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The Red Oak Park a neighborhood in Boulder CO features renewable energy design ©Dennis Schroeder / NREL

IEA-PVPS Self-Consumption Policies 2016

Tables and Figures



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	Included in the analysis	Excluded from the analysis
Prosumer	<ul style="list-style-type: none">+ Savings from consumption of electricity from the grid+ Revenues/Savings from PV electricity injected to the grid (if applicable)- Costs associated to the PV system- Taxes or fees on self-consumed PV (if applicable)	<ul style="list-style-type: none">+ Potential savings from reduced variable charges under tiered rates (if applicable)+ Potential savings from reduced capacity charges (if applicable)
Electricity Market*	<ul style="list-style-type: none">+ Fees over on-site self-consumption (if applicable)- Reduced revenues associated to self-consumed PV- Subsidies on PV generation (if applicable)	<ul style="list-style-type: none">+ Benefits such as avoided T&D investment, reliability benefits and energy cost reduction- Needed investments such as grid reinforcements- Increase in balancing costs
Tax Collector	<ul style="list-style-type: none">+ VAT of PV investment+ VAT of operating costs+ Taxes over insurance cost+ Corporate tax rate of installer- Taxes and levies over electricity	<ul style="list-style-type: none">+ Other benefits such as indirect tax collections resulting from increased revenues in other economic sectors (e.g. equipment manufacturers)

Note: *The Electricity Marketencloses generators, suppliers, TSO, DSO, regulators, and electricity consumers

Source: Creara Analysis

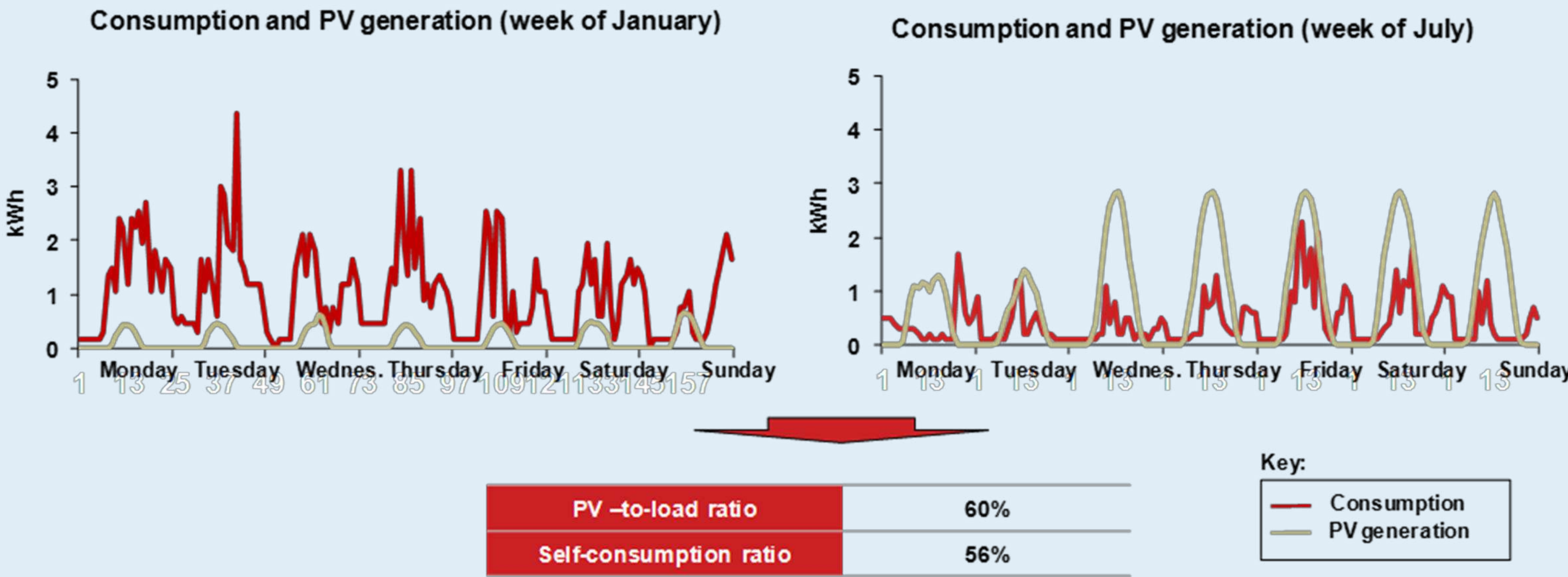
Key:

- + Positive impact
- Negative impact

Figure 7. Cash flow components considered in the analysis



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Note:
Source: The generation curve in Rome was used as a reference

Figure 8. Generation curve and electricity load (winter and summer)



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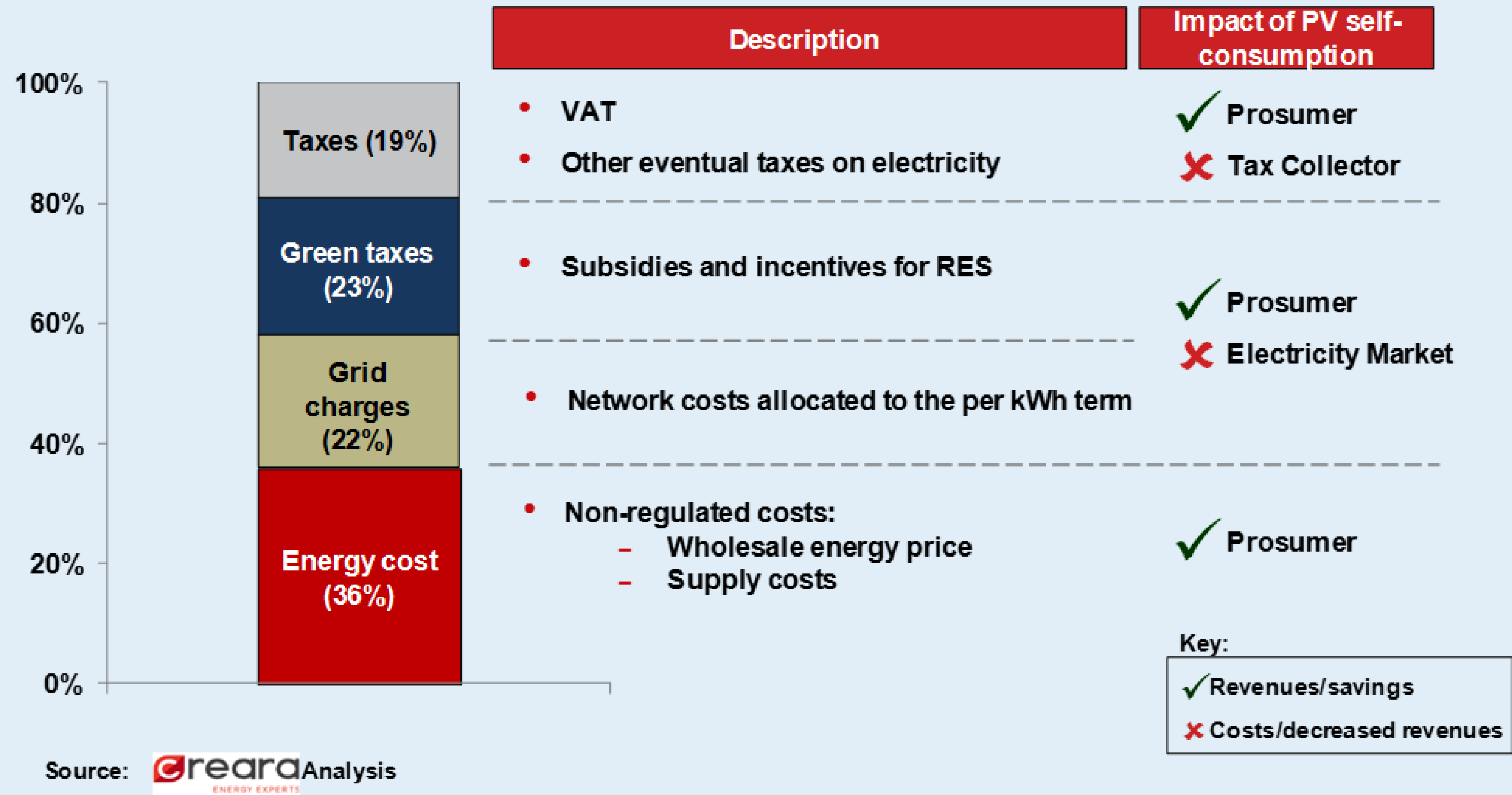


