



**BE  MART**

**Together for Active and Efficient Buildings**



The BE-Smart project has received funding from The European Union's  
Horizon 2020 research and innovation programme under grant agreement  
No 818009.



## Guaranteeing viability of results

# Business prospects and funding opportunities for BIPV projects at European scale

## SIE

Supported by: CSEM, ISSOL SA, IFE, IMMOROC SA, AIT, PADA, CEA, SGDE, Solaxess SA, EPFL, WHITE Arch., OSLO KOMMUNE, Compáz, L - UP SAS



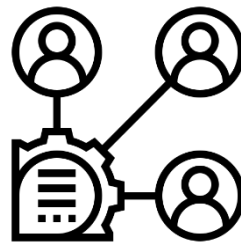


# Be-Smart commercial objectives

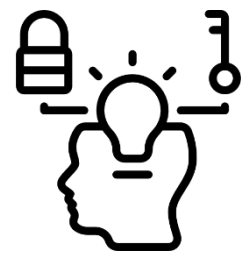
➤ Guarantee BE-SMART results are prepared for exploitation, by:



Making high-level business decisions to **launch commercialization plans for the establishment of the integrated business model with significant cost reduction for Building Integrated PV (BIPV) solutions, and more specifically for Energy Positive (E+) Glazing**, at European and International level.



Promote engagement of all the stakeholders through the value chain to ensure the most cost-effective options for significant cost reduction for BIPV solutions using E+ Glazing.



To define the **most appropriate strategy for IPR management among partners**, defining it for each one of the business models and results within BE-SMART.





# Be-Smart Exploitation Activities



**Market analysis:** Market potential, application perspective, risks and opportunities.



**Develop exploitation plans** for each key exploitable results, **business plan** for commercial results.



**Assess necessary infrastructure for the promotion** of a mass market for BIPV implementation in Europe.





# Main impact

Identification of market needs through tackling key BIPV stakeholders for building several business models and subsequently define Be-Smart products market positioning.



BE-Smart goal of **positioning BIPV as a material supplied to the construction sector with the concept of Energy Positive Glazing (E+Glazing or EPoG)**



BE-Smart **business model and exploitation strategy for each key stakeholders** of the whole value chain





# Key Takeouts for Product-Market Fit



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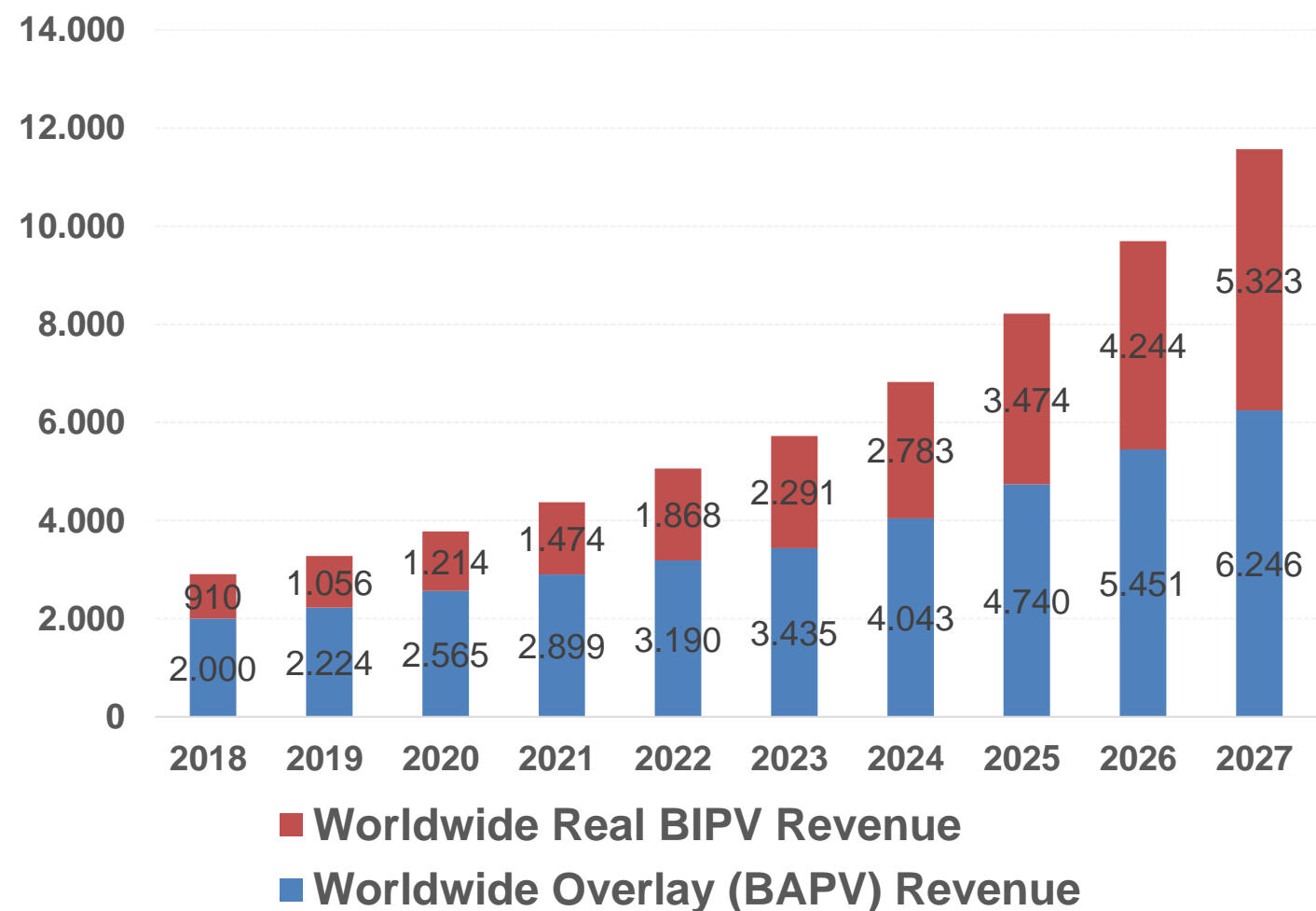


# Worldwide BIPV Market

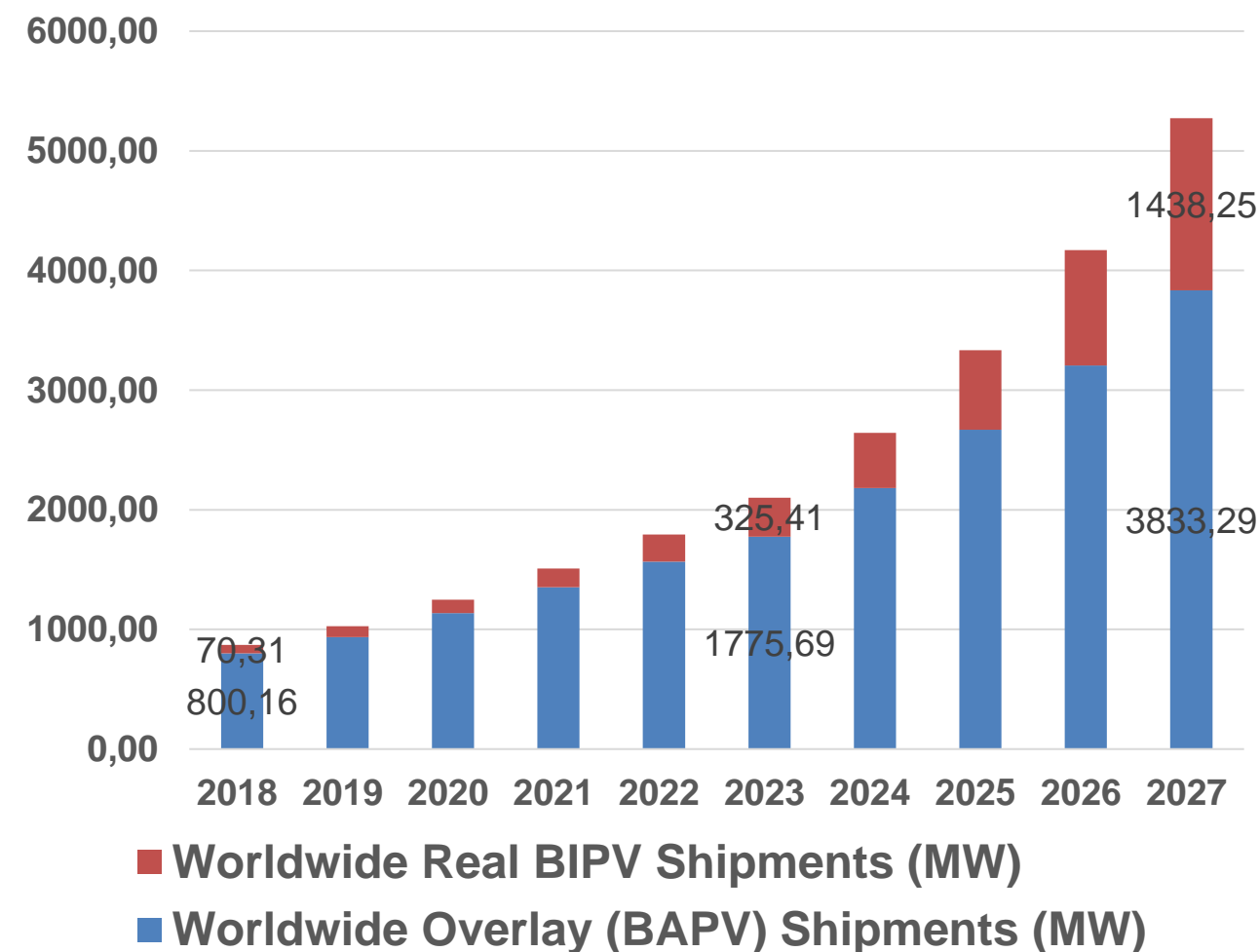
“BIPV refers to any solar-panel product that is specifically intended to fit into a building’s architecture in a way that is aesthetically pleasing along with some advanced functionality”

- Real BIPV revenue accounts for the whole market 0,9M (31%) in 2018 to 5,3M (46%) in 2027, with average growth rate at 22%.
- The shipments of real BIPV will grow from 70MW in 2018 to around 1400MW in 2027.
- The revenue per MW is believed to decrease from \$2.5M/MW to \$1.63M/MW.

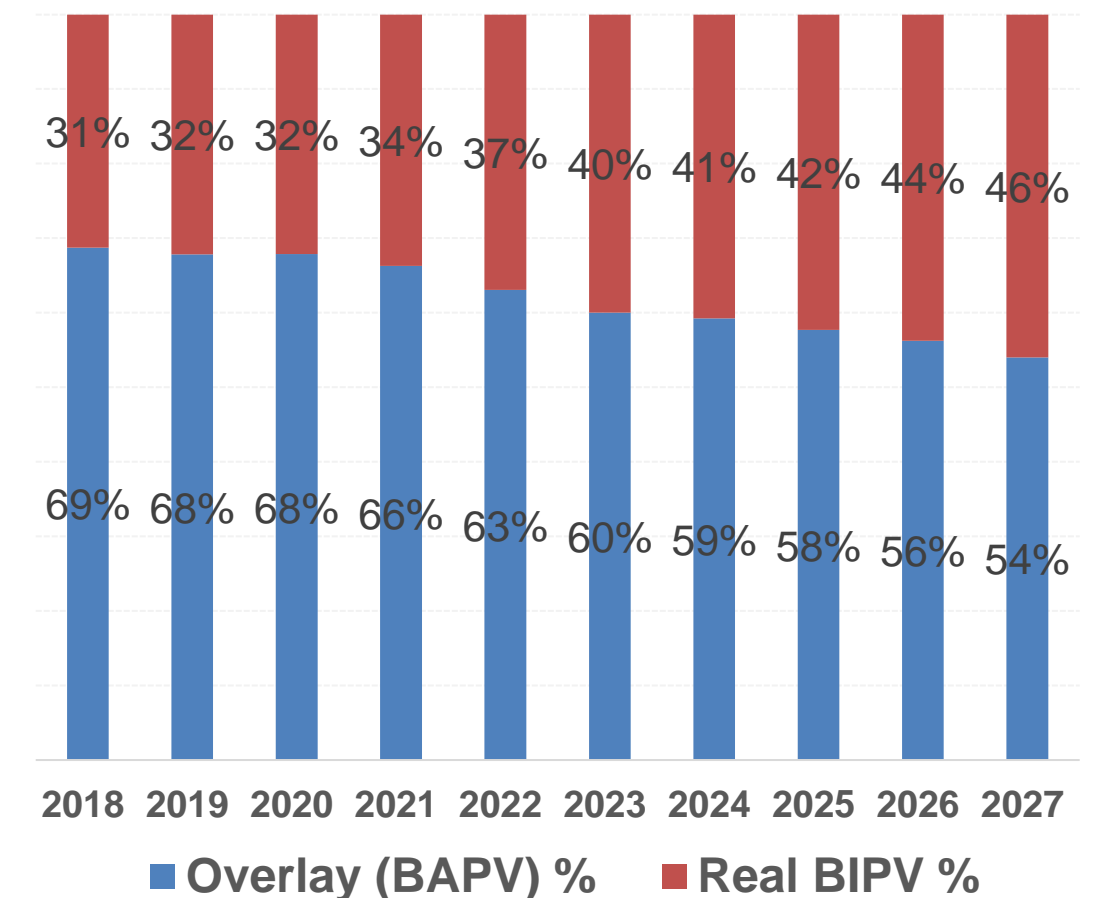
Worldwide BIPV Revenue (\$ Millions)



