

Policy options to support the uptake of small-scale renewable electricity generation (SSG) in Ireland: Overview of economic modelling for the consultation

15th September 2022



Nomenclature

- CAP: Climate Action Plan
- CAPEX: CAPital Expenditure
- CEG: Clean Export Guarantee
- DAM: Day-Ahead Market
- DUoS: Distribution Use of System
- EC: European Commission
- FiP: Feed-in Premium
- IEA: The International Energy Agency
- IRR: Internal Rate of Return
- MSS: Micro-generation Support Scheme
- MV: Medium Voltage
- OPEX: OPerating Expenditure
- O&M: Operation and Maintenance
- PSO: Public Service Obligation
- PV: PhotoVoltaics
- RED: Renewable Energy Directive
- RESS: Renewable Electricity Support Scheme
- RTU: Remote Terminal Unit
- SEC: Sustainable Energy Community
- SME: Small and Medium-sized Enterprises
- SSG: Small-Scale electricity Generation
- TUoS: Transmission Use of System
- ViaGap: Viability Gap

Background

- CAP 2021:
“We will develop a Small-scale Generation Scheme (>50 kW) to support the deployment of rooftop and ground-mounted solar PV in cohorts that are not as suited to other support measures, such as the MSS and the RESS.”
- Full report by Ricardo and BioXL at:
- <https://www.gov.ie/en/consultation/353f2-consultation-on-a-small-scale-generation-support-scheme-ssg-in-ireland/>
 - Thanks to both teams.

Action	108	Deliver a Solar and Small-Scale Generation Policy Framework		
Steps Necessary for Delivery	Proposed Output	Timeline	Lead	Key Stakeholders
Publish a draft Small-Scale Generation (SSG) scheme for consultation to support the deployment of rooftop and ground-mounted solar PV in cohorts that are not as suited to measures such as the Microgeneration Support Scheme and RESS	Consultation published	Q2 2022	DECC	CRU, SEAI, ESBN
Develop and trial a streamlined grid connection pathway for export connections for renewables self-consumers from 51kW to 200kW	Commence Application process trial for 51-200kW	Q3 2022	CRU	DECC, ESBN
Determine an appropriate settlement mechanism for small-scale generators between 51 kW and 500 kW	SSG Premium tariff	Q4 2022	CRU	DECC, ESBN, SEAI
Publish final Small-Scale Generation high-level design to support the deployment of rooftop and ground-mounted solar PV in cohorts that are not as suited to measures such as the Micro-generation Support Scheme and RESS.	Published high level design	Q1 2023	DECC	CRU, SEAI, ESBN

SSG scope

- **50 kW – 1 MW or 6 MW**
 - **50 kW** is the upper threshold of the Micro-generation Support Scheme ([MSS](#)).
 - **1 MW or 6 MW** is the upper limit from the recent (Feb. 2022) [Guidelines on State aid for climate, environmental protection and energy](#). The new guidelines stipulate competitive bidding processes are not required “*where evidence, including that gathered in the public consultation, is provided that one of the following applies: ...*
(i) for electricity generation or storage projects – projects below or equal to 1 MW of installed capacity; ...
(iv) for 100 % SME-owned or renewable energy community projects equal to or below 6 MW installed capacity or maximum demand”
 - 0.5 MW is the minimum offer quantity in [RESS](#) 1 and 2 terms and conditions. However, feedback suggests that the RESS may not be fully suited to support community energy project feedback.

*[RED II](#) defines a ‘Renewable Energy Community’ as a legal entity: (a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity; (b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities; (c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.

Policy principles

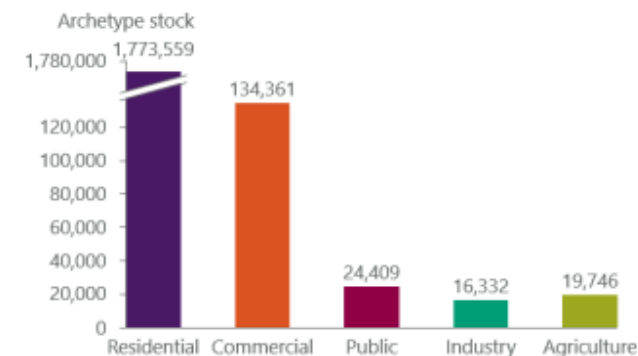
- Build on / align with the work done for the MSS where appropriate:
 - Clean Export Guarantee ([CEG](#)), for renewable self consumers, i.e. not relevant to export-only sites.
 - Feed-in-Premium (FiP), i.e. a tariff in addition to the CEG.
- Provide economic support to renewable technologies where a **viability gap exists**, i.e. cover the difference between the cost and the savings from self-consumption and/or the revenue received for exported electricity.
- Focus on rooftop solar PV costs for < 1 MW, given that is where the majority of uptake is expected, though scheme is expected to be technology agnostic.
- Just transition (e.g., diversification of income streams for farmers).
- Promoting community energy (as per the [RED II](#)).
- Cost recovery likely to be via the PSO levy.