Figure 9. Segmentation of the variable components of the retail electricity tariff



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Parameter	Unit	Value	Comments
Retail rate with taxes			
Peak	EUR/kWh	0,23	-
Off peak	EUR/kWh	0,19	-
Standard	EUR/kWh	0,22	-
Annual fee per meter	EUR	13,00	Meter charge (scenario without PV)
Estimated annual price increase of grid electricity	%	2%	Conservative estimate (the higher the price increase, the better the profitability of the investment for the prosumer)
Annual solar irradiation	kWh/m2/yr	1 611	
Performance Ratio (PR)	%	0.8	-
Size	kW	3	-
Turnkey cost	EUR/Wp	2	-
Annual degradation rate	%	0,5%	-
Lifetime of the investment	years	30	-
Operating costs	EUR/(kWp.yr)	20	Includes annual O&M and insurance costs (5 Currency Unit/kWp per year)
Tax on insurance	%	6%	Based on average market values
CPI	%	2%	It is assumed that operating costs grow according to the CPI
Inverter replacement	EUR/W	0,26	The inverter is replaced once during the lifetime of the PV system
Financing			
Leverage	%	50%	-
Interest rate	%	7%	A tenure of 10 years is assumed
Discount rate	%	7%/ 5%	Prosumer/ Tax Collector and Electricity Market
kWp/kW ratio	-	1,15	-
Installer margin	%	20%	-
Corporate tax rate	%	30%	-

Table 25. Parameters used in the analysis



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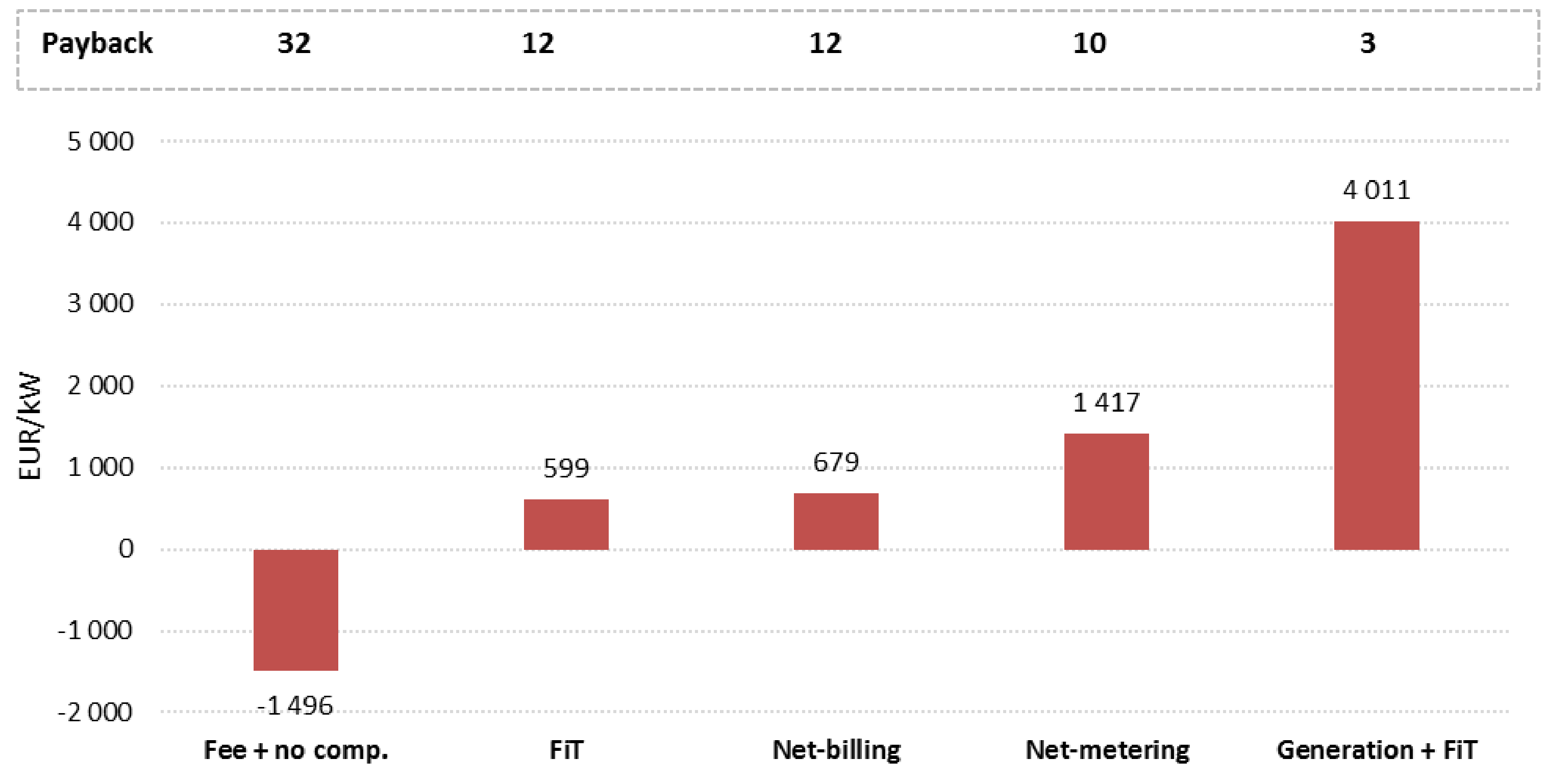


