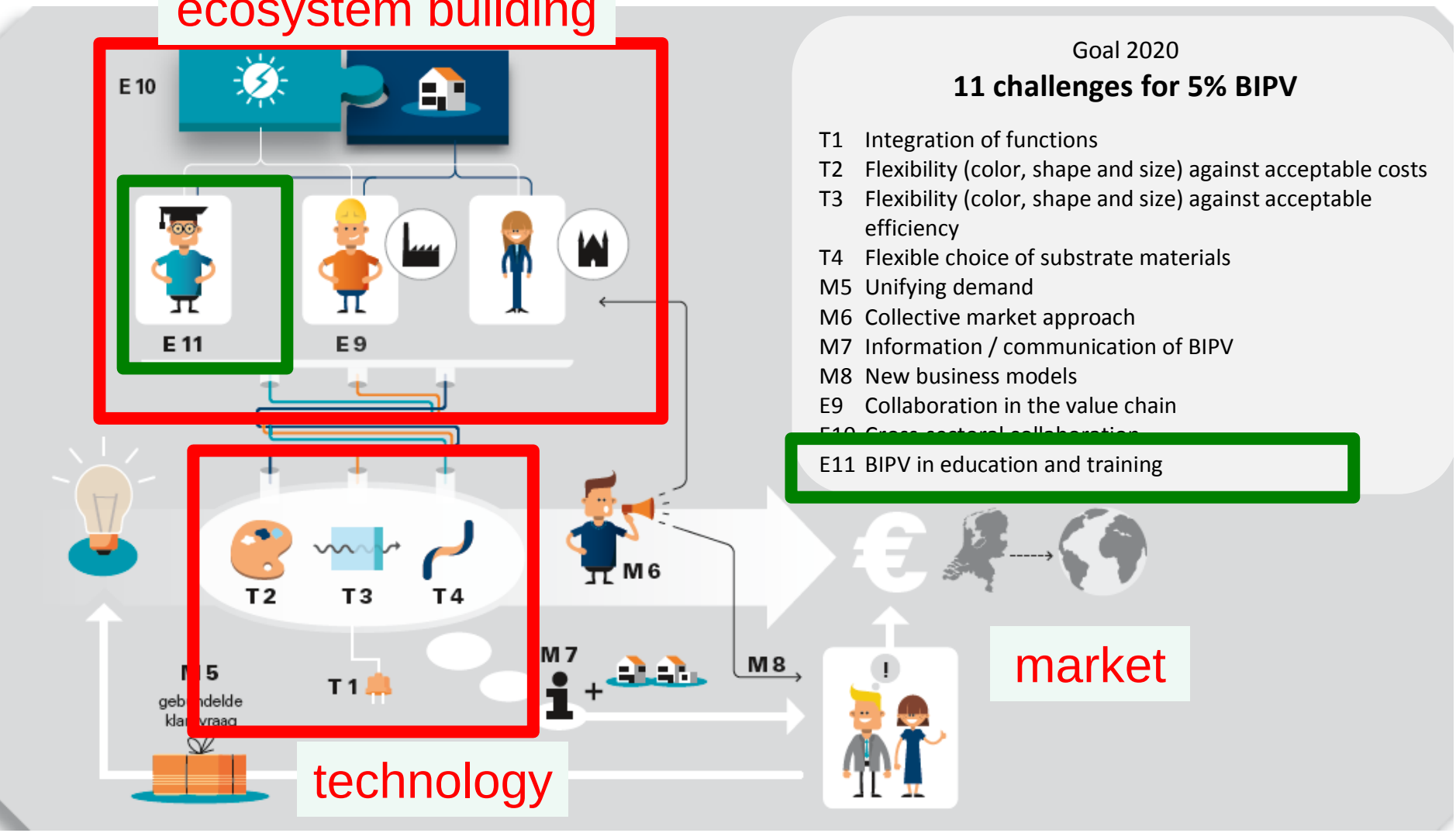


Industry
- New Business Models
- Collaboration construction sector
- Prices per m^2 (not per Wp)
- Simplified integration (prefab)
- BIPV industry association
- Communication

Government
- Future security in incentive schemes
- BIPV-specific legislation & support
- Standardization & Certification BIPV

Project “Really building BIPV”