Key assumptions

- The SSG minimum threshold implies a minimum roof space:
 - $6.25 \text{ m}^2/\text{kWp} \rightarrow \sim 450 \text{ m}^2$ for 50 kW (assuming 30% roof unavailable due to shading), ~ size of a basketball court.
- The installed capacity for demand sites are assumed to be limited by the customer's maximum import capacity (MIC) connection agreement.
- The ground-mounted solar PV archetypes have a DC (panel) rating 1.5 times that of the AC (converter, MIC) rating. This is often termed [oversizing](#).
- A discount rate of 6% was selected (in contrast to 3.75% used for MSS) to represent investment hurdle rate / cost of capital.
- Scheme modelled as being open for 8 years (to hit 2030 targets), support payments provided for 15 years, export payments capped at 80% for renewable self-consumers.

Archetypes

- The term ‘archetype’ is used throughout the SSG study. Archetypes are a way of reducing a wider population down to a smaller group that should still retain the key characteristics of the wider population. This is done by looking at key properties of the population and grouping those that are similar.
- In reality, each site will differ and have its own characteristics.
- To try understand where the potential SSG deployment may occur, a characterisation exercise was conducted with the following steps:
 - Installed capacity (kW) banding exercise to understand what barriers might generators of different sizes face.
 - Electricity consumption (kWh) profiling, using mainly the [National Heat Study](#) (NHS) demand [archetype dataset](#) for demand sites.
 - Sizing an appropriate installed capacity.



Note:

- Industry stock represents pieces of industrial equipment.



Generation capacity banding

50 kW – 100 kW

- Many sites/buildings across the country will not have a consumption level (and therefore MIC) high enough to facilitate > 100 kW.

100 kW – 200 kW

- Balance responsibility obligations for > 200 kW from 2026 ([IMER](#)).
- DSO connection policy requires a MV substation > 200 kVA ([Substation Construction](#)).

200 kW – 500 kW

- Currently, applicants > 500 kW to participate in gated annual grid application windows under the Enduring Connection Policy (ECP).
- Connection application fees increase from €1,591 to €9,037 > 500 kW ([ECP-2 ruleset](#)).

500 kW – 1,000 kW

- DSO grid code requires remote terminal unit (RTU) / controllability > 1 MW ([Distribution Code](#))
- State aid exemption <= 1 MW.

1,000 kW – 6,000 kW

- State aid exemption <= 6 MW for 100 % SME-owned or renewable energy community.

Archetype selection (ascending installed capacity)

#	Archetype	Example type(s)-Size(s)	Size (kW)	Annual demand (MWh)
1	Commercial site – rooftop-mounted PV	Hotel-Large, Retail-Large	60	231
2	Agricultural site – rooftop-mounted PV	Pig farm	100	342
3	Public building – rooftop-mounted PV	Education-Large, Office-Large	100	192
4	Industrial site – rooftop-mounted PV	Chemicals, Food and Drink	250	1,042
5	Commercial site – rooftop-mounted PV	Warehouse	250	33
6	Public building – rooftop-mounted PV	Healthcare-Large, Office-Large	325	680
7	Industrial site – rooftop-mounted PV	Chemicals, Food and Drink	625	2,607
8	Export site – ground-mounted PV	Agriculture, Community Energy	999 [†]	0
9	Export site – ground-mounted PV	SME-owned, Community Energy	4,000*, [†]	0
10	Export site – onshore wind	SME-owned, Community Energy	4,000*	0

From data, MSS will be more appropriate for most commercial and agricultural premises.

[Shine et al. 2017](#) have electricity consumption stats for 43 dairy farms:

Min (MWh)	Average (MWh)	Max
4.9	24.0	62.4

Exporting more than MIC – outlier / thought experiment

Generation-only => capacity restricted for reasons other than MIC. (Note not all sites will be able to install this amount of capacity due to network infrastructure limitations and the associated reinforcement costs.)