Figure 10. NPV per installed kW (30 years) for the prosumer per Business Case



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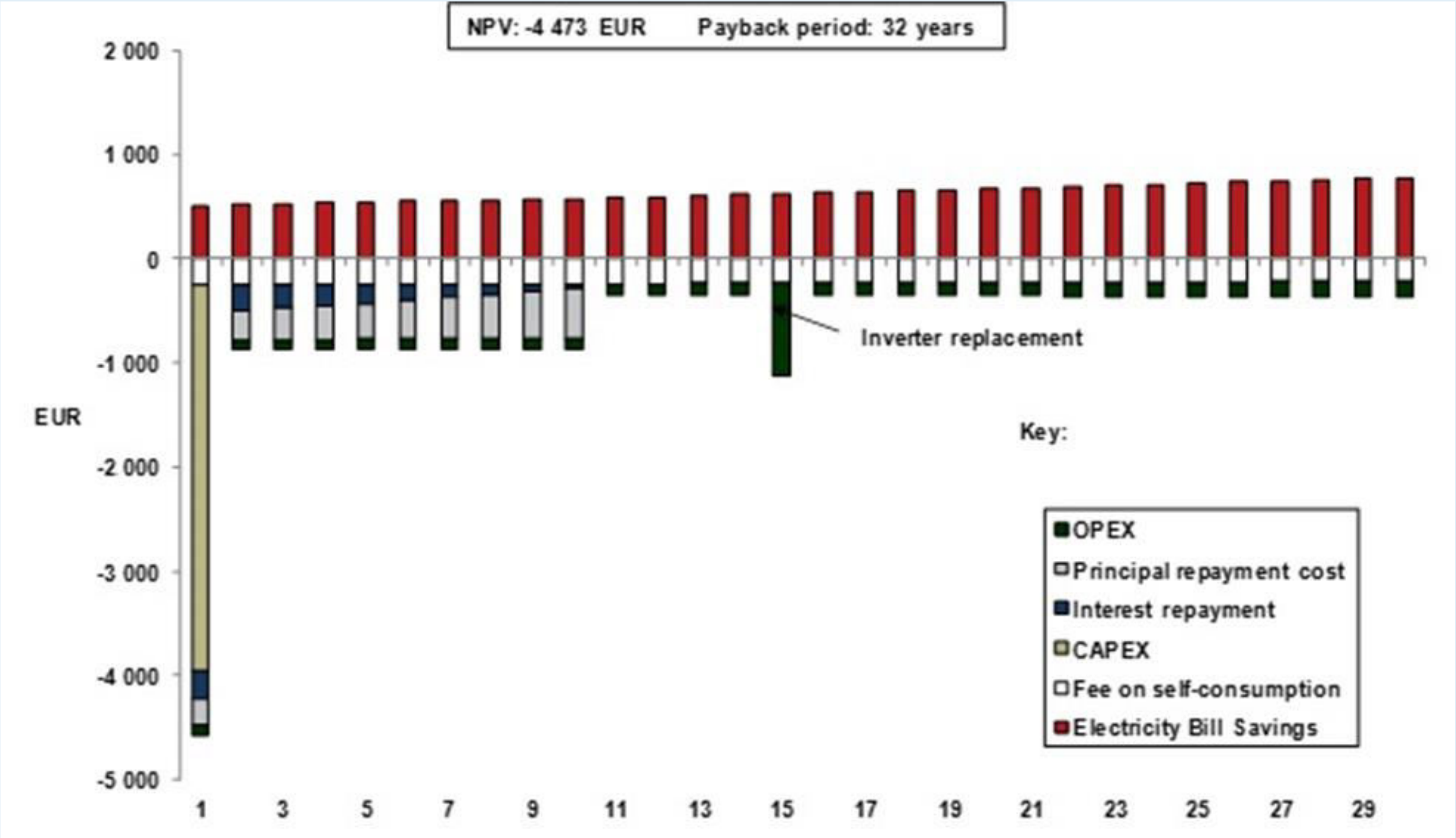


Figure 11. Annual cash flows for the prosumer under “Fee + no comp”



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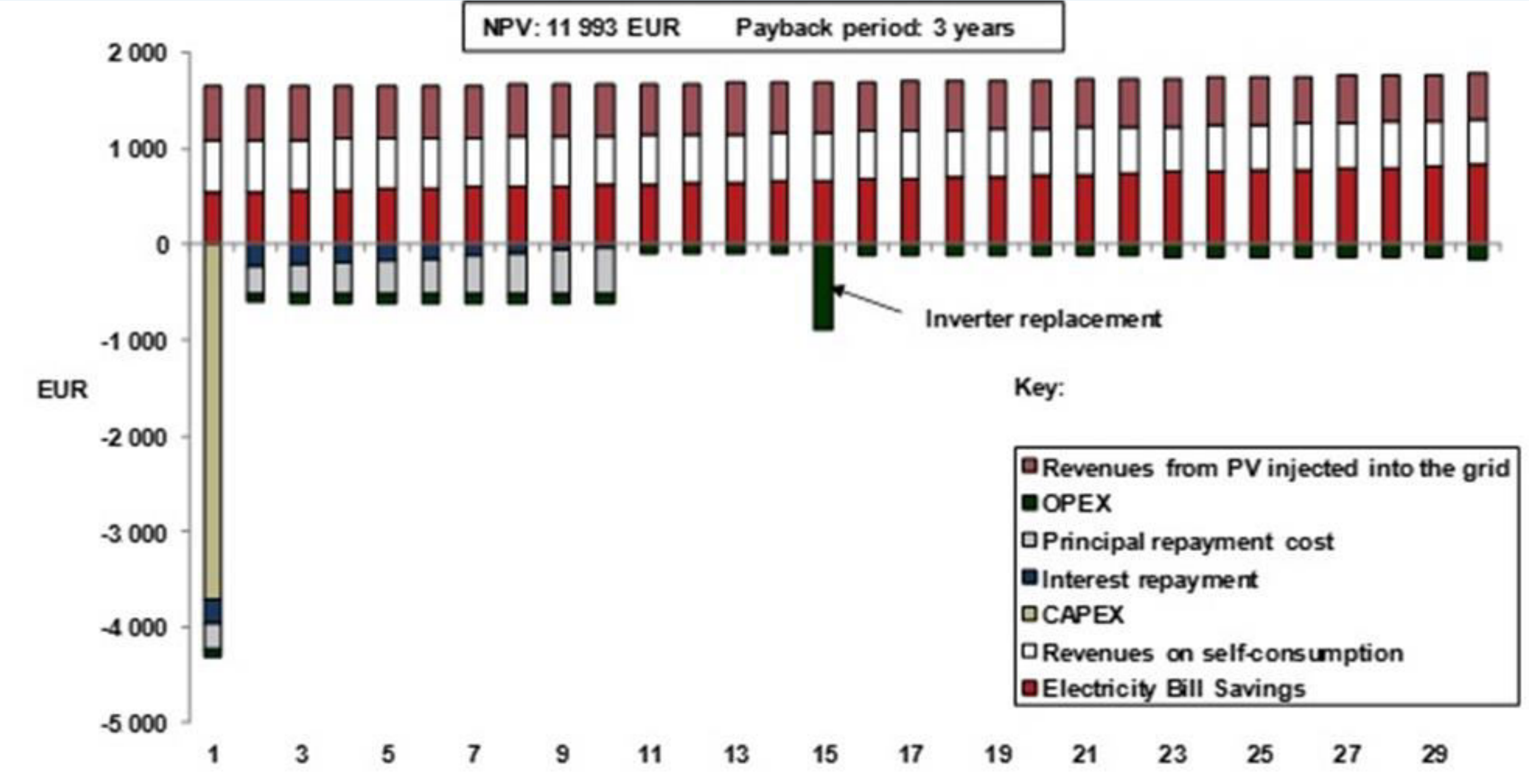