WERKELIJK BOUWEN AAN BIPV



Goal 2020

11 challenges for 5% BIPV

- T1 Integration of functions
- T2 Flexibility (color, shape and size) against acceptable costs
- T3 Flexibility (color, shape and size) against acceptable efficiency
- T4 Flexible choice of substrate materials
- M5 Unifying demand
- M6 Collective market approach
- M7 Information / communication of BIPV
- M8 New business models
- E9 Collaboration in the value chain
- E11 BIPV in education and training

Sept 2016-2020

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Provincie Noord-Brabant

Europese Unie

The Dem4BIPV project: Development of innovative educational material for Building-Integrated Photovoltaics

Dem4BIPV started in **September 2015** and will run until **August 2018**. The project is funded by the Erasmus+ programme of the European Commission.

Consortium

Utrecht University

FH University of Applied Sciences TECHNIKUM WIEN

University of Cyprus PV Technology

Erasmus+

Deloitte.

WIP

Project activities

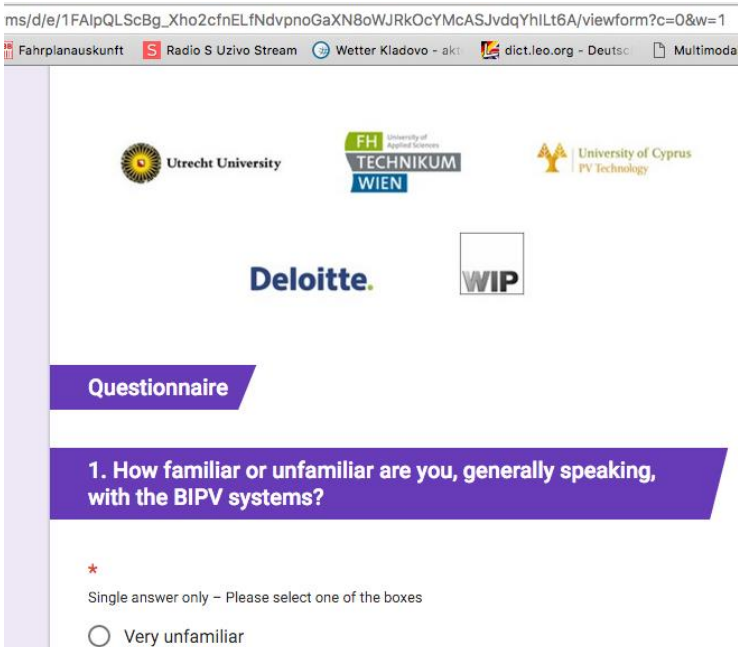
- **Analysis of the existing and future market needs in terms of BIPV system integration and education needs in this field**
- Development of high-quality didactic content on BIPV for higher education
- Development of a virtual learning environment for the practical aspects of the course (i.e. lab work of experimental nature)
- Deployment of remote laboratories
- Pilot testing of the course and refinement

Status and outlook for BIPV in relation to **educational needs** in the BIPV sector

Stakeholder survey

Survey Design

- The Dem4BIPV - Consortium defined the Stakeholder groups and the topics
- Participants in the questionnaire were able to state their opinion on a 4-points scale (no need, not so strong need, fairly strong need, very strong need), besides ‘don’t know’
- Questionnaire was available on the Internet (Google forms) from **February to April 2016.**
- A total number of **100 participants** took part in the survey