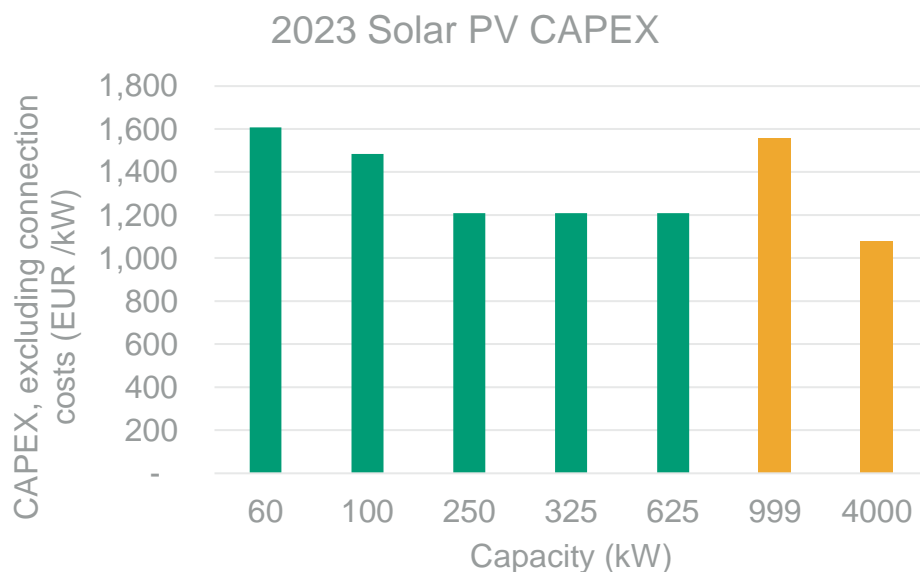
* 4-MW selected for community energy projects due to additional €18,732 shallow works cost for [connection application fees](#) for > 4 MW.

† This is the AC rating (converter / grid connection), the DC rating is 1.5 times this.

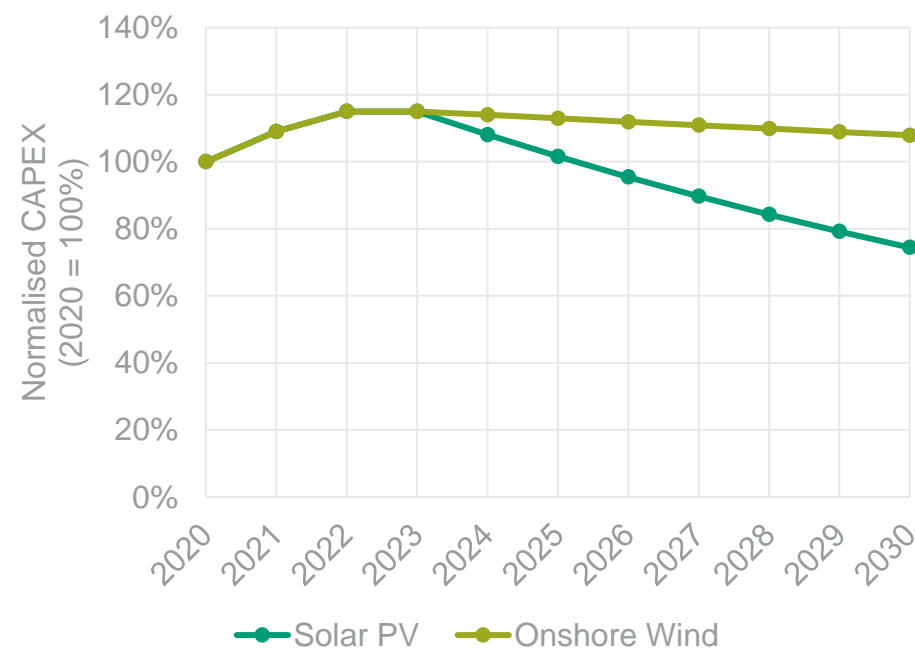
Costs – Technology CAPEX

- SEAI scheme data used as the 2020 starting point for rooftop PV.