Figure 12. Annual cash flows for the prosumer under “Generation + FiT”



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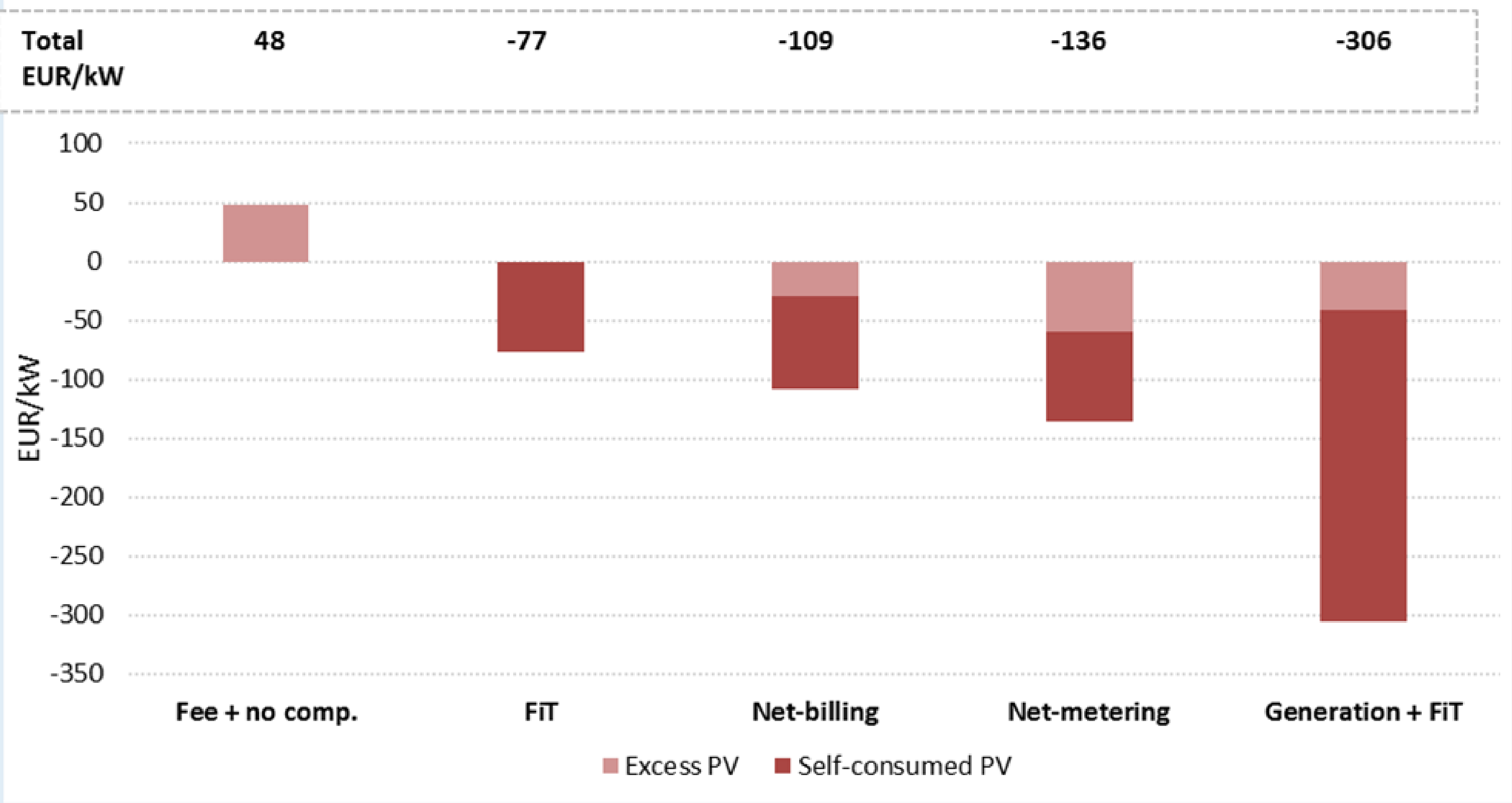


Figure 13. Annual impact per installed kW for the Electricity Market per Business Case



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	A	B	C	D	E
	Fee+ no comp	FiT	Net-billing	Net-metering	Generation + FiT
+ VAT of PV investment	✓	✓	✓	✓	✓
+ Corporate tax rate of installer	✓	✓	✓	✓	✓
+ VAT of operating costs	✓	✓	✓	✓	✓
+ Taxes over insurance cost	✓	✓	✓	✓	✓
+ VAT from fee on self-consumption	✓	✗	✗	✗	✗
- Taxes from on-site self-consumption	✓	✓	✓	✓	✓
- Taxes from compensated PV electricity	✗	✗	✓	✓*	✗
- VAT from meter rent	✓	✓	✓	✓	✓

Note: * Under Net-Metering the impact is higher than under Net-Billing, as in the former the prosumer saves on 100% of the taxes associated to compensated electricity, whereas under the later the prosumer saves on part of the taxes

Source:  Analysis

Key:

+

Positive impact

-

Negative impact

✓Has an impact

✗Has no impact

Figure 14. Impacting elements on the Tax Collector for each Case



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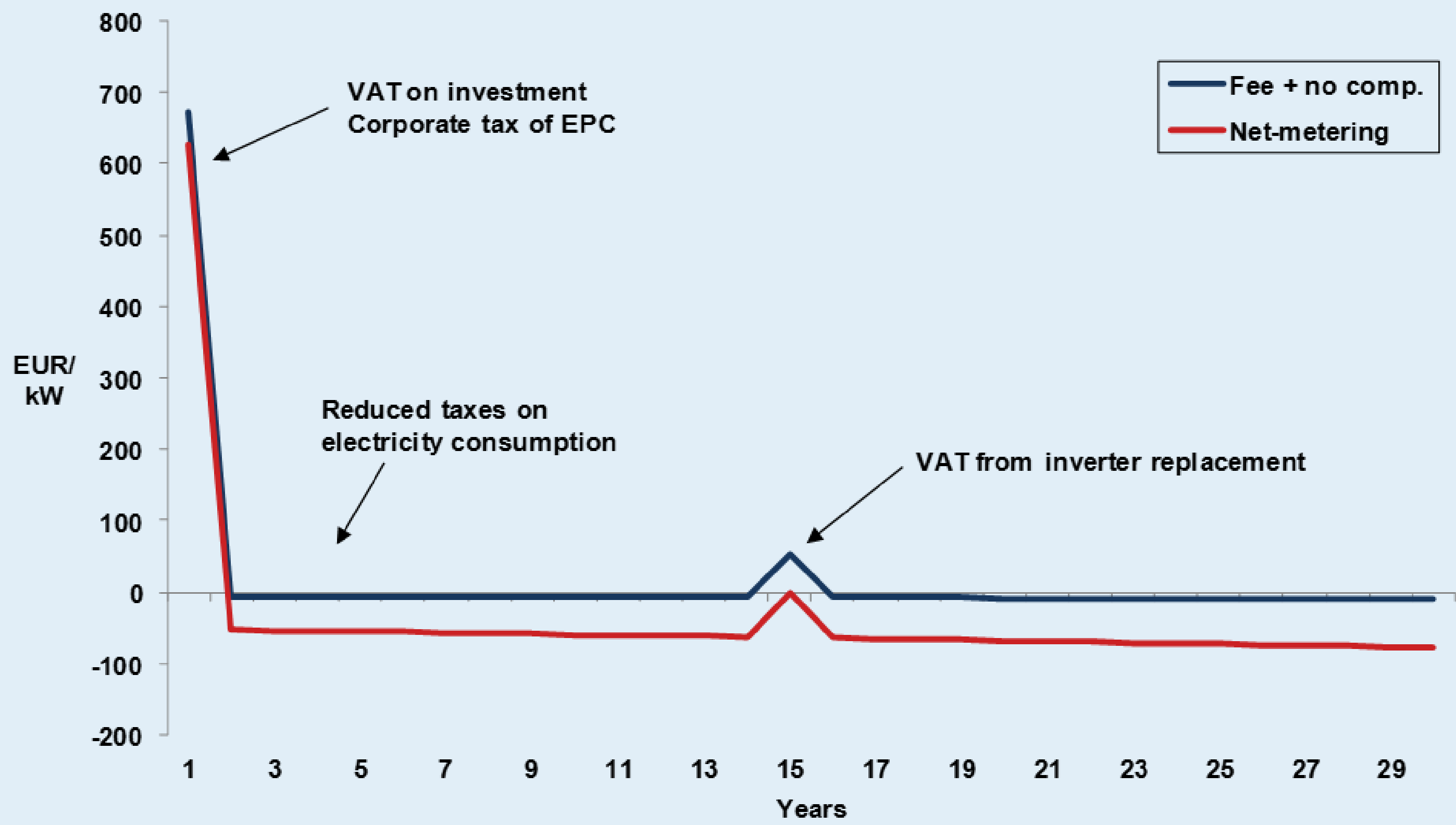


Figure 15. Annual cash flows for the Tax Collector (“Fee + no comp” and “Net-metering”)



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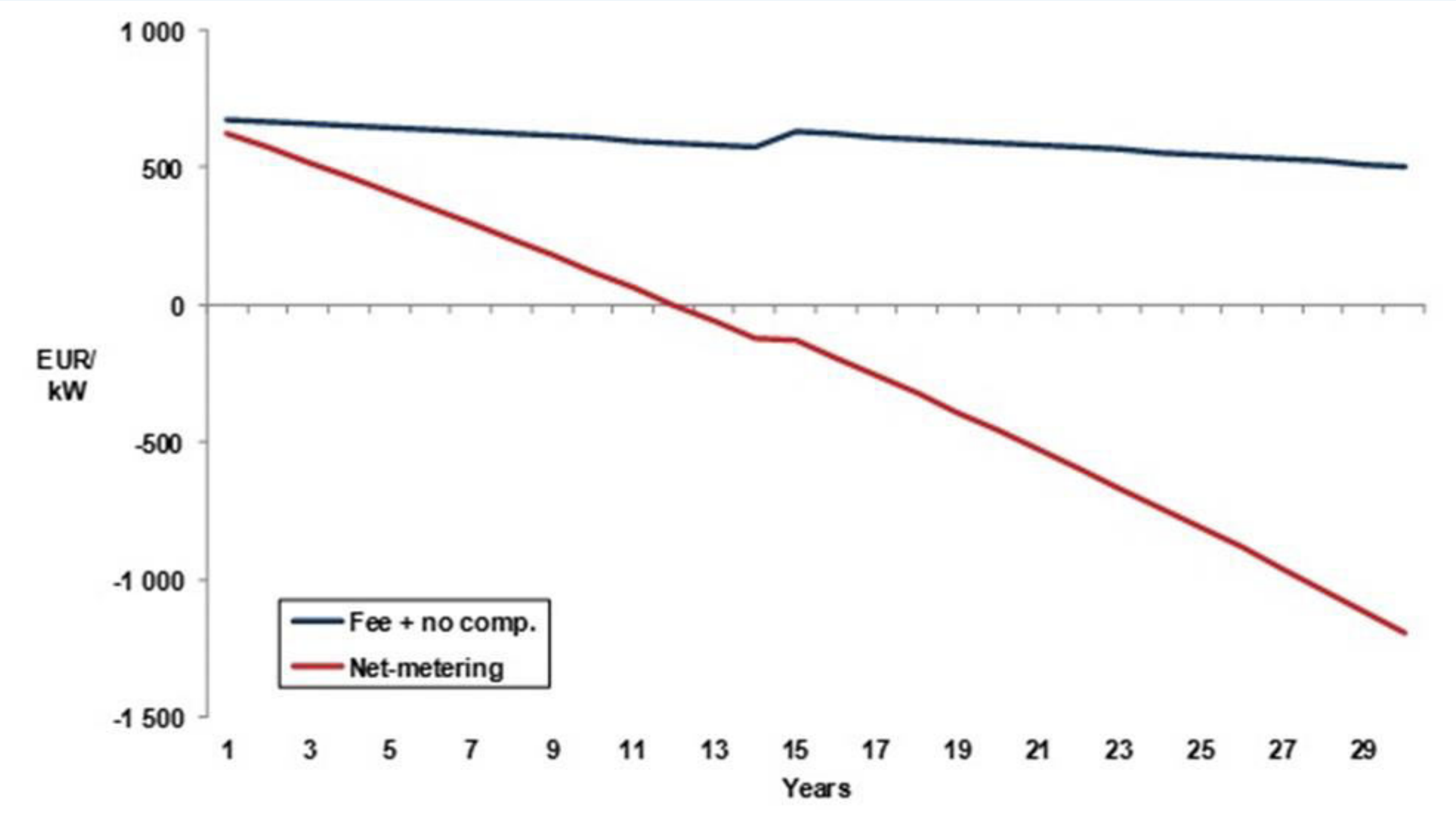


Figure 16. Accumulated cash flows for the Tax Collector (“Fee + no comp” and “Net-metering”)