Worldwide BIPV Shipments (MW)



Worldwide BIPV Revenue % From Two Categories



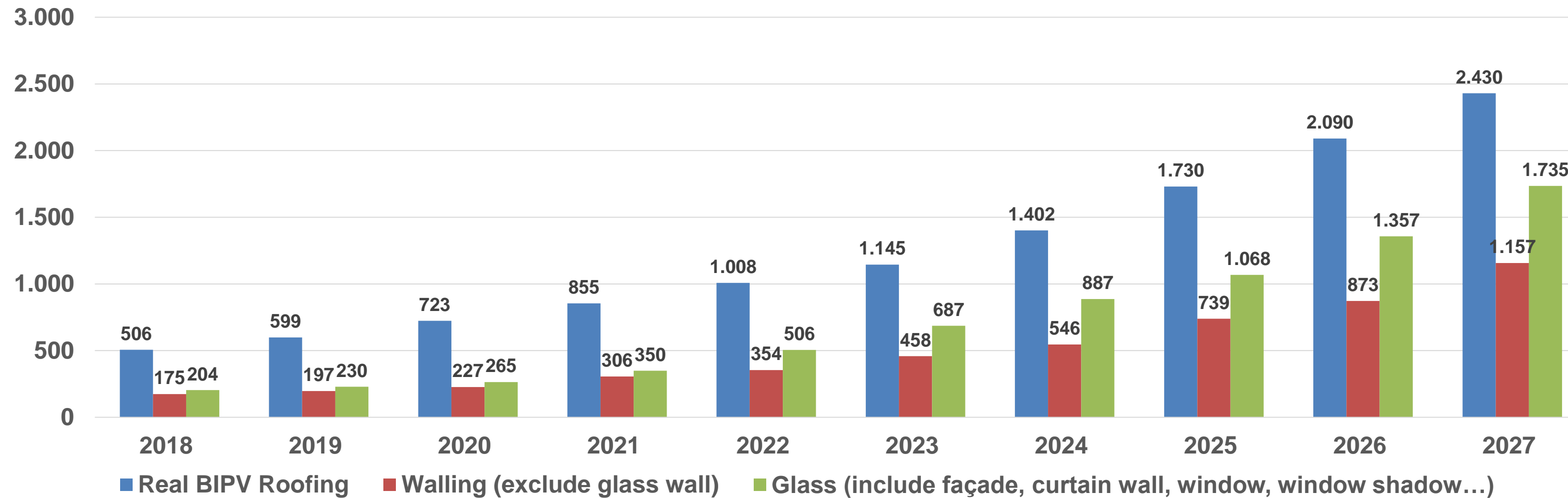
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## Real BIPV Market – By Product

- **BIPV roofing** will remain dominating category during the forecast period and reach \$2,4M by 2027.
- Much of the demand of **BIPV for walls** (other than glass walls) is expected to be fulfilled by repurposed roofing BIPV – BIPV roofing products (notably shingles) are used on walls as well as roofs.
- **BIPV Glass** is already a substantial market. It has higher aesthetics level, and most of the revenue will come from facades/curtain walls and skylights.

Worldwide Real BIPV Revenue by Product (\$ millions)



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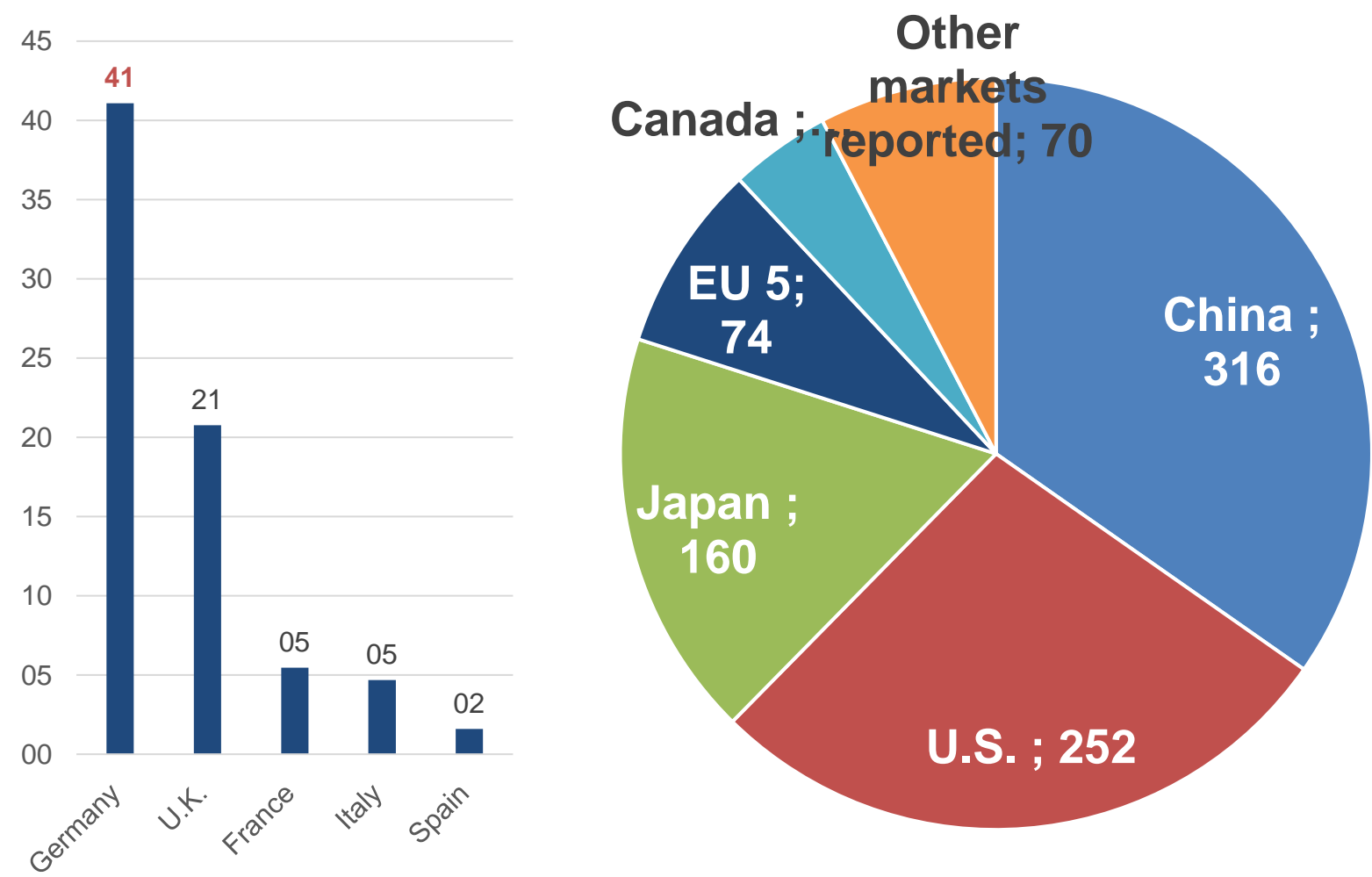




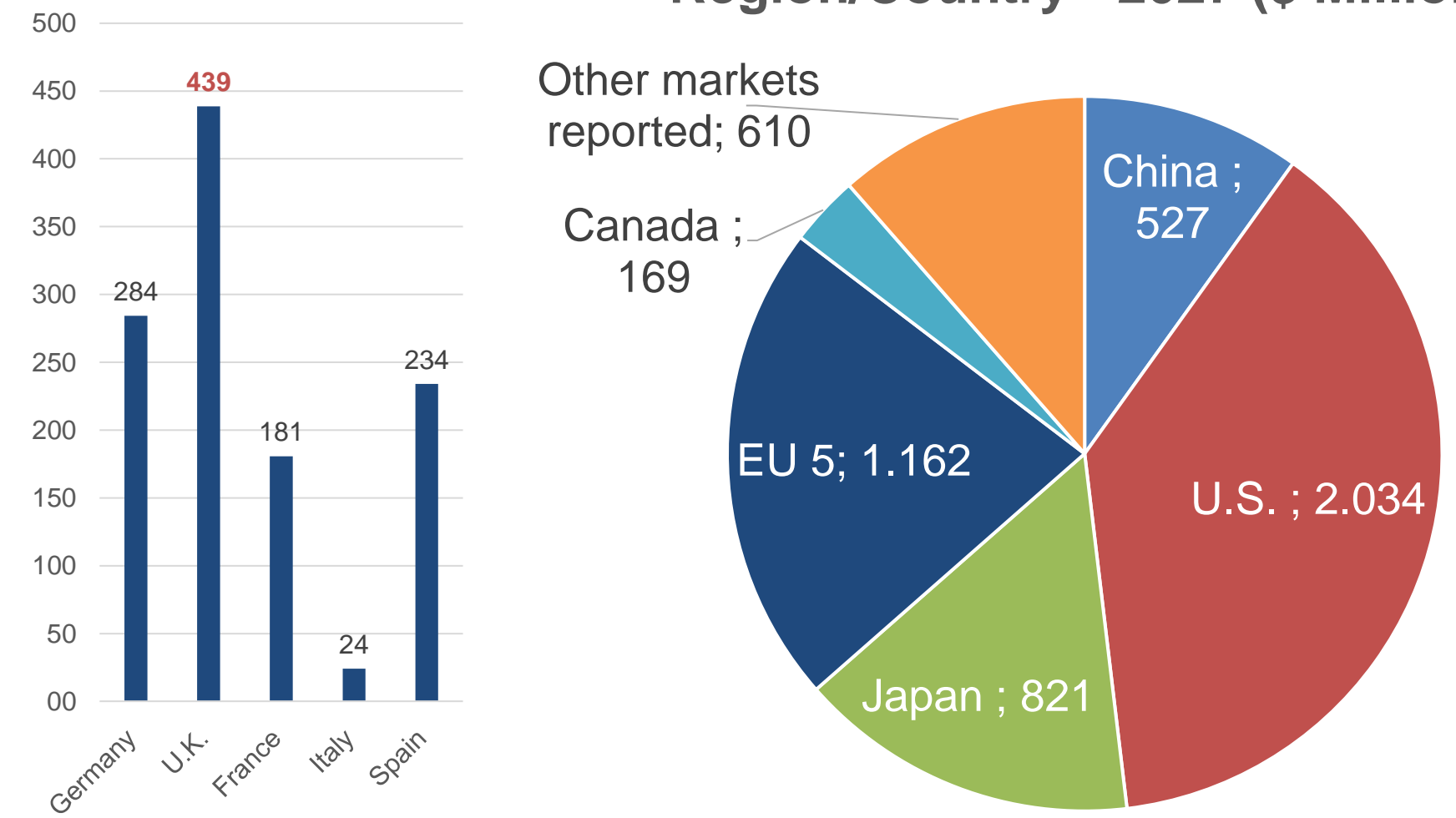
# Real BIPV Market – By Region/Country

- **2018:** Top four markets were China, US, Japan and Germany.
- **2027:** UK will replace Germany to enter the top four rankings.