Technology	2020-2022 increment	Post-2023 decrement
Solar PV	15.00%	-6.0%
Onshore wind	15.00%	-0.9%

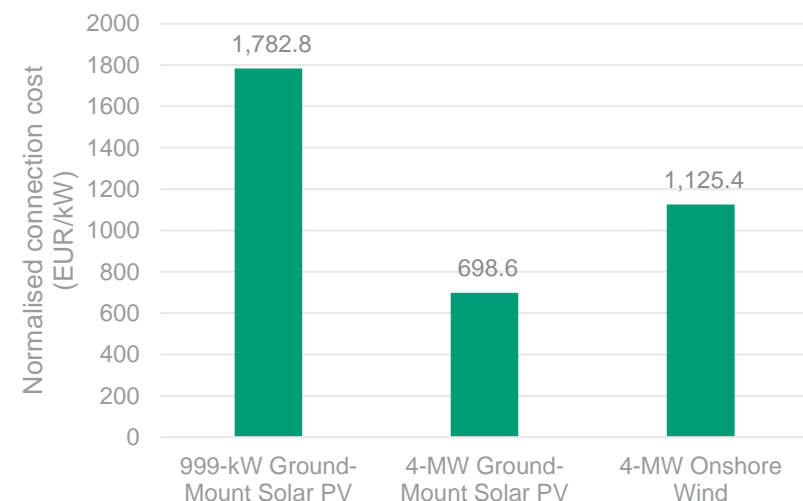
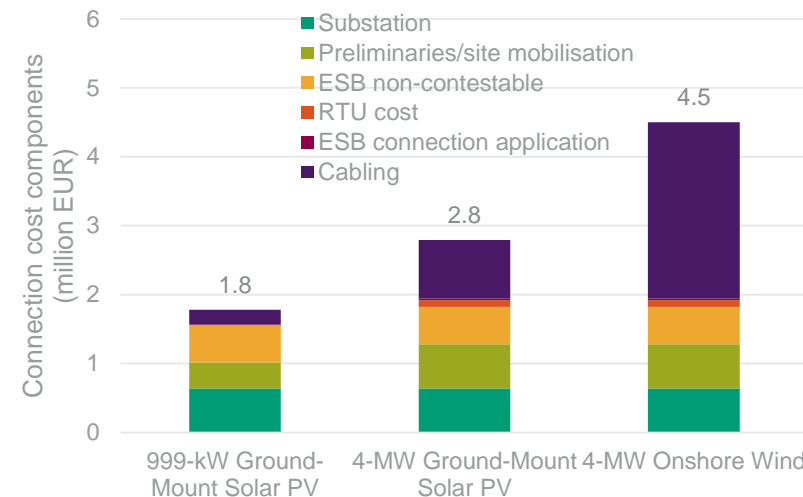


- The IEA's 2021 *Renewables [report](#)* was used as a source for CAPEX cost trends.