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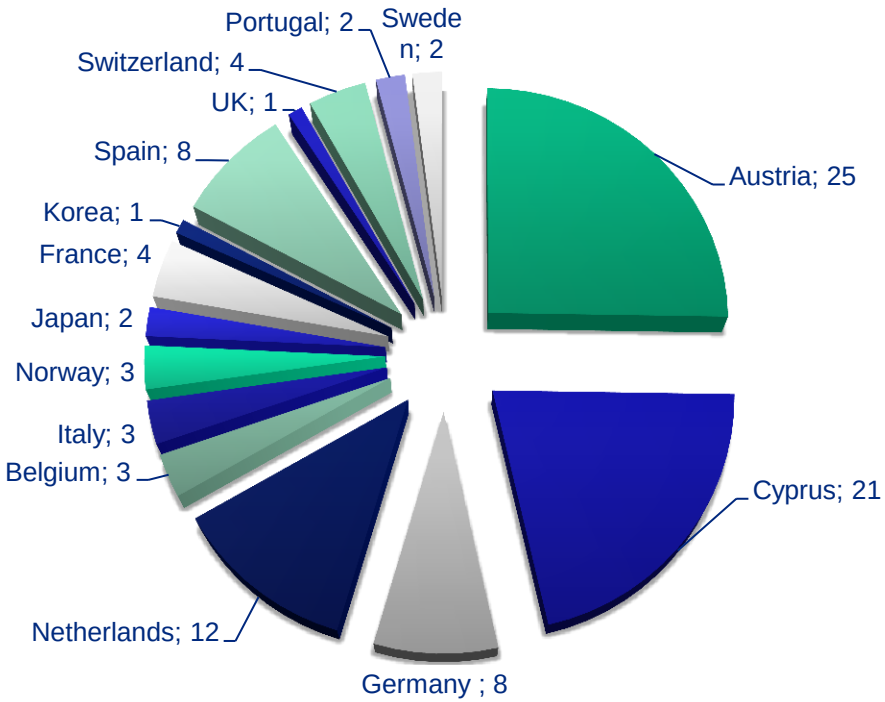
Portrayal of participating Stakeholders and Countries

Number of response in total per country



Percentage of response per Stakeholder group

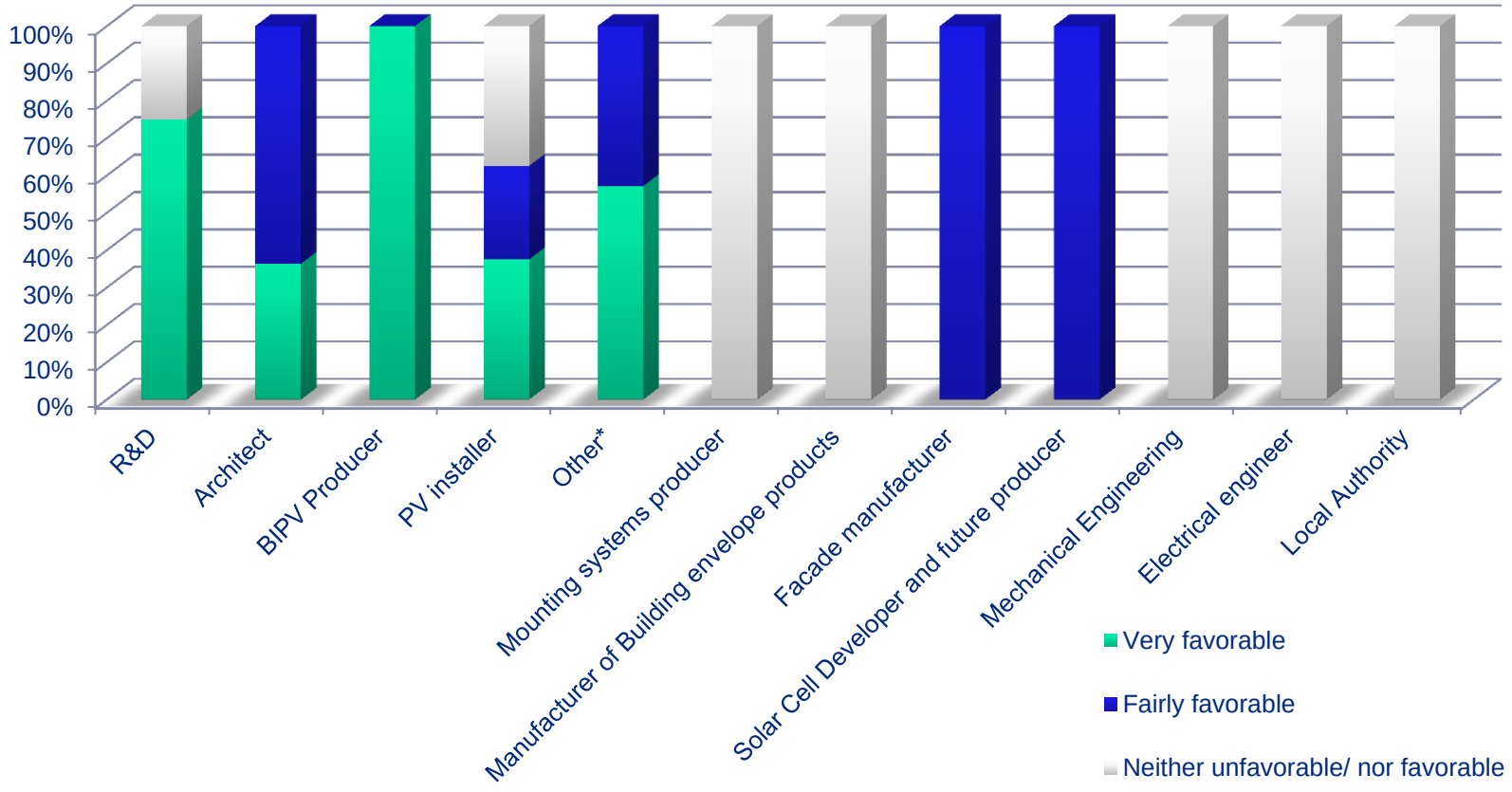
The **majority** of the participants are from **R&D**, followed by **architects**.