**Worldwide Real BIPV Revenue by Region/Country – 2018 (\$ Million)**



**Worldwide Real BIPV Revenue by Region/Country - 2027 (\$ Million)**

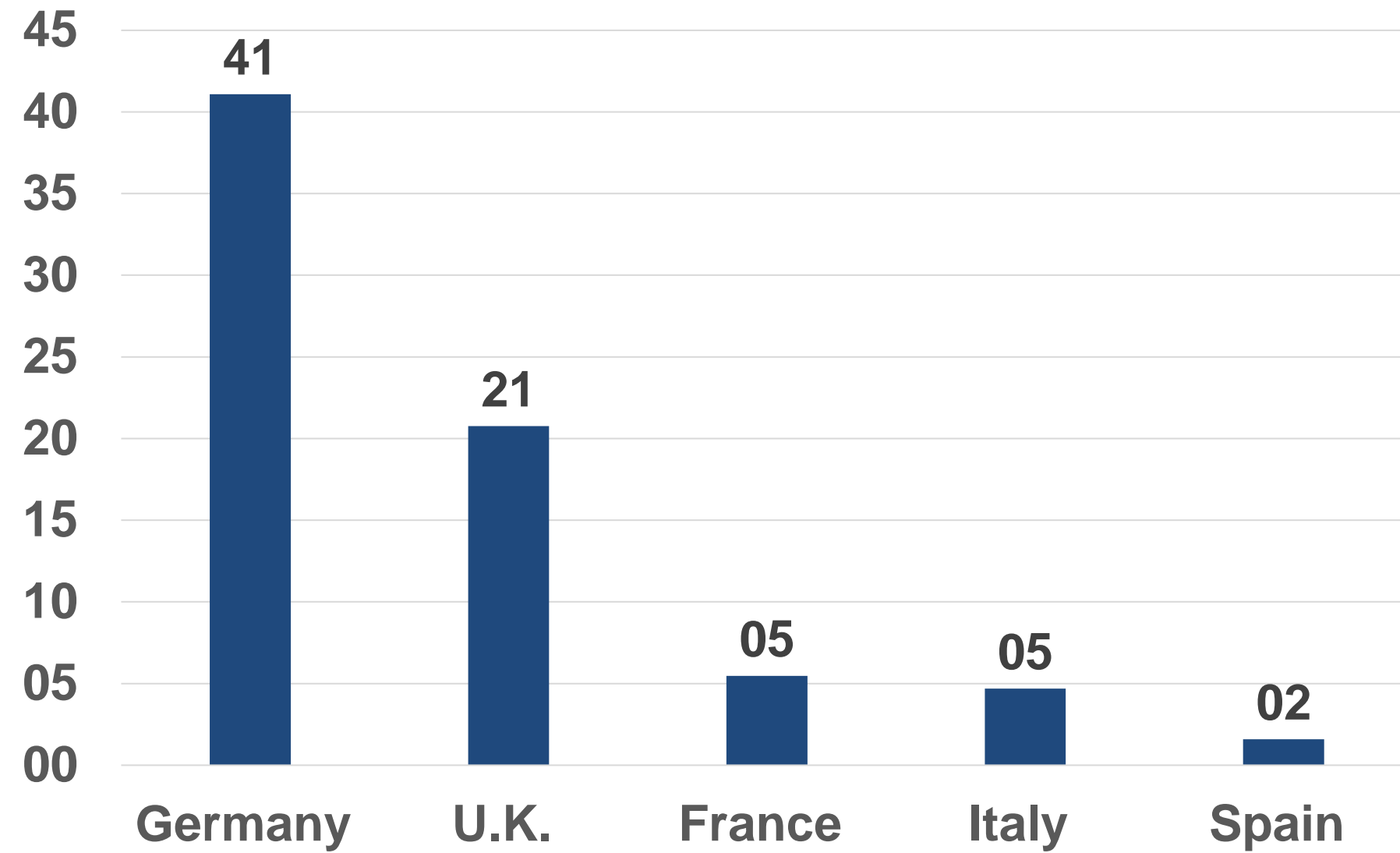


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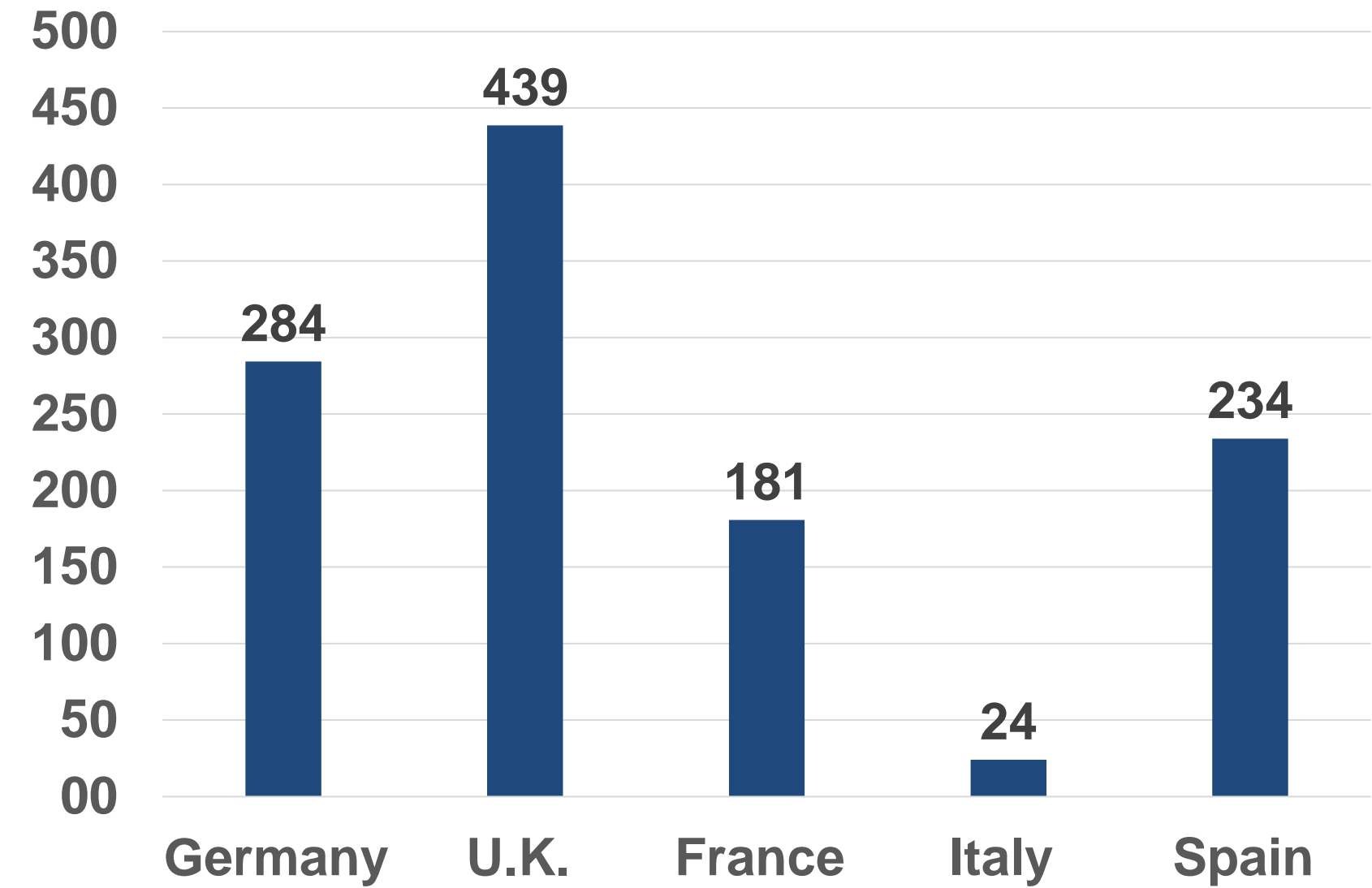


## Real BIPV Market – Europe (\$ Millions)

2018



2027



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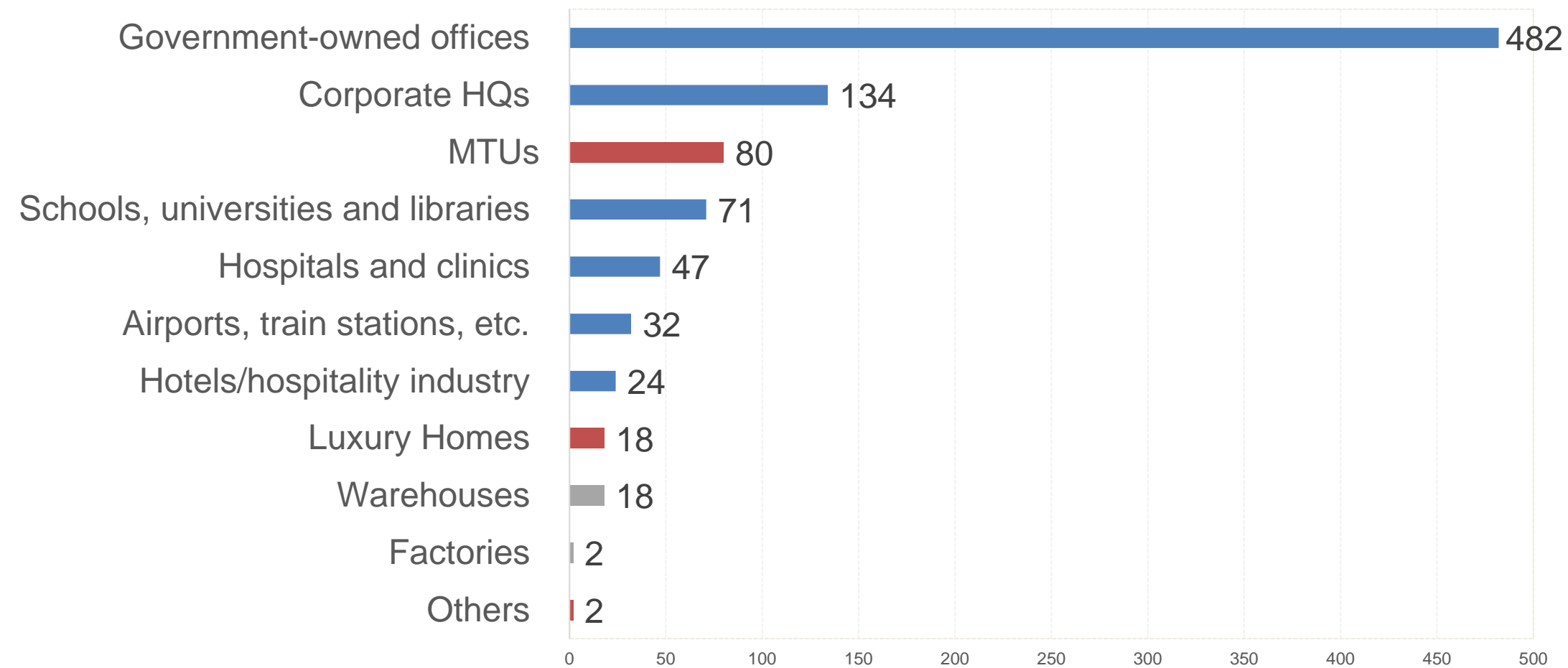
Source: n-Tech market research



# Real BIPV Market – By Building Types

- **Commercial building segment** is the most promising target in the market..
- Within the commercial buildings, **government-owned offices and corporate HQs** are top two end users.
- Ease of use and reliability will increase the addressable market for BIPV