Costs – Grid-connection CAPEX

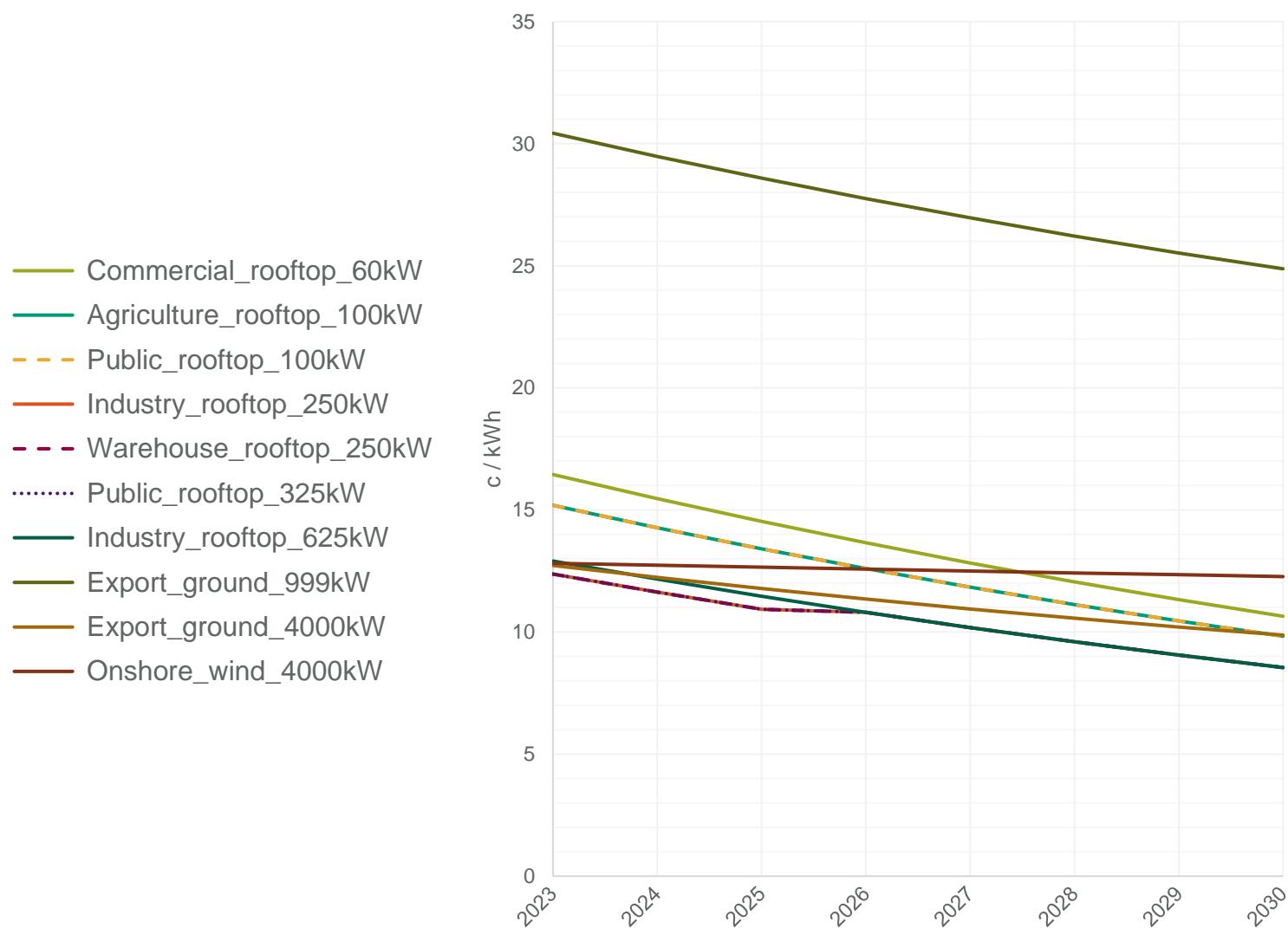
- Connection costs were assumed applicable for the generation-only sites (given the < MIC assumption for demand sites).
- Six types of connection costs are considered.
- A remote terminal unit (RTU) is not applied to generators below 1 MW.
- Cable lengths of 0.5 km, 2 km and 6 km were assumed for 999-kW solar PV, 4-MW solar PV and 4-MW onshore wind, respectively.



Costs – OPEX

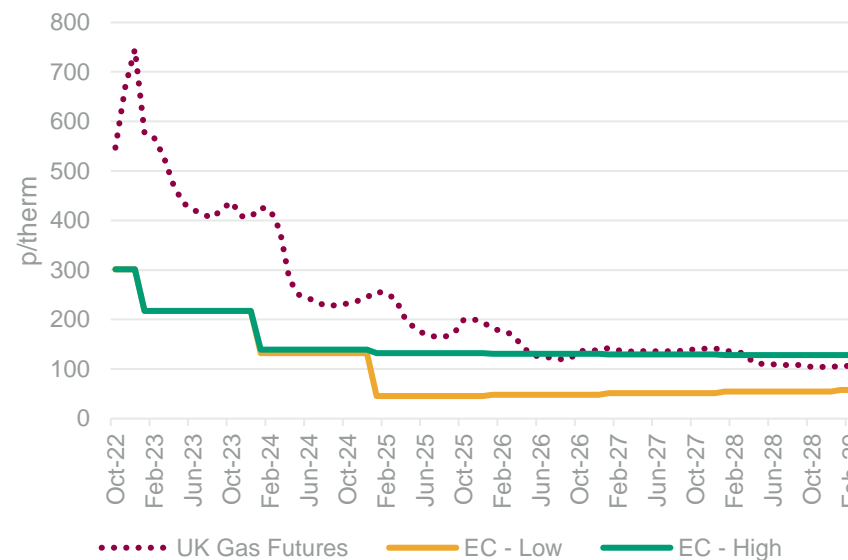
- Total OPEX (% CAPEX / year)
 - 1% for rooftop solar PV, 2% for ground-mount solar PV, 3.5% for onshore wind.
- Land lease
 - 5.3 €/kW/year, applied to ground-mount solar PV and onshore wind, i.e. a value of zero is taken for rooftop solar PV.
- Local authority rates
 - 6.4 €/kW/year, applied to ground-mount solar PV and onshore wind, i.e. a value of zero taken for rooftop solar PV.
- Fixed OPEX
 - Total OPEX – (land lease + local authority rates)
- Balancing costs
 - 5 €/MWh, applied to ≥ 400 kWh before 2026 and ≥ 200 kWh thereafter for all generators.