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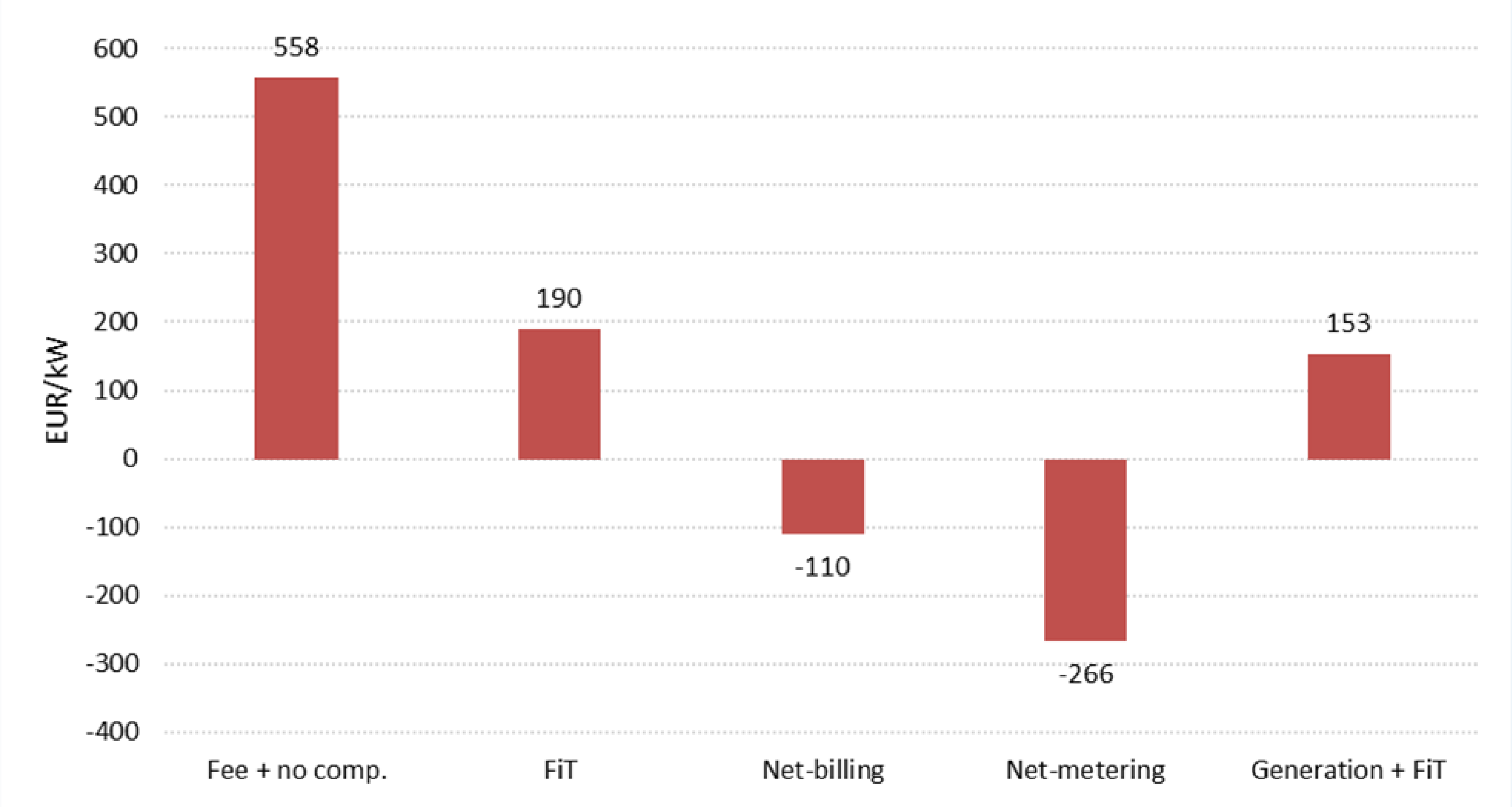


Figure 17. NPV per installed kW (30 years) for the Tax Collector



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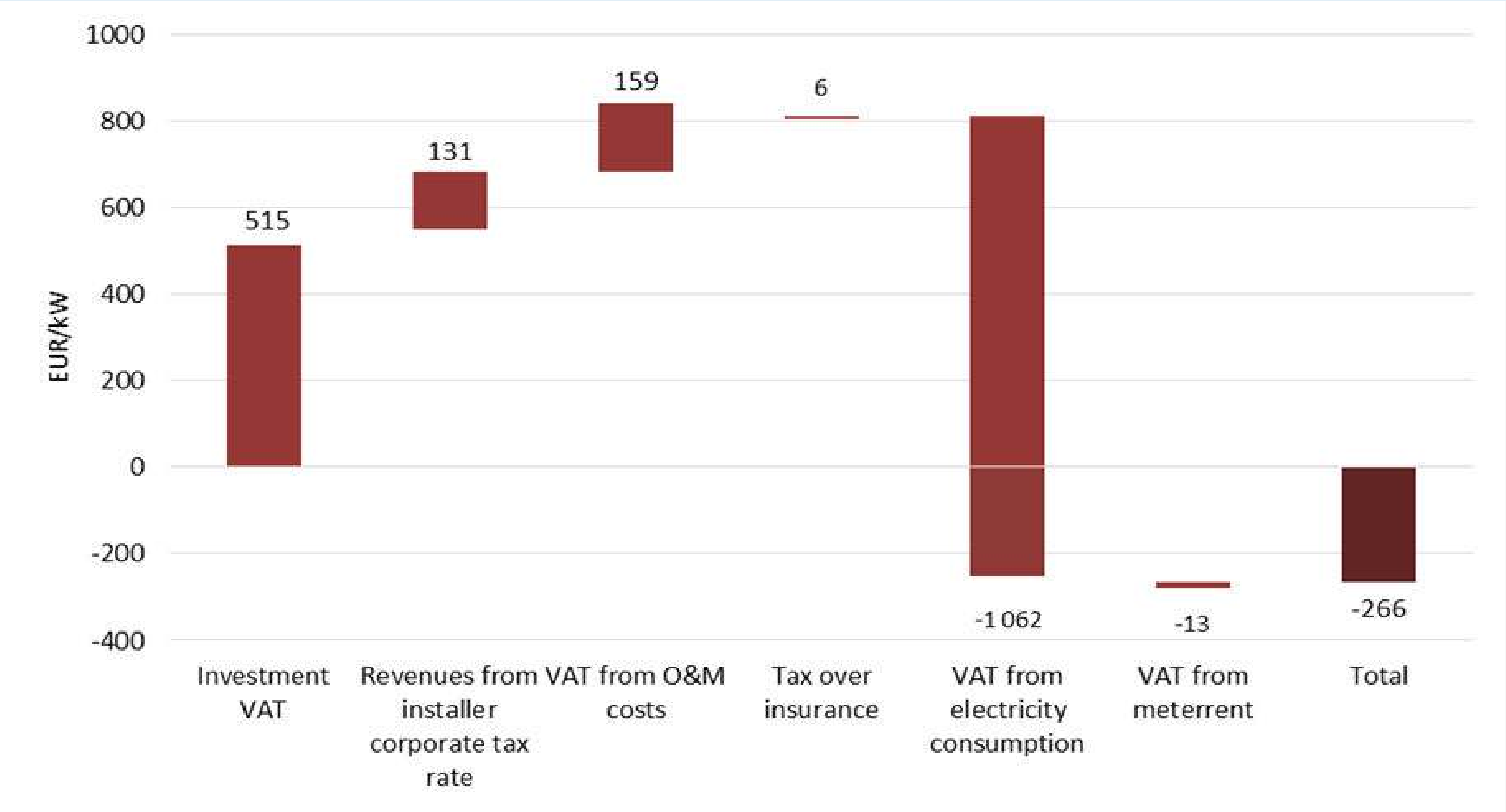