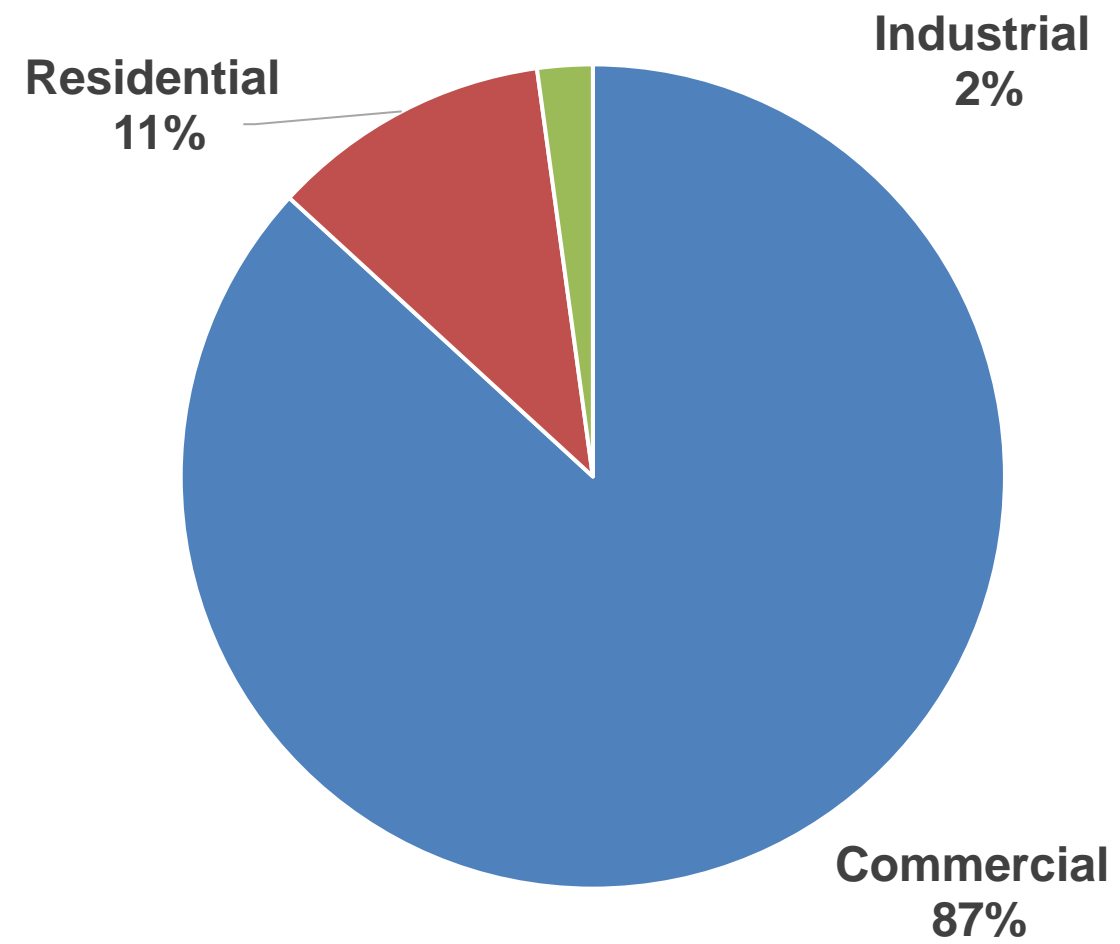
**BIPV Revenue by End-User  
2018 - \$ Millions**



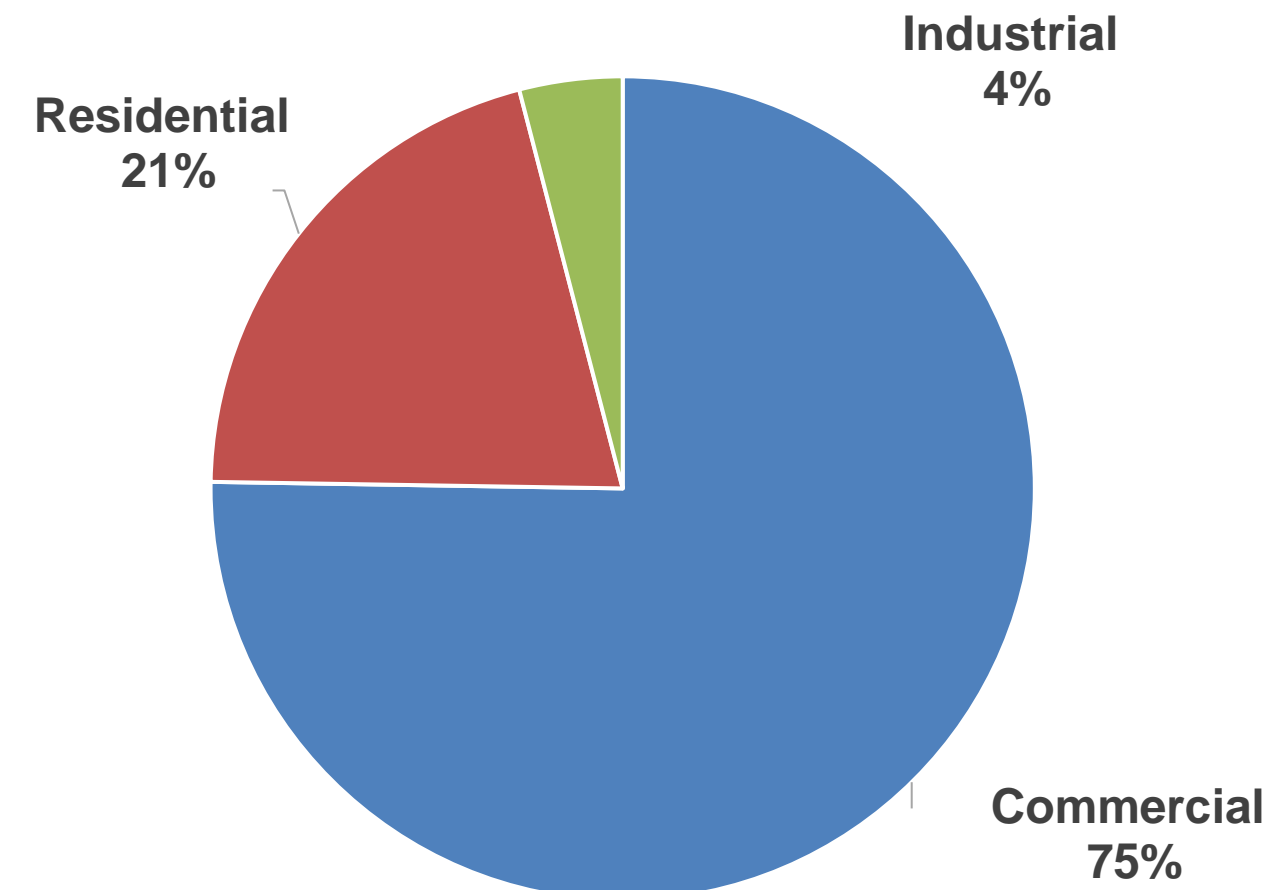


# Real BIPV Market – By Building Types

2018 BIPV Revenue by End-User



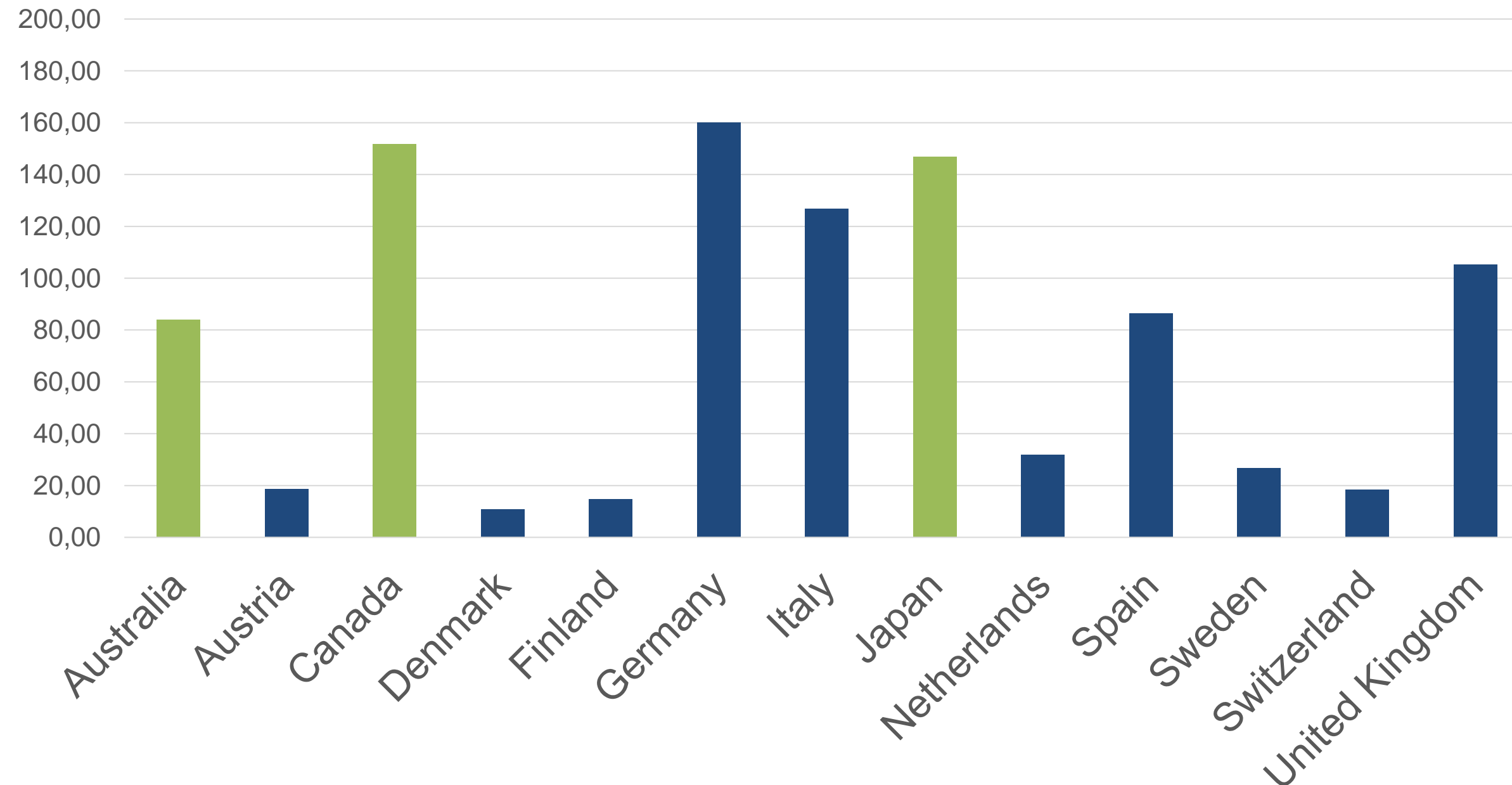
2027 BIPV Revenue by End-User





# BIPV Electricity Production Potential

Potential production of solar electricity (TWh/y) on building envelope



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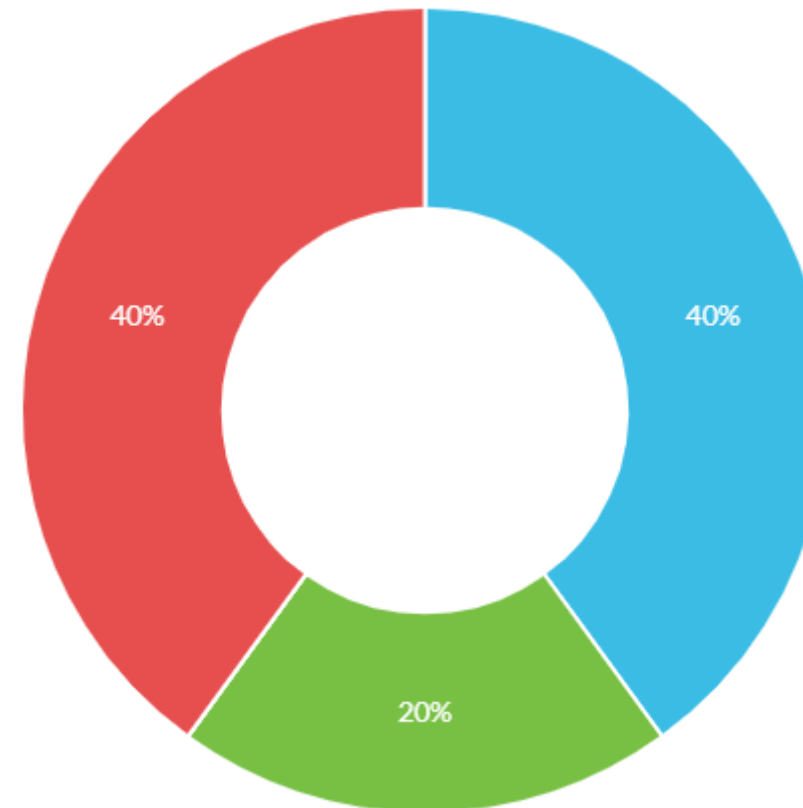