About 10% are **PV installer, BIPV producer and consultant.**
Facade manufacturer and educational sector share about 5%.

Facade installer, electrician and buildings planners were in focus of the survey, no response was received.

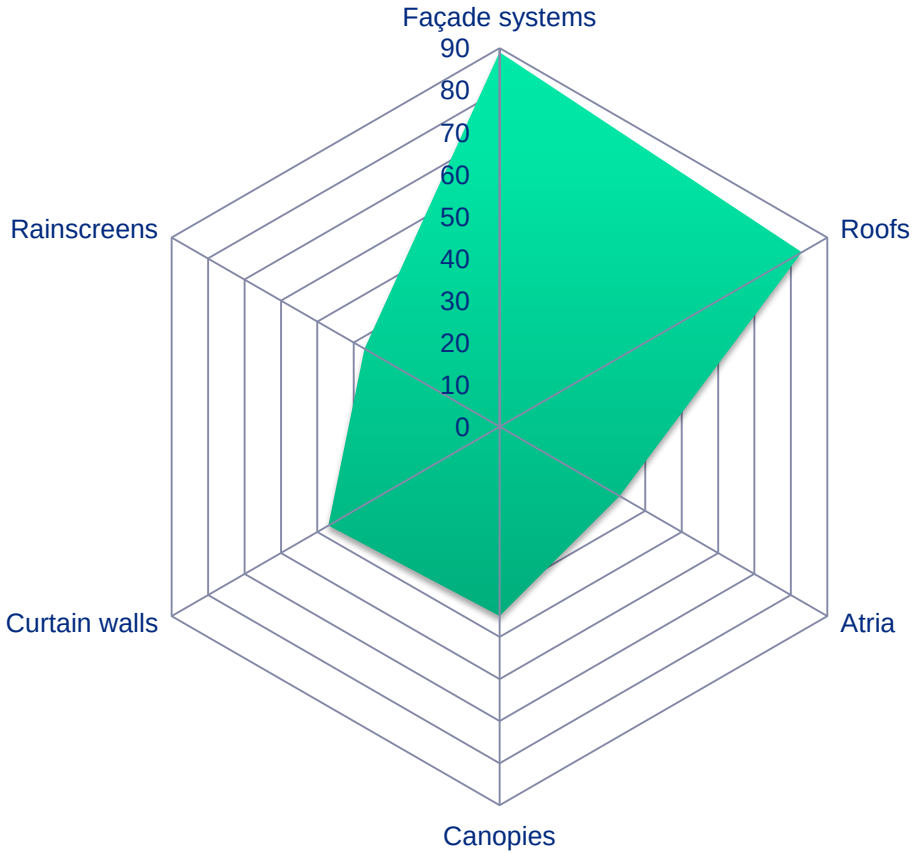
Attitude towards BIPV systems

Stakeholder response in from the categories
Very favorable, fairly favorable, "Neither unfavorable/ nor favorable