Figure 18. Segmentation of impact for the Tax Collector (example “Net-metering”)



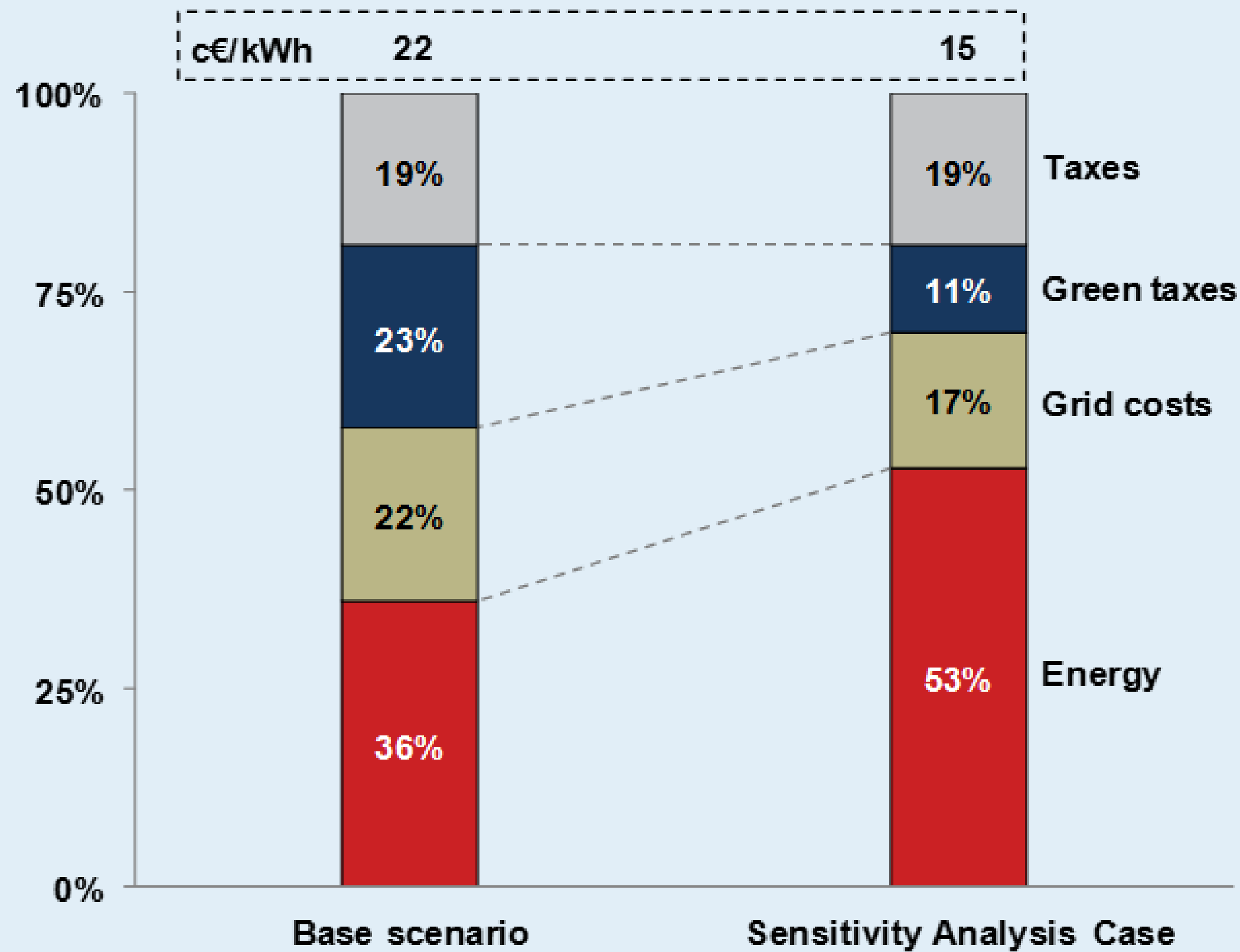
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Figure 19. Costs associated with each Business Case (NPV per kW)



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Source:  **creara** Analysis
ENERGY EXPERTS

Figure 20. Retail tariff structure for Base-Case and Sensitivity Analysis Case



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NPV (€/kW)	1 kW SC ratio 81%	3 kW SC ratio 56%	7 kW SC ratio 33%	Optimum capacity (kW)
Fee + no comp.	-1,014	-4,494	-14,515	0
FiT	911	1,794	1,281	~3,8
Net-billing	1,133	2,030	-444	~2,6
Net-metering	1,254	4,253	1,854	~3,8
Generation + FiT	4,698	12,024	22,731	∞

Source:  **reara** Analysis
ENERGY EXPERTS

Keys	
	Better than Base Case
	Worse than Base Case

Table 26. NPV for the prosumer when different values of the PV installed capacity are applied



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NPV (EUR/kW)	Prosumer		Electricity Market		Tax Collector	
	Base	S.A.C*	Base	S.A.C*	Base	S.A.C*
Fee + no comp.	-1 496	-1 698	932	932	558	537
FiT	599	-498	-1 498	-599	190	413
Net-billing	679	-199	-2 110	-1 033	-110	168
Net-metering	1 417	-317	-2 626	-1 012	-266	151
Generation + FiT	4 011	2 683	-5 930	-3 078	153	331

*Sensitivity Analysis Case

Source:  rearaAnalysis
ENERGY EXPERTS

Keys

Better than Base Case

Worse than Base Case

Table 27. NPV per installed kW (30 years) for all stakeholders per Business Case and Scenario