# Customer and End User Perception

## SURVEY CHARACTERISTICS

- Distribution channels: Be-Smart social media, LinkedIn professional networks on sustainability and solar pv, the EC Portal, ...
- Date of launch and closure: **15 Dec 2020 – 15 March 2020**
- Name: *The Future of Buildings – Building Integrated Photovoltaics in Europe*
- Format: Online (Mobile and PC version)

Number of respondents: 91



|                 |    |
|-----------------|----|
| Switzerland     | 38 |
| Norway          | 36 |
| Germany         | 7  |
| UK              | 4  |
| Sweden          | 2  |
| Other countries | 4  |
| Spain           |    |
| Serbia          |    |
| South Korea     |    |
| Taiwan          |    |



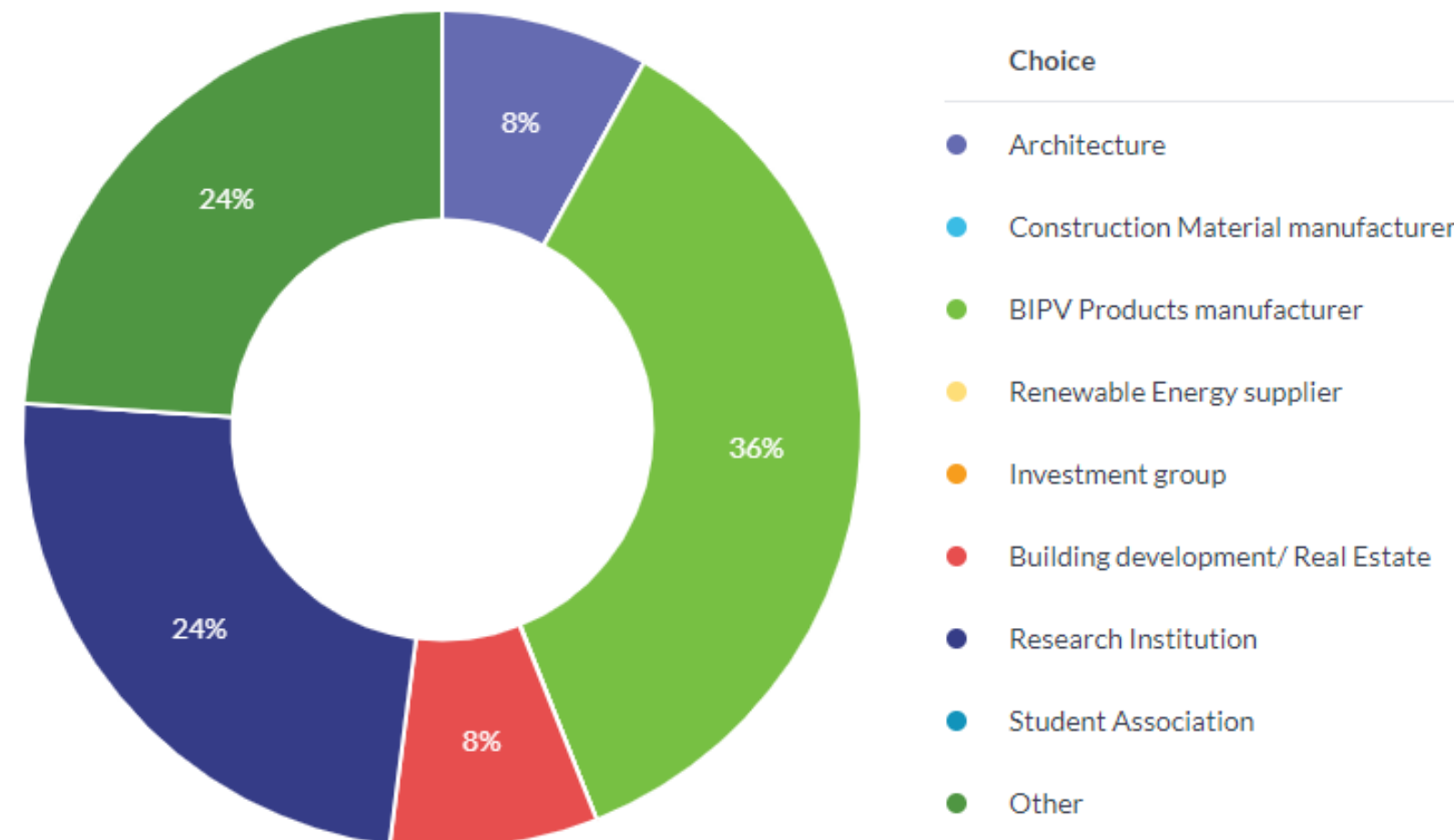


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### Stakeholder groups



### Main respondents:

- BIPV product manufacturers
- Research Institutions
- Other (EPC construction, Consultant, Communication)
- Building developers
- Architects

**66.7% have boosted or have been partially involved with BIPV projects before.**



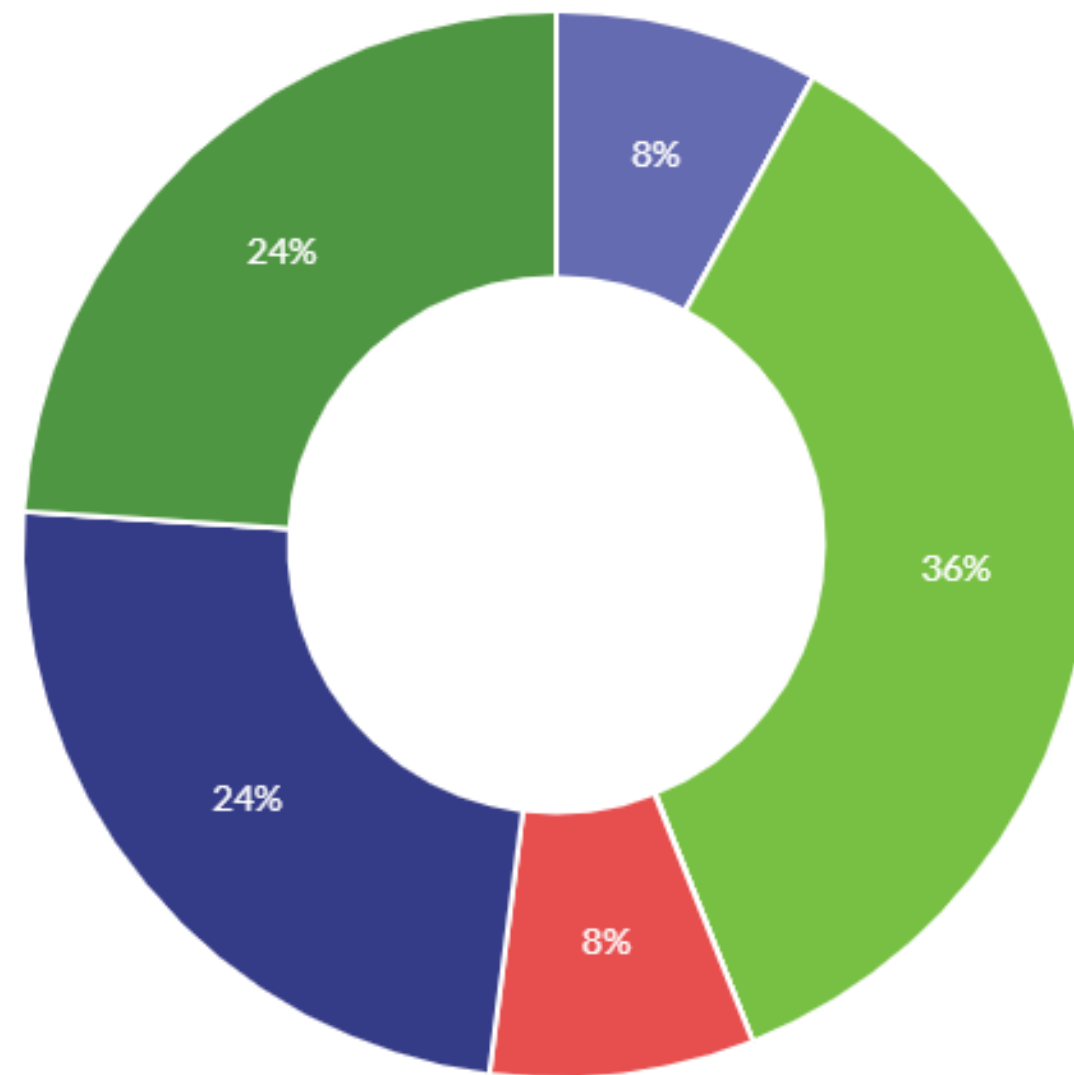
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# Customer and End User Perception

## SURVEY CHARACTERISTICS

### Stakeholder groups



### Choice

- Architecture
- Construction Material manufacturer
- BIPV Products manufacturer
- Renewable Energy supplier
- Investment group
- Building development/ Real Estate
- Research Institution
- Student Association
- Other

### Decision markers and level of influence:

| DECISION MAKER             | AVERAGE SCORE (1-5) |
|----------------------------|---------------------|
| <b>Architects</b>          | 4.68                |
| <b>Constructors</b>        | 3.64                |
| Local Planning Authorities | 3.4                 |
| Private Homeowners         | 3.28                |



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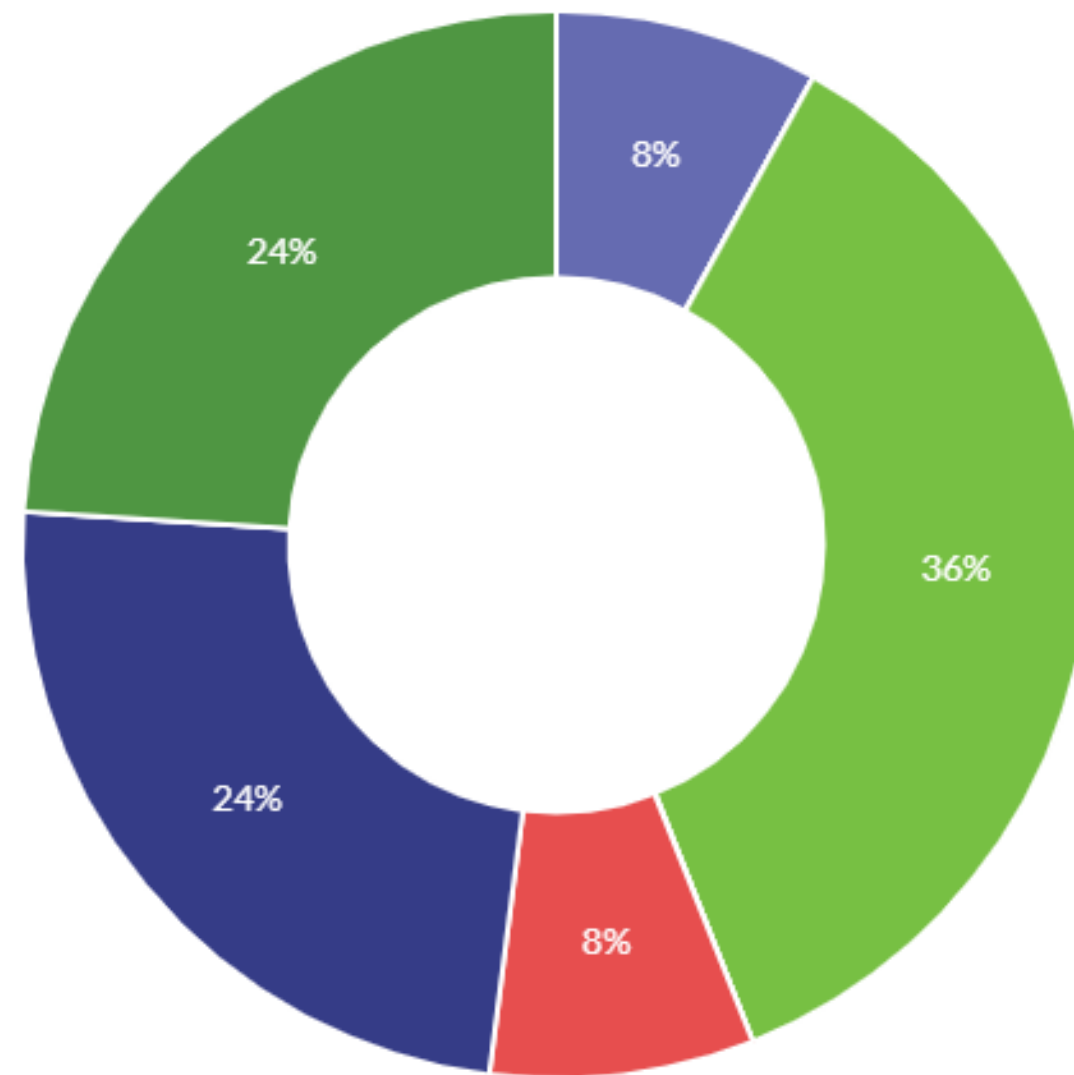