Levelised Costs – over project life (25 for wind, 30 years for PV)



Note of caution regarding the current price environment

- In April the European Commission (EC) provided guidance on wholesale fossil fuel price projections in an attempt to capture the effect of the invasion of Ukraine.
- Even since then, market prices have gone to unimaginable levels.

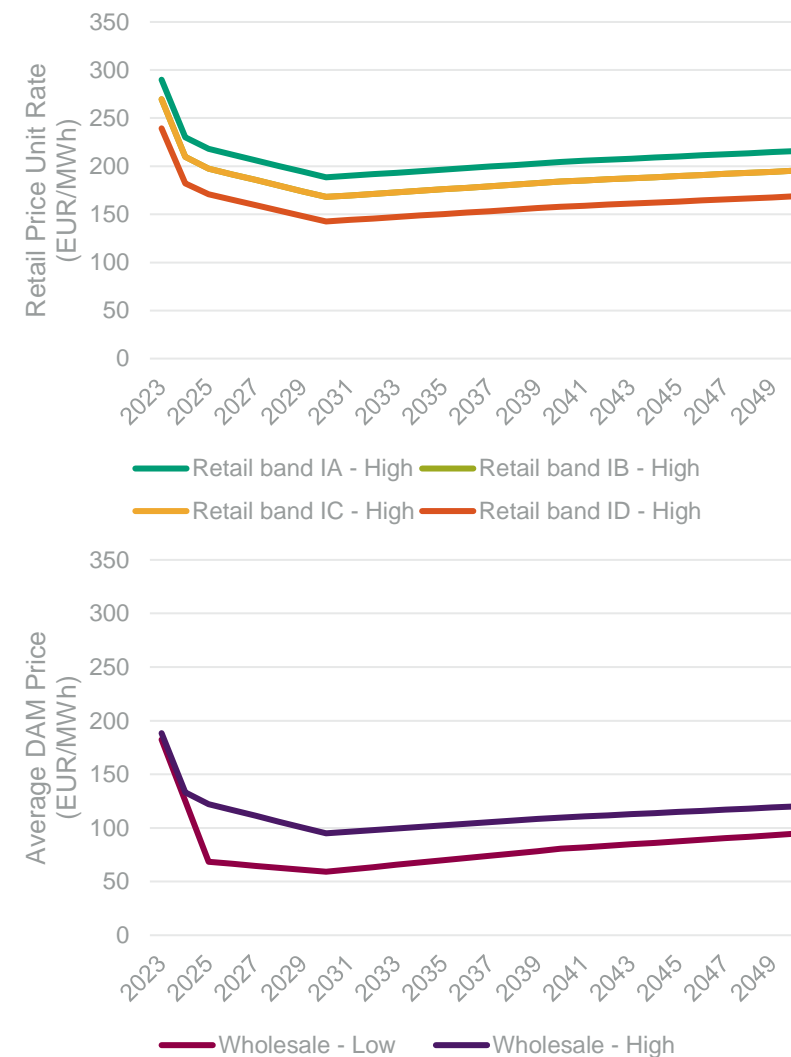


Monetary benefits

- Two forms for a demand sites:
 - Bill savings due to self-consumption, valued at an estimation of the retail unit rate, i.e. an estimation of the standing charge has been subtracted from the total retail price. Fixed components have been used an estimate of the standing charge:
 - PSO, DUoS Standing Charge, DUoS Capacity Charge, TUoS Demand Network Capacity Charge

Band	Min (kWh)	Max (kWh)	DUoS group
IA	-	20,000	DG5
IB	20,000	500,000	DG6
IC	500,000	2,000,000	DG6
ID	2,000,000		DG7