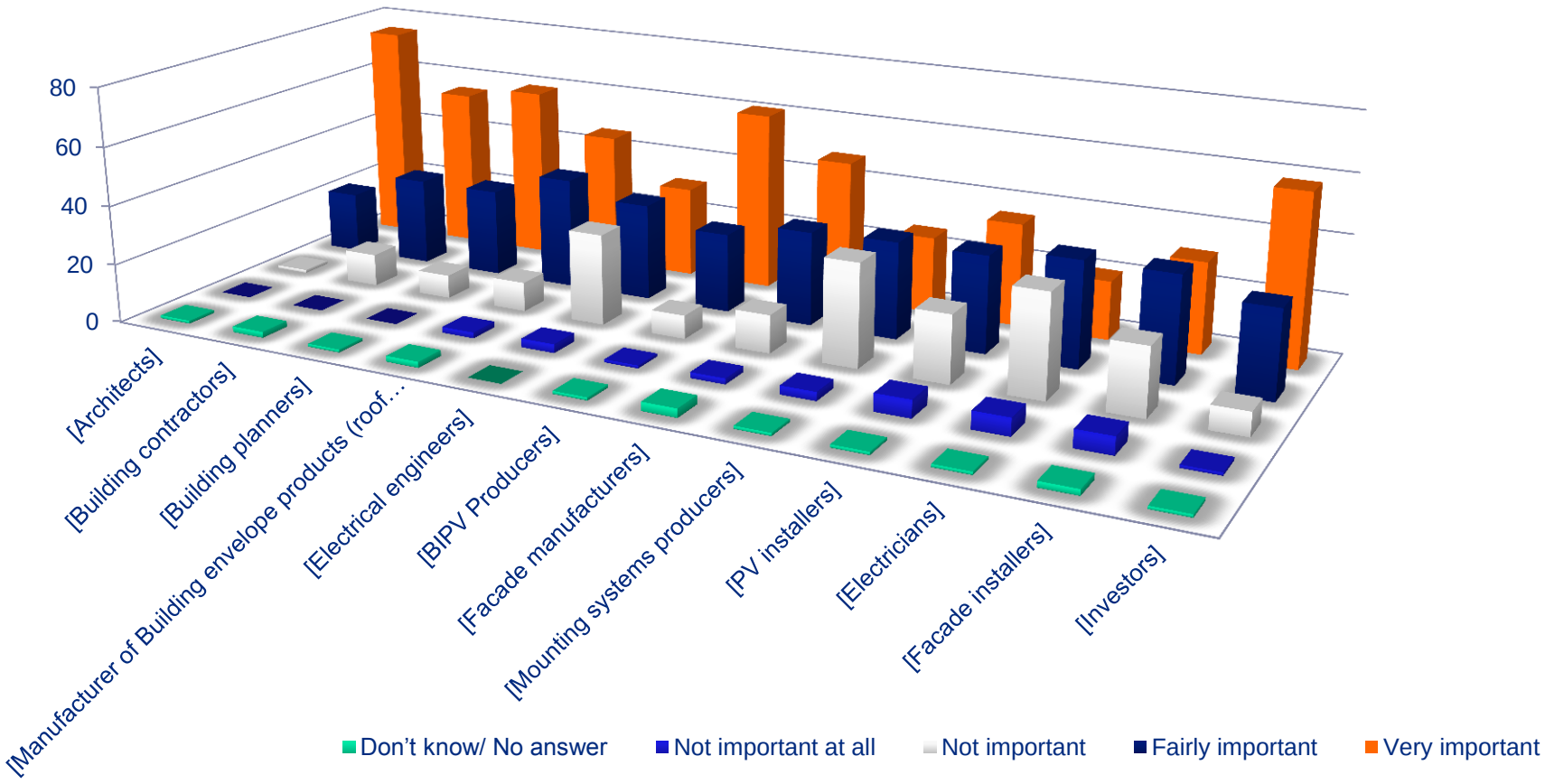


**F&E institution, Electrical engineer, Mounting systems producer, Building contractor, Building Services & Sustainability, Consultant, Consultancy in BIPV policy, Pilot project development, Legal reseach, Project manager, University, Education, Research. Civil & Environmental Engineer, Electrical engineer, Investor, BIPV Producer, PV module producer, Mounting systems, producer, government, Robot cleaning BIPV, Civil Engineer*