# Customer and End User Perception

## SURVEY CHARACTERISTICS

### Stakeholder groups



### Choice

- Architecture
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- Investment group
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- Research Institution
- Student Association
- Other

### Main BIPV applications (Buildings)

| BIPV BUILDING                                | AVERAGE SCORE (10-5) |
|--|----------------------|
| Residential buildings                        | 3.48                 |
| Industrial buildings                         | 3.08                 |
| <b>Commercial and governmental buildings</b> | <b>4.04</b>          |
| <b>NZEBs</b>                                 | <b>4.28</b>          |



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# Customer and End User Perception

## KEY DRIVERS

What are the parameters you consider relevant to select the most suitable BIPV products for your field/ markets of action?

| Choice   | Score | Average |
|--|-------|---------|
| <input checked="" type="radio"/> Quality of materials (Specify which one: glass, thin film...) | 108   | 4.32    |
| <input checked="" type="radio"/> Aesthetics  | 106   | 4.24    |
| <input checked="" type="radio"/> Costs (financing, supply...)                                  | 93    | 3.72    |
| <input type="radio"/> Scale of the project   | 76    | 3.04    |
| <input type="radio"/> Return on Investment (ROI)   | 80    | 3.2     |
| <input type="radio"/> Payback period   | 82    | 3.28    |
| <input type="radio"/> Partners involved in the project   | 76    | 3.04    |
| <input type="radio"/> Other (Cost per m2, Cost per kWp, Output per m2)                         | 79    | 3.16    |

Please rank the level of relevance (1 Low -5 High) of the BIPV key market drivers in your markets of action (at country level).

| Choice  | Score | Average |
|---|-------|---------|
| <input checked="" type="radio"/> Zero energy building directives                  | 99    | 4.13    |
| <input type="radio"/> Requested by certification schemes                          | 78    | 3.25    |
| <input type="radio"/> Significant demand for BIPV products in markets of action   | 73    | 3.04    |
| <input type="radio"/> Financial incentives  | 75    | 3.13    |
| <input type="radio"/> Environmental awareness                                     | 84    | 3.5     |
| <input checked="" type="radio"/> Public image                                     | 86    | 3.58    |
| <input type="radio"/> Increasing of renewable technologies penetration by clients | 77    | 3.21    |
| <input type="radio"/> Increasing efficiency/ROI of renewable technologies         | 72    | 3       |





# Customer and End User Perception

## BIPV BENEFITS AND CHALLENGES

Please rank the level of importance (1 Low -5 High) the benefits of BIPV in your field/ areas of action.

| Choice                             | Score | Average |
|------------------------------------|-------|---------|
| Energy savings                     | 92    | 3.68    |
| Superior design/aesthetics         | 100   | 4       |
| Easy installation                  | 80    | 3.2     |
| CO2 tax                            | 63    | 2.52    |
| Greenhouse gas savings             | 78    | 3.12    |
| Natural illumination               | 57    | 2.28    |
| Brand image                        | 90    | 3.6     |
| Increase in the rental/ sale price | 78    | 3.12    |
| Low grade heat                     | 58    | 2.32    |
| Insulation properties              | 59    | 2.36    |

What are the challenges of BIPV in your field/areas of action? Rank in terms of priority (1 Low - 5 High).

| Choice  | Score | Average |
|---|-------|---------|
| Cost reduction  | 106   | 4.24    |
| Performance ratio (actual reading of output in kWh per year over calculated, nominal output kWh per year) | 82    | 3.28    |
| Lifetime  | 81    | 3.24    |
| Product flexibility   | 89    | 3.56    |
| Better aesthetics   | 80    | 3.2     |
| Standardization across industry   | 90    | 3.6     |
| Regulations   | 99    | 3.96    |





# Customer and End User Perception

## ADDITIONAL CHALLENGES AND RECOMMENDATIONS

*“Cost is always the main constraint, and lack of transparency in the pricing of solutions from providers”*

*“To convince investors within the PV sector that BIPV is a different element, and not only a matter of cost reduction but of cost gains in the future”*

*“Lack of sufficient knowledge through the value chain is probably the biggest challenge in our market of action ”*

*“We need to boost educational training in crucial stakeholders such as PV installers and electricians”*

*“Need to join forces in order to deliver a clear speech to policy regulators”*





# **Business Strategies within the framework of Be-Smart project**

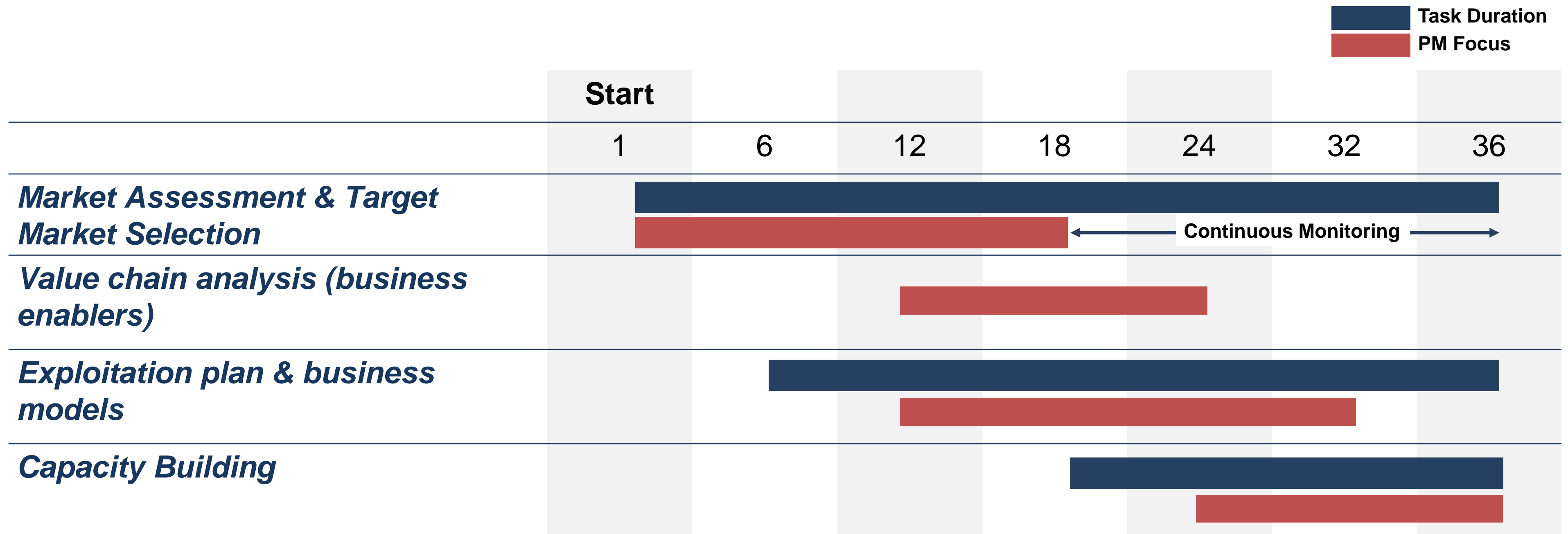
## **SIE**

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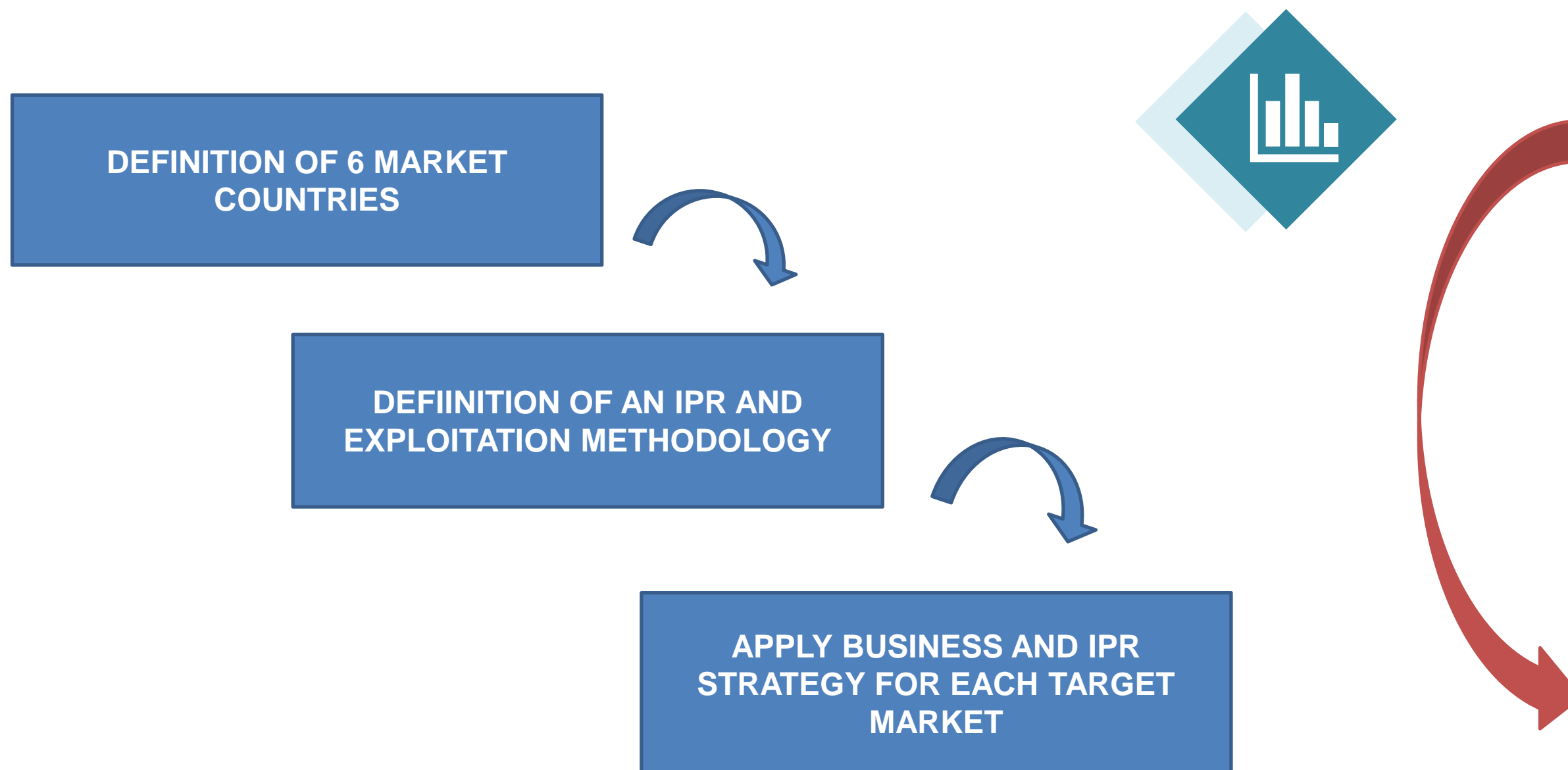
# Business focus





# Starting point: Business Strategy

## EXPLOITATION PLAN/STRATEGY AND CUSTOMER AND MARKET APPROACH



### Market aspect

- Significant base of early BIPV adopting architects and demonstration sites
- Growing demand for renewable energy and energy solutions
- Mix of power sourcing but still dominated by fossil fuels (so BIPV can save more CO2 emission)
- Highly dense urban areas so that free fields aren't available for large PV or wind turbines units / building height
- Commercial buildings (and maybe residential buildings) with huge surfaces to be covered
- Demand for building new commercial buildings
- Existing capabilities to calculate, install and maintain BIPV-systems
- Levelized cost of energy (LCOE) - Medium to high
- Relevant gross national product

- BIPV Revenue in 2018
- BIPV Revenue forecast in 2027







# Priorisation Criteria



## Political aspect

- Clear renewable energy strategy and goals.
- Building policies promoting NZEB (& MOPEC) and integration of renewable energy (at least as ancillary source of electricity).
- Electricity pricing policies fostering self-production (& maybe also storage) and consumption, carbon-free generation.
- Incentives: e.g., tax credits, net metering, price of electricity awarded by local distribution company.