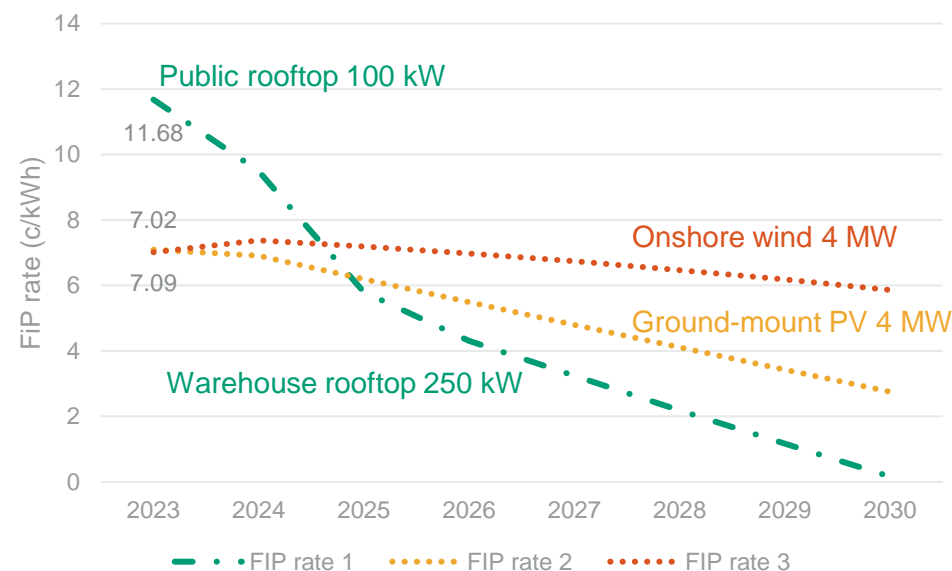
- Export payments via the CEG, valued at the annual average day-ahead price.
 - Export payments via the CEG, valued at the annual average day-ahead price.
- One form for a generation only (“export”) site:
 - Day-ahead market revenue for generation.



Policy options (in addition to the CEG if applicable)

	1 Single Feed-in-Premium	2: Multiple Feed-in-Premiums	3: Single Feed-in-Premium with additional Community Energy support
Type	One rate FIP for all archetypes.	Three different FIP for archetypes to match certain viability gaps as closely as possible.	Similar to support provided under policy option 1 + aid for studies and consultancy services for community energy projects under SEC
Policy lifetime	8 years (to hit 2030 targets)		
Support lifetime	15 years (aligns with other support schemes)		
Level of support	Close the viability gaps (reducing over time)		

Annual viability gaps, and FiP rates under policy option 2



Illustrative example of policy option 2

Archetype technology	Export level	CAPEX - 2023 installation	Lifetime OPEX - 2023 installation	Total lifetime subsidy	ViaGap after CEG - 2023 installation	FiP level	1st year export - 2023 installation	1st year subsidy - 2023 installation	1st yr bill saving	IRR	Payback (incl. subsidy)
	%	€	€	€	c/kWh	c/kWh	kWh	€	€		yr
Commercial_rooftop_60kW	21.95%	96,445	28,934	18,927	20.71	11.68	11,190	1,307	7,986	5.00%	15.84
Agriculture_rooftop_100kW	12.35%	155,719	46,716	18,633	14.87	11.68	11,016	1,286	15,689	5.79%	15.01
Public_rooftop_100kW	34.48%	148,346	44,504	49,561	11.68	11.68	29,300	3,421	11,172	6.00%	13.98
Industry_rooftop_250kW	18.94%	302,275	90,683	68,059	(7.43)	11.68	40,235	4,698	34,555	8.28%	11.82
Warehouse_rooftop_250kW	92.33%	302,275	90,683	331,765	6.34	11.68	196,135	22,902	3,270	9.72%	9.55
Public_rooftop_325kW	44.21%	392,958	117,887	206,503	2.47	11.68	122,082	14,255	30,920	8.73%	10.93
Industry_rooftop_625kW	18.91%	755,688	305,821	169,888	10.99	11.68	100,435	11,728	74,825	6.09%	14.34
Export_ground_999kW	100.00%	3,336,017	1,076,382	1,628,312	31.65	11.68	962,636	112,404	-	-1.83%	n/a
Export_ground_4000kW	100.00%	7,107,593	3,363,105	5,345,337	7.09	7.09	5,203,440	368,995	-	6.00%	12.86
Onshore_wind_4000kW	100.00%	12,702,967	8,566,598	10,974,474	7.02	7.02	10,424,400	731,632	-	6.00%	12.39

End