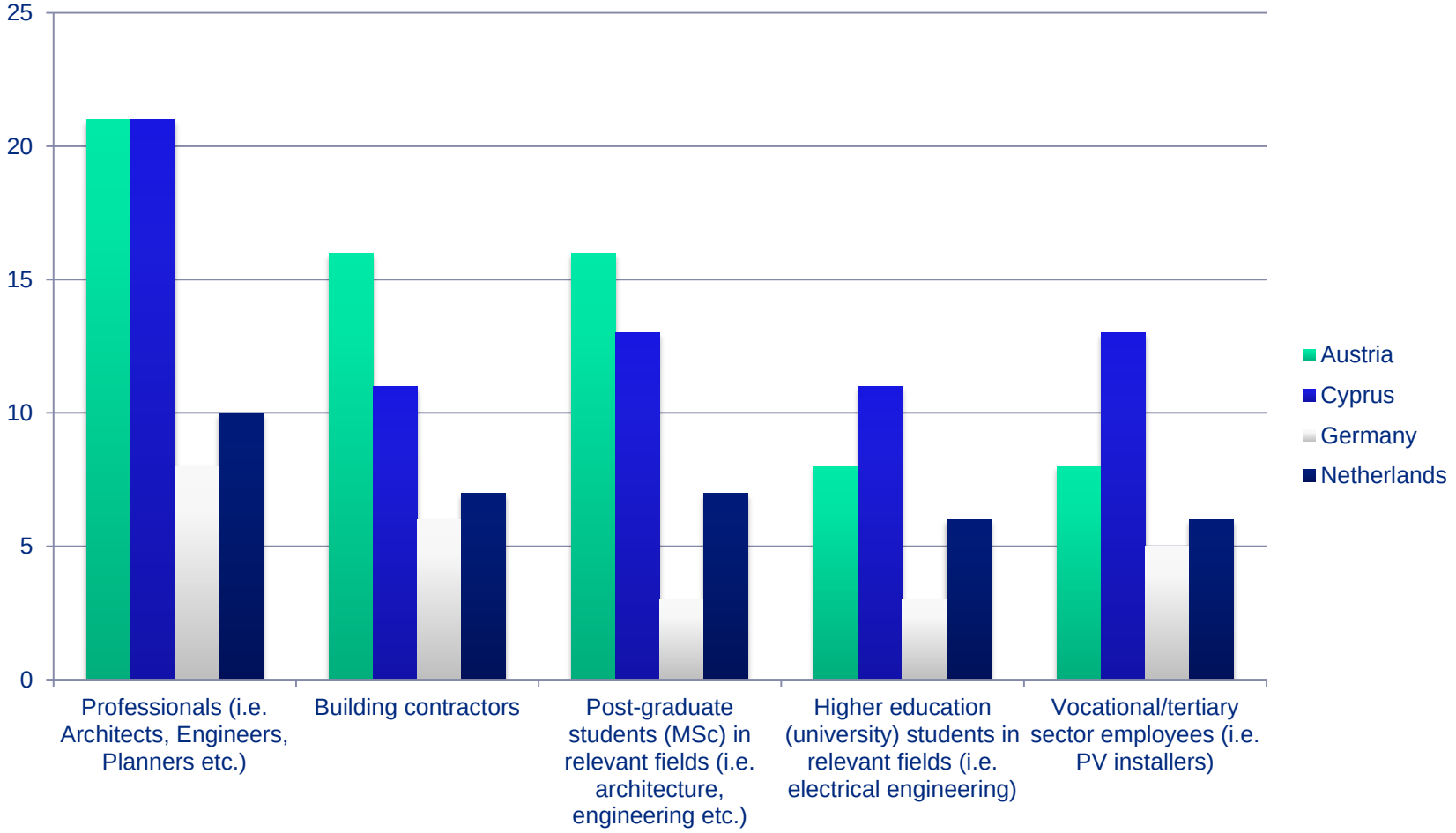
Envision of the integration of BIPV systems in the building envelope environment of all respondents; n=100