## Legal aspect

- Self-consumption of energy produced (single person, groups, entities).
- Direct provision of self-produced electricity allowed between companies or private persons (shared micro grid).
- Regulations concerning BIPV in buildings (test, certification, standard, Safety and quality norms etc).
- Supportive building code but not too restrictive.



## Market aspect

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- Relevant gross national product.







# Priorisation Criteria

## Approach 1:

Based on the current market data and technical potential



Germany, France, UK, Italy, Spain

## Approach 2:

The countries where partners locate or are interested to enter



Switzerland, Sweden, UK



## Target Market Analysis on:

UK, Germany, Switzerland, Sweden and Norway

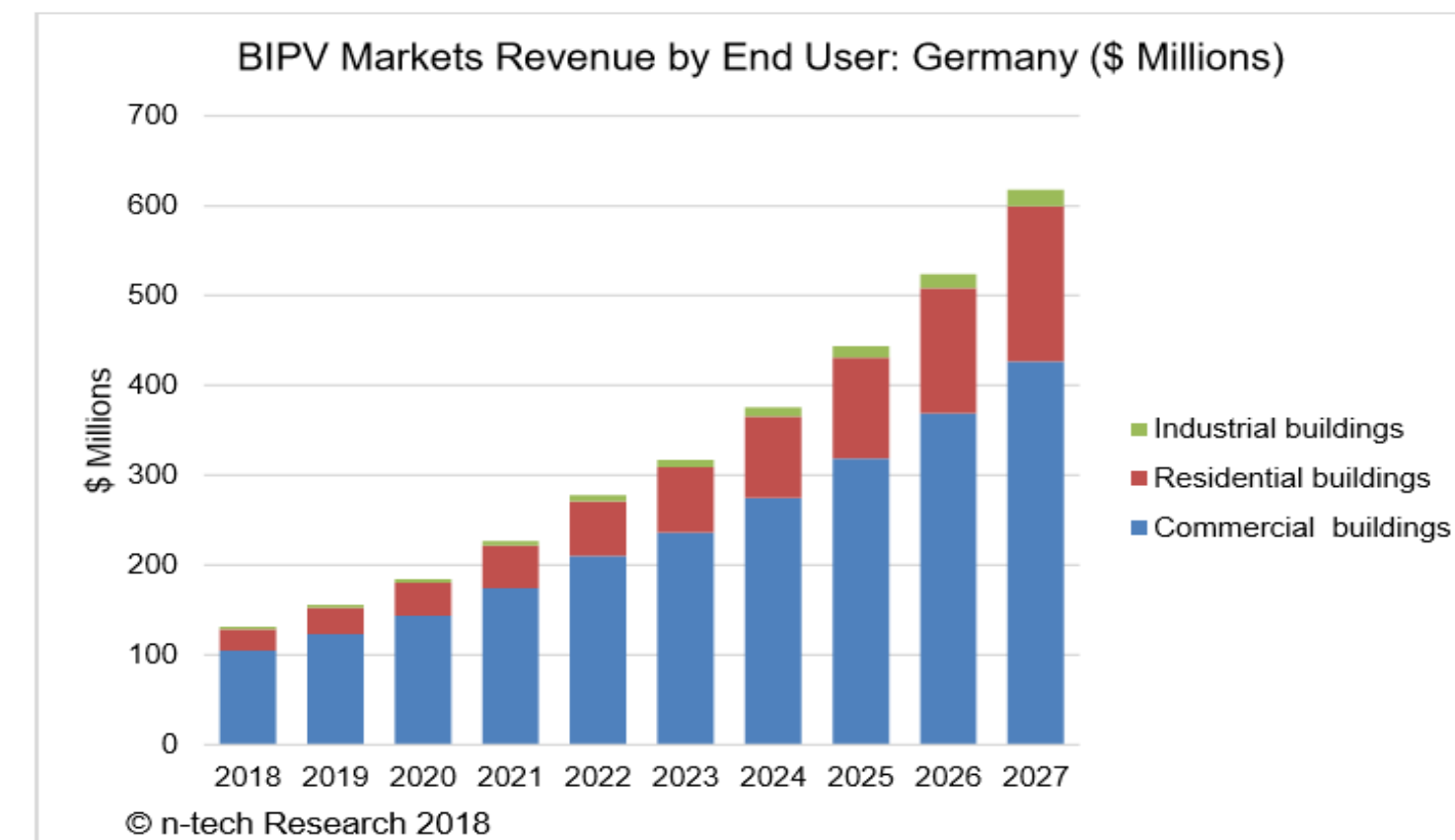
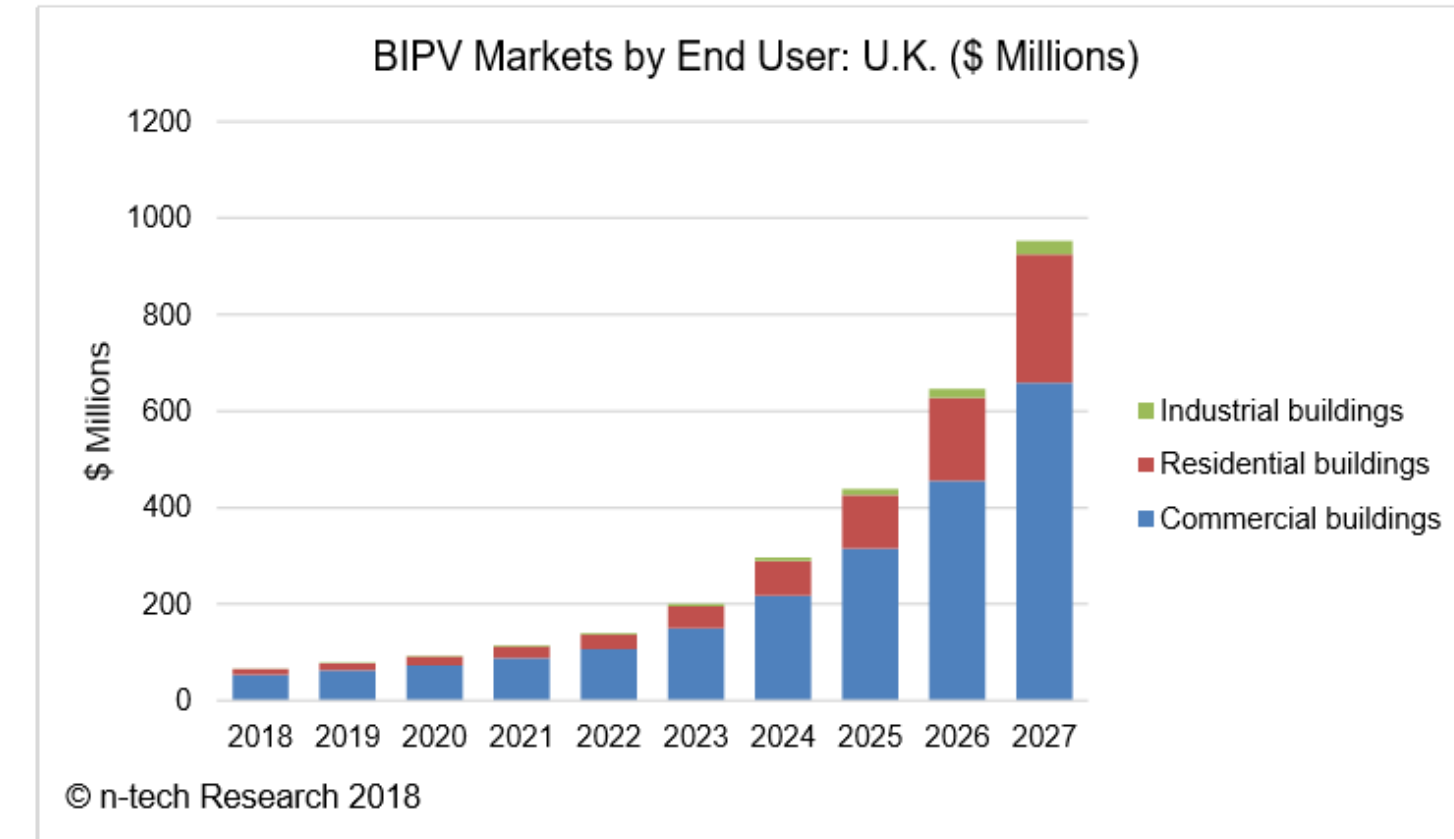




# Step 1: Target market analysis

## UK, Germany, Switzerland, Sweden and Norway

- Countries where demonstration sites are taking place – real data and impact metrics
- Expected increase in solar capacity
  - Sweden (317 MW total solar capacity in 2017, projected 1,601 MW total capacity in 2022. (SolarPower, 2020)
  - Shares of PVs in Switzerland's energy mix has risen from 2.9 % in 2017 to 3.4% in 2018 (SwissSolar, 2018)
- The rising of nZEBs and green certifications across Europe
  - 27% of industry stakeholders in Europe are doing the majority of their projects green, remain moderate by 2021.
  - Norwegian firms projected to do more than 60% of green projects - 30% in 2018 to 64% by 2021, (Dodge, 2019).
- A first sight- friendly regulation towards BIPV and solar
  - German Renewable Energy Act EEG 2019 - increasing the share of renewable energies (RE) to 65% of gross electricity consumption by 2030.
  - German Saving Ordinance (EnEV) - cover at least 80% of its electricity consumption with renewable by 2050.
  - Switzerland's "Energy Strategy 2050"



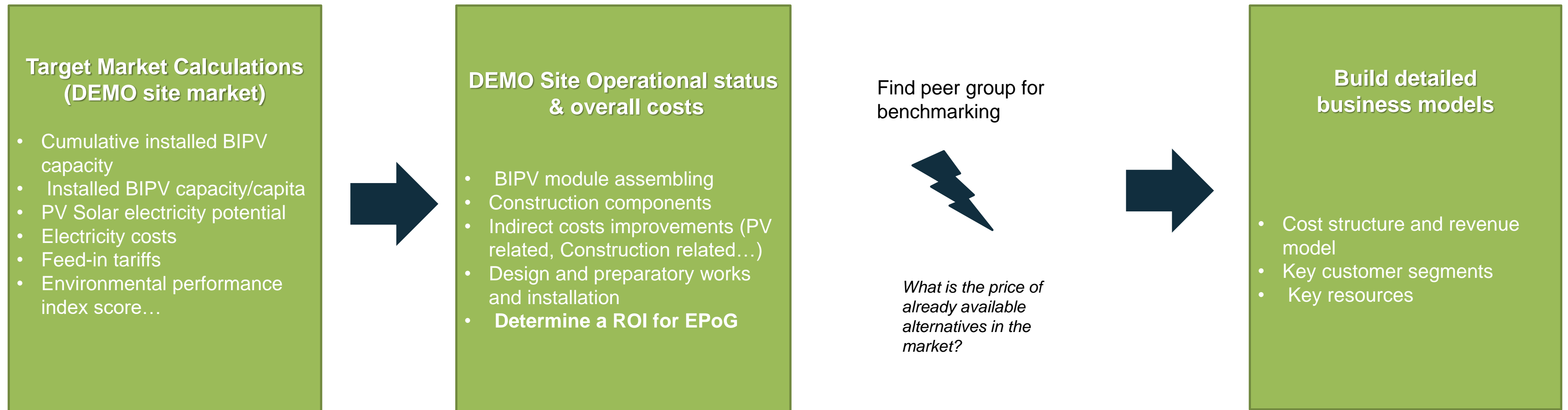
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# Step 2: Scale up product development

- Disclose overall operating costs for each one of the DEMO sites, in order to prove competitiveness regarding costs reductions (50-75% cost reduction for respect to BIPV products currently available in the market).