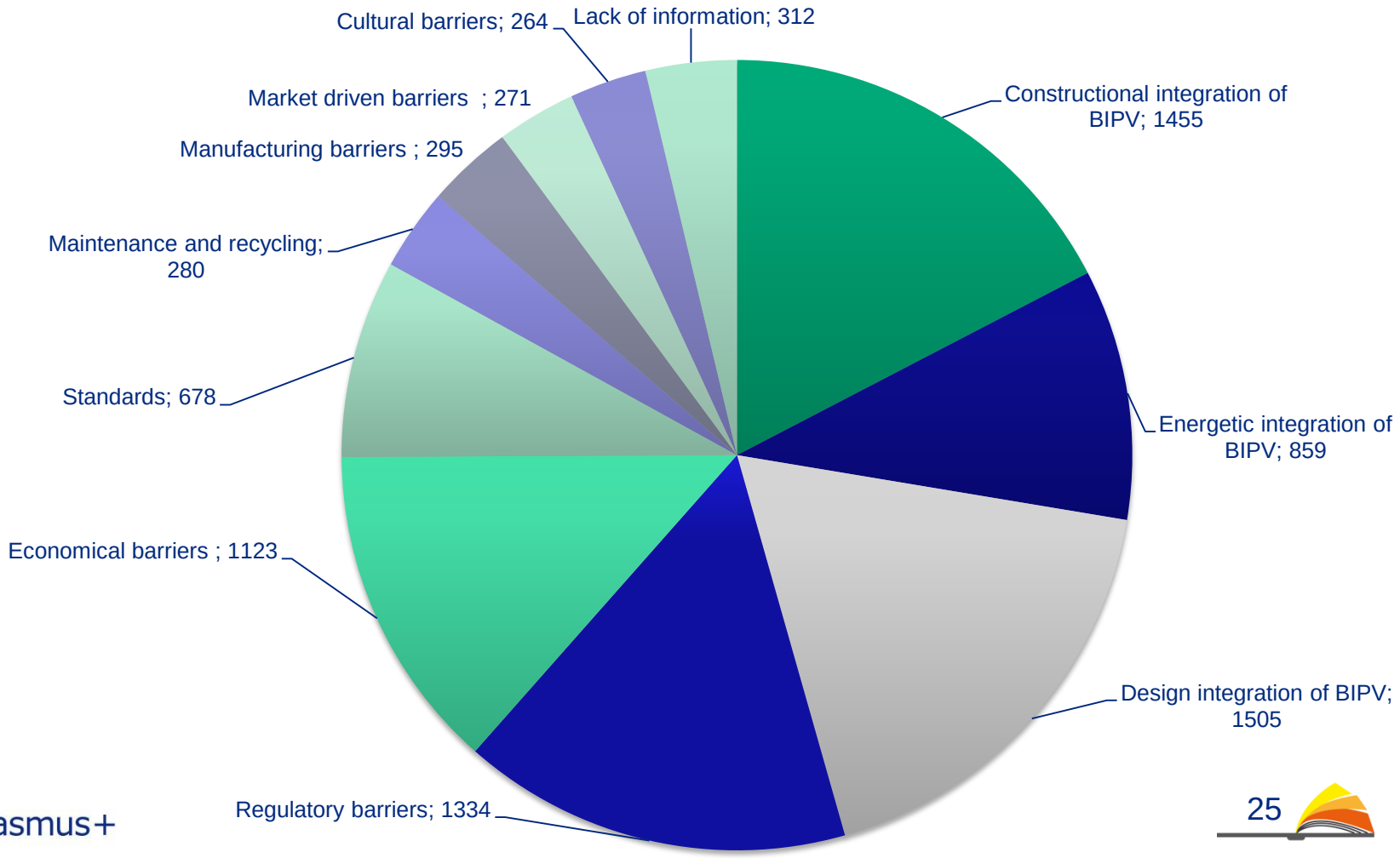
Stakeholder groups with an important role in wider deployment of BIPV; all corespondents;n=100