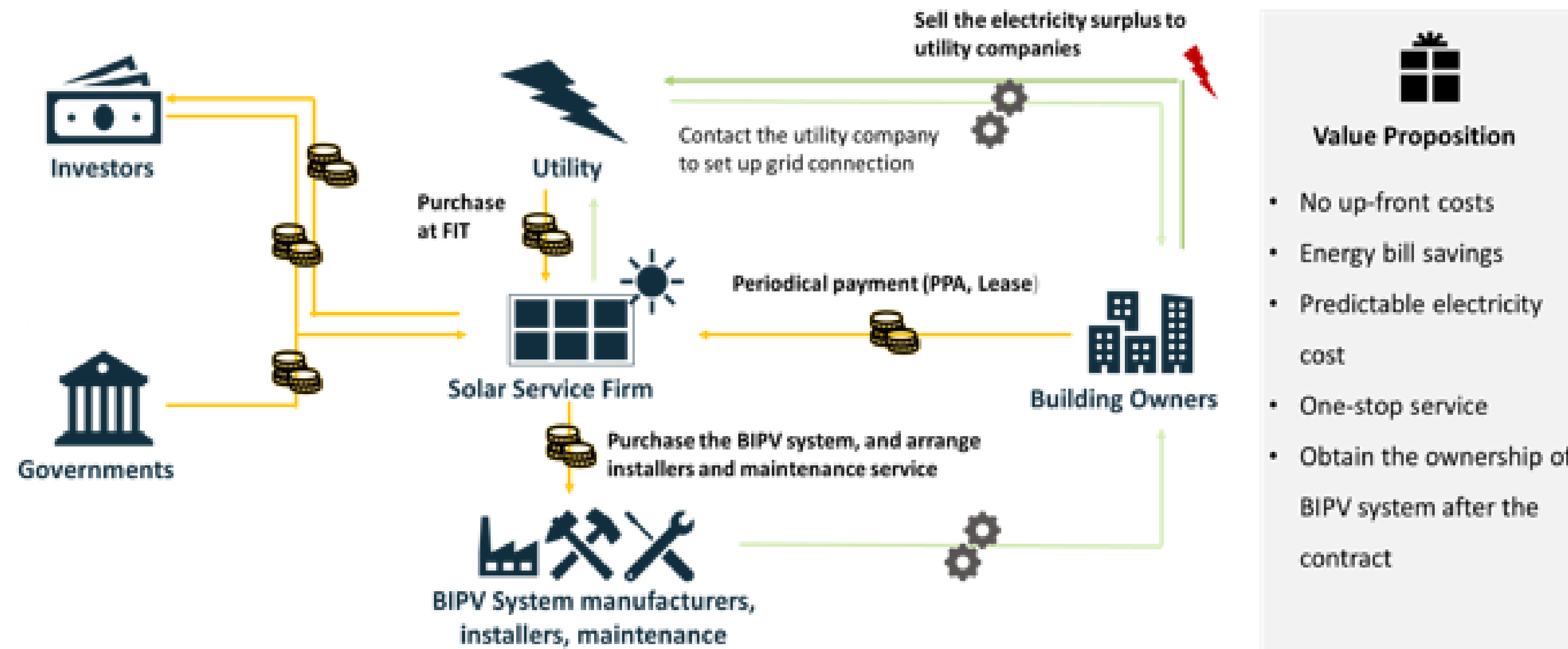
## INDIVIDUAL BUSINESS MODELLING





# Step 3: Build generic and Individual Business Models

Setting up business agreements under Third Party Owned (TPO) business models.



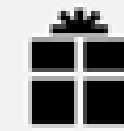
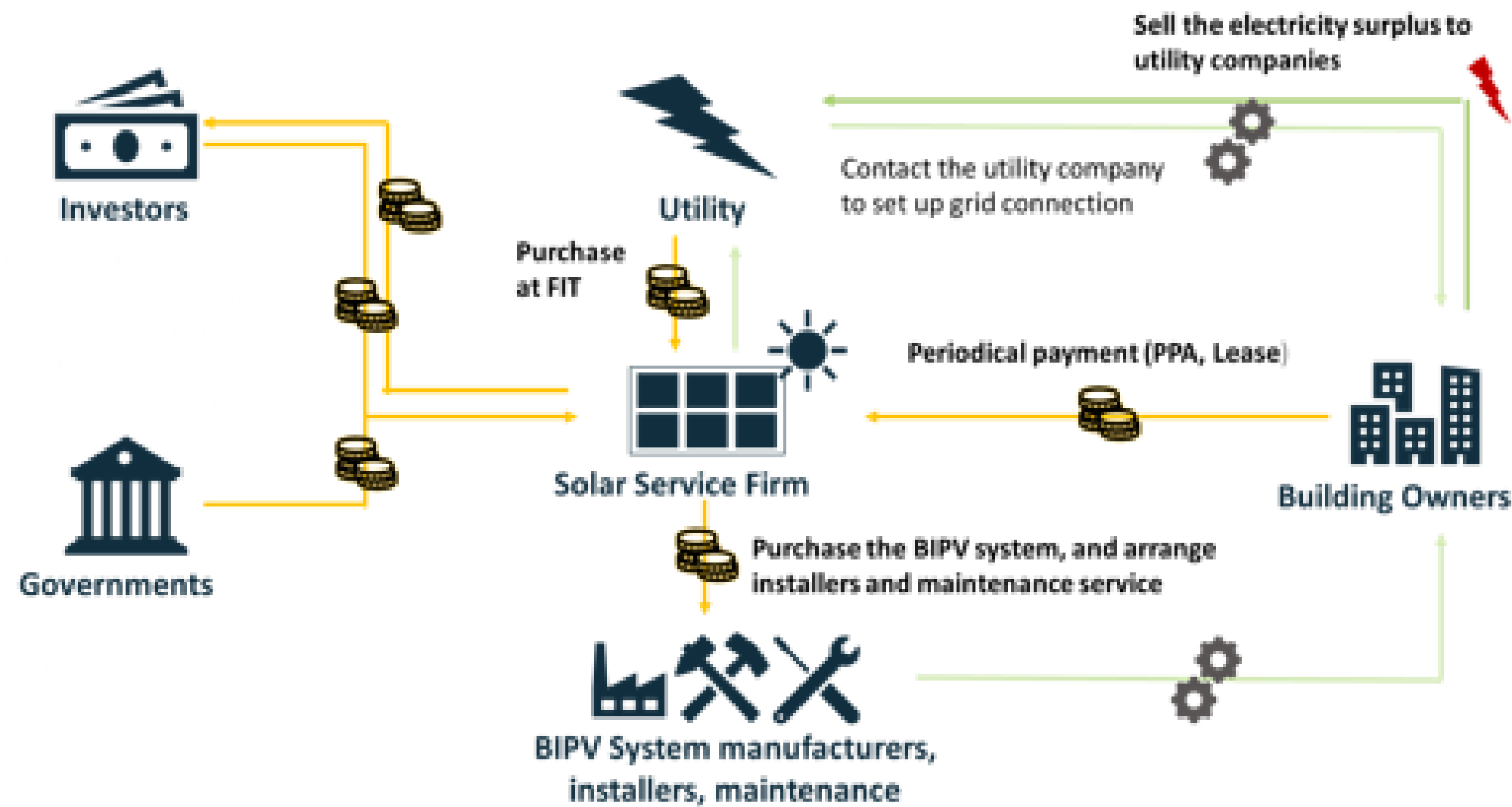


# Step 4: Choose appropriate “smart-money” providers

Setting up business agreements under Third Party Owned (TPO) business models.

Impact Investing Funds (II)  
Business Angels and Venture Building firms

Public Funding Authorities (EC, National Agencies)



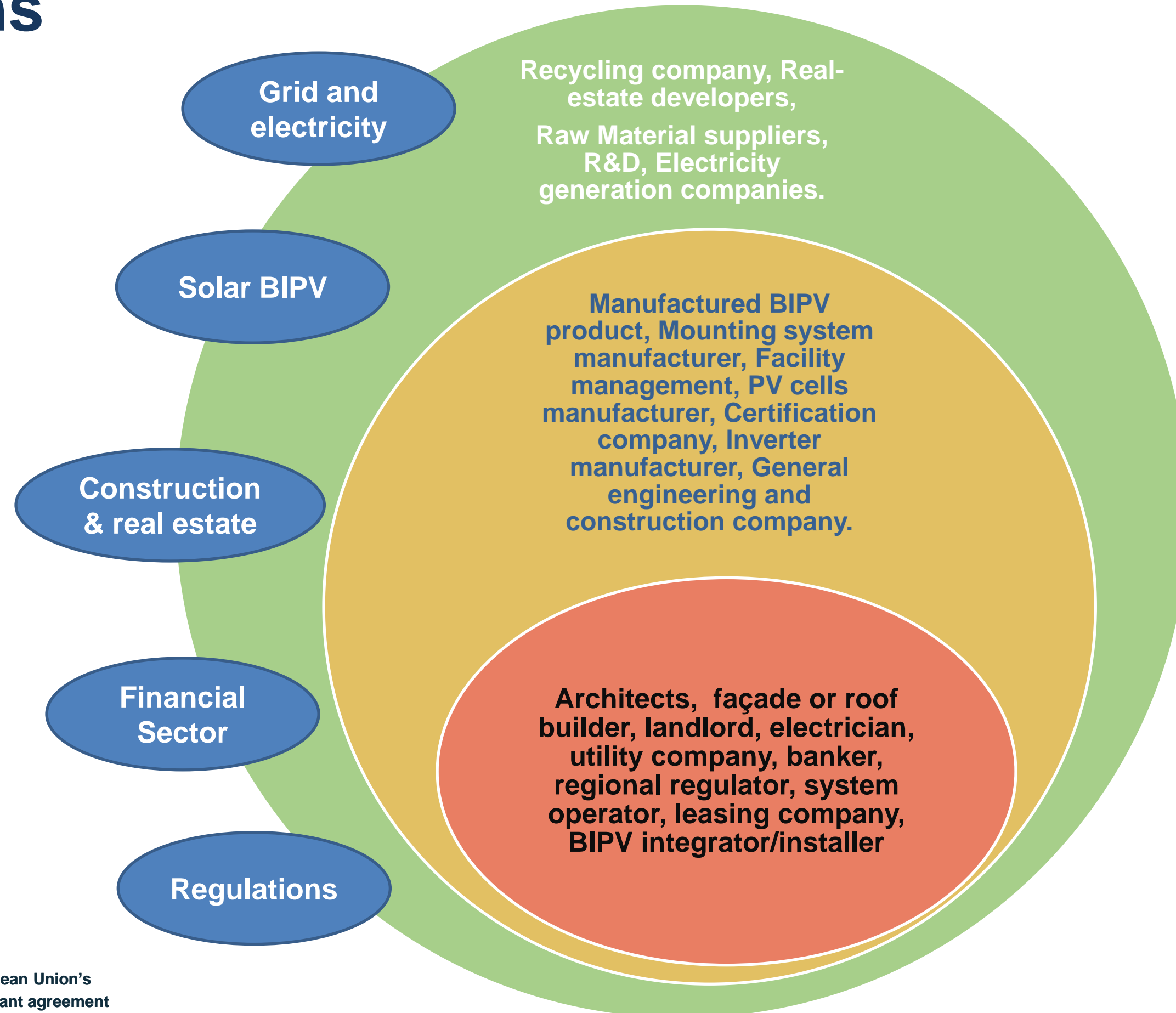
### Value Proposition

- No up-front costs
- Energy bill savings
- Predictable electricity cost
- One-stop service
- Obtain the ownership of BIPV system after the contract





# Other considerations





## Further recommendations for market scale up

- ✓ **Conduct deep product-market fit validation**
- ✓ **Who are the early adopters?**
- ✓ **Prioritize main channels to reach adopters (users)**
- ✓ **Optimize funding opportunities and needs**







**Thank you  
for your attention.**