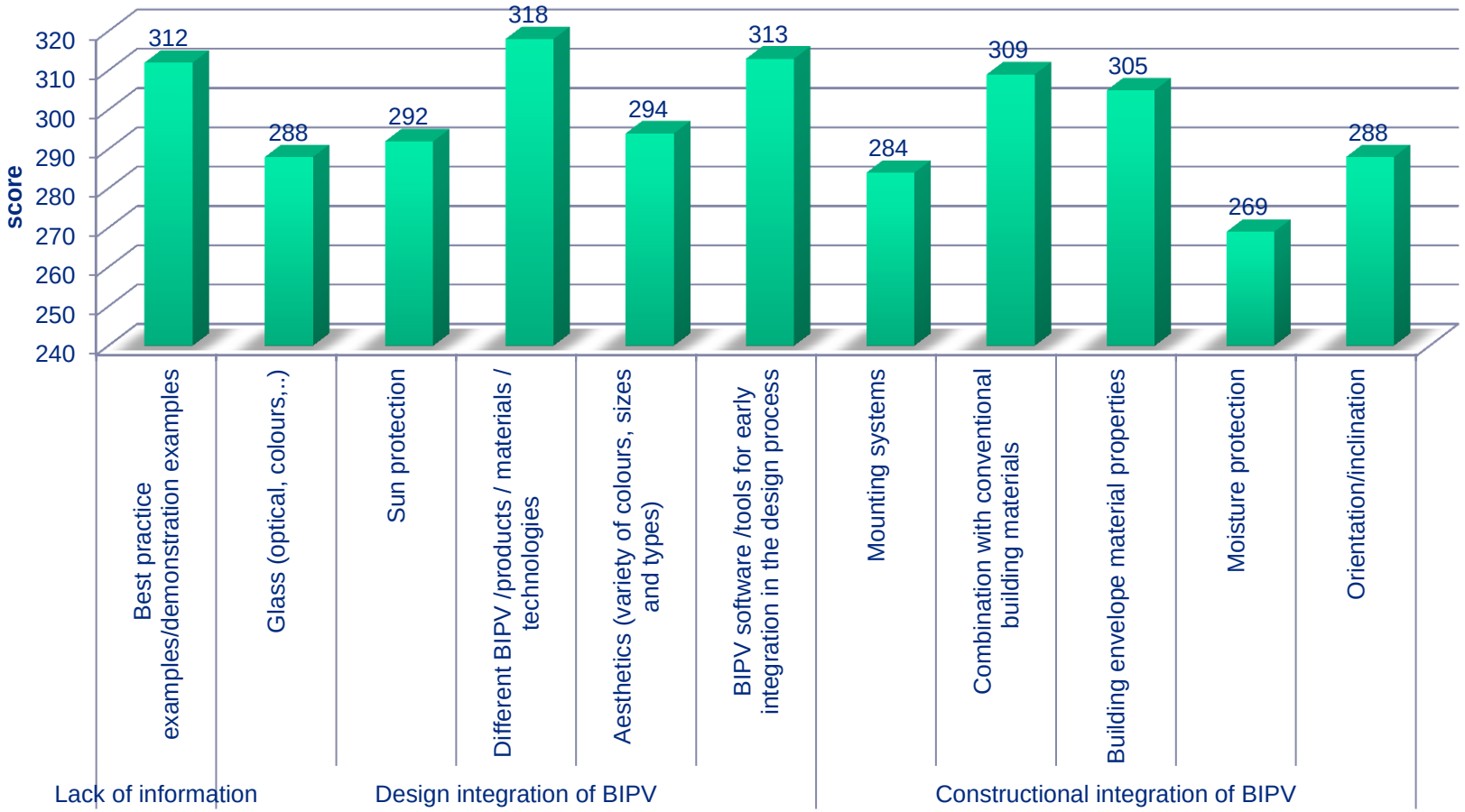
Educational need for groups of students and/or professionals in Austria, Cyprus, Germany and Netherlands; n=66



Sum of the educational requirement towards BIPV of all respondents; n=100



Educational needs for the groups - design integration, constructional integration and lack of information



Conclusion (1/2)

- **from 1.5 GW in 2014 to 2.3 GW in 2015 global BIPV market increase:** about 40%.

- Forecast: 4.8 GW for 2020 in Europe (11.1 GW global).

- **Positively impacted** by the **regulatory framework.** the European level the Directive on Energy Performance in Buildings (EPBD) (Directive 2010/31/EU) and the **Renewable Energy Directive (1/77/EC) was set up by the European Union** (EU).

Conclusion (2/2)

- Main group of Stakeholders for educational need
  - **professionals** (i.e. Architects, Engineers, Planners etc.)
  - **building contractors**
  - **post- graduate students (MSc)** in relevant fields (i.e. architectural, engineering, etc.).

- main topics with high priority for education:
  - **design integration, regulatory and constructional topics**
  - Especially on **mounting systems and building, envelope materials properties, different BIPV products/materials/technologies, BIPV software, laws and directives**

- **Architects, building contractors, building planers, façade and mounting systems producers**, as well as investors **play an important** role in the future.

Future work

Based on outcomes of survey:

- Development of educational material in a modular way
  - Tailor made courses for different university systems
  - Ready by mid-2017
- To accommodate different levels of background knowledge and interest
- Virtual labs for experimenting with BIPV will be operational in Austria, Cyprus and The Netherlands (2018)

Thank you for your attention

www.dem4bipv.eu

Amsterdam

Brighton