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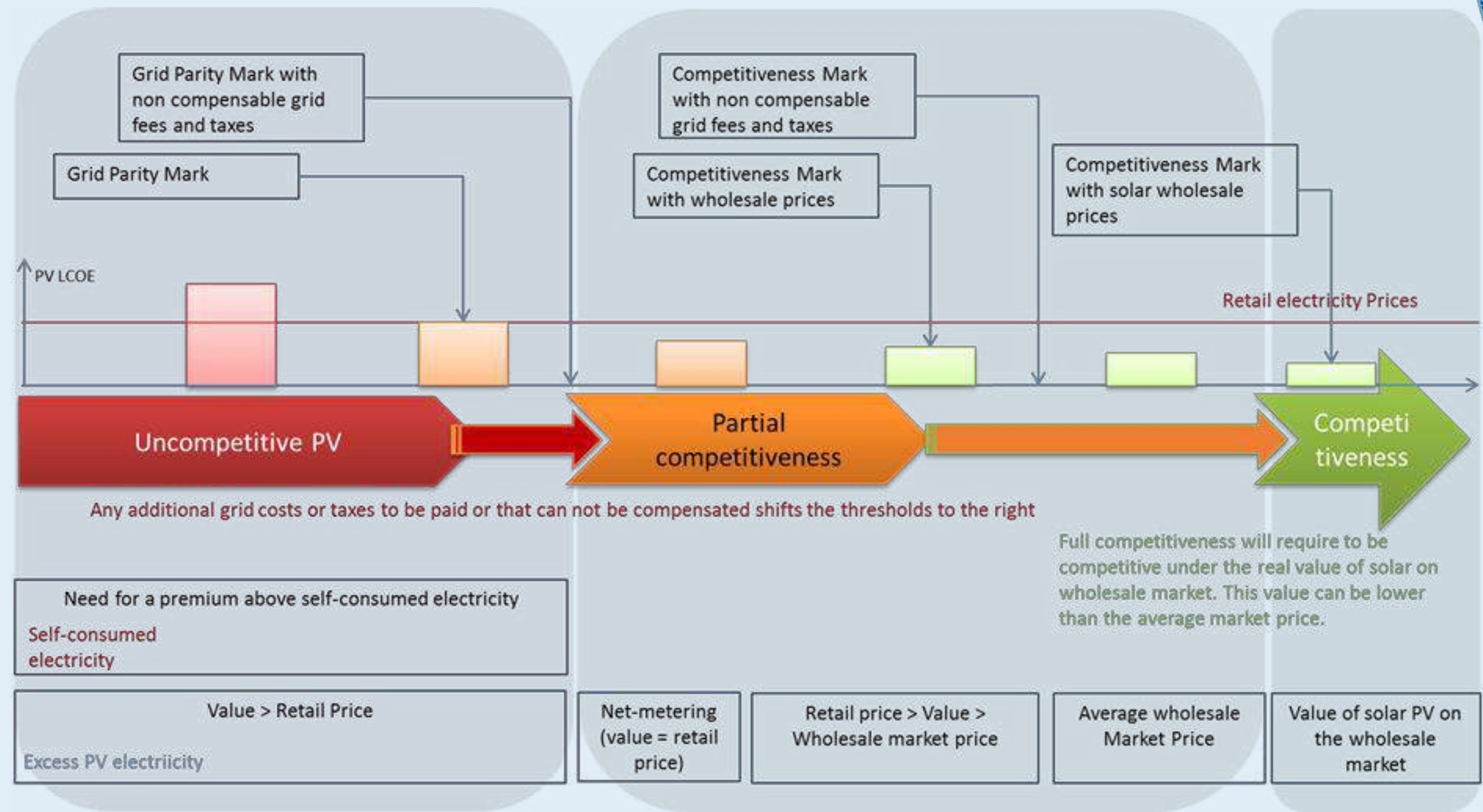


Figure 21. Steps toward Competitive PV Systems using Self-consumption



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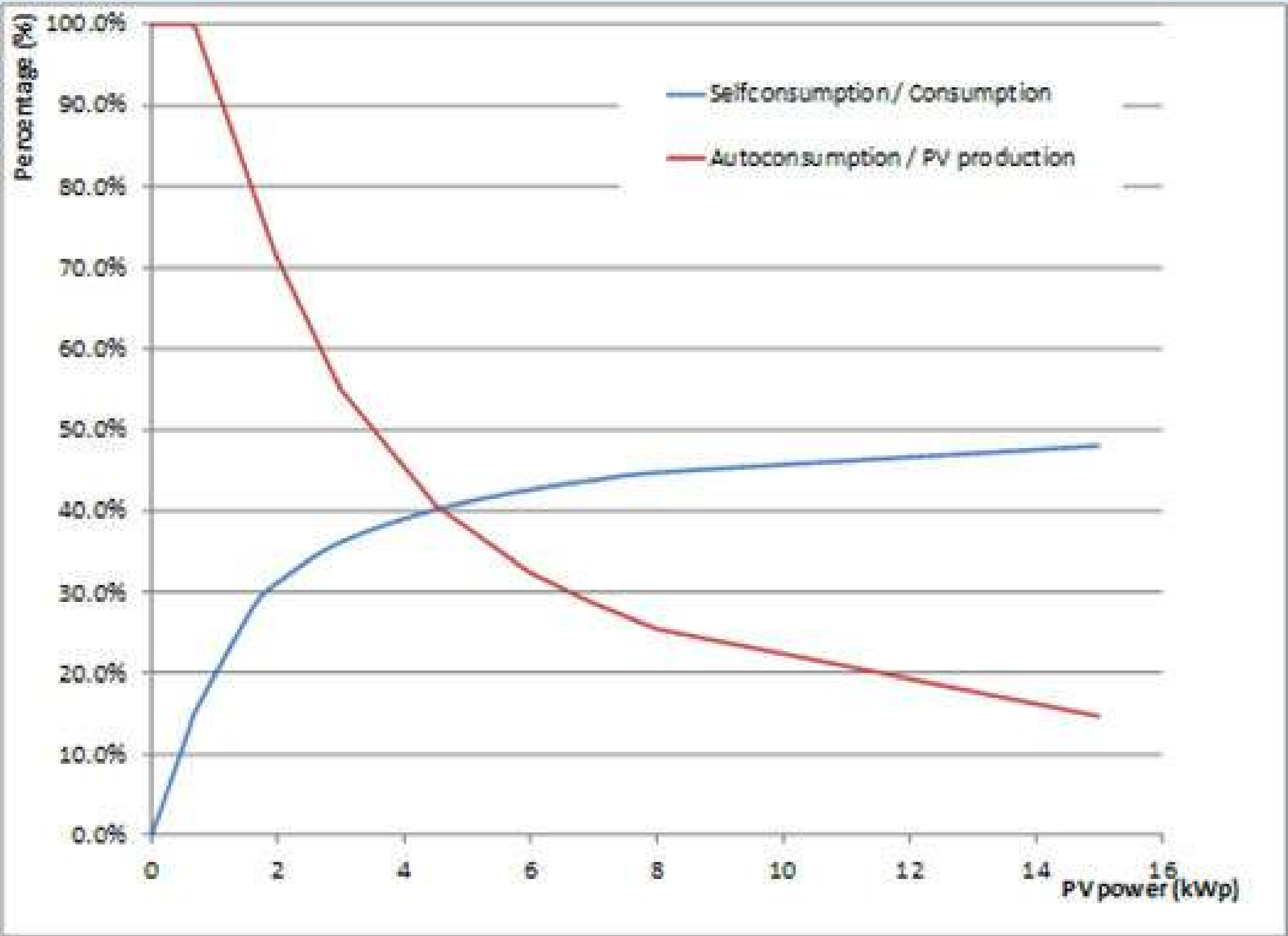


Figure 22. SC and SS ratios for residential case in Germany (consumption 4,5 MWh/year)
(Source: Total, V. Cassagne)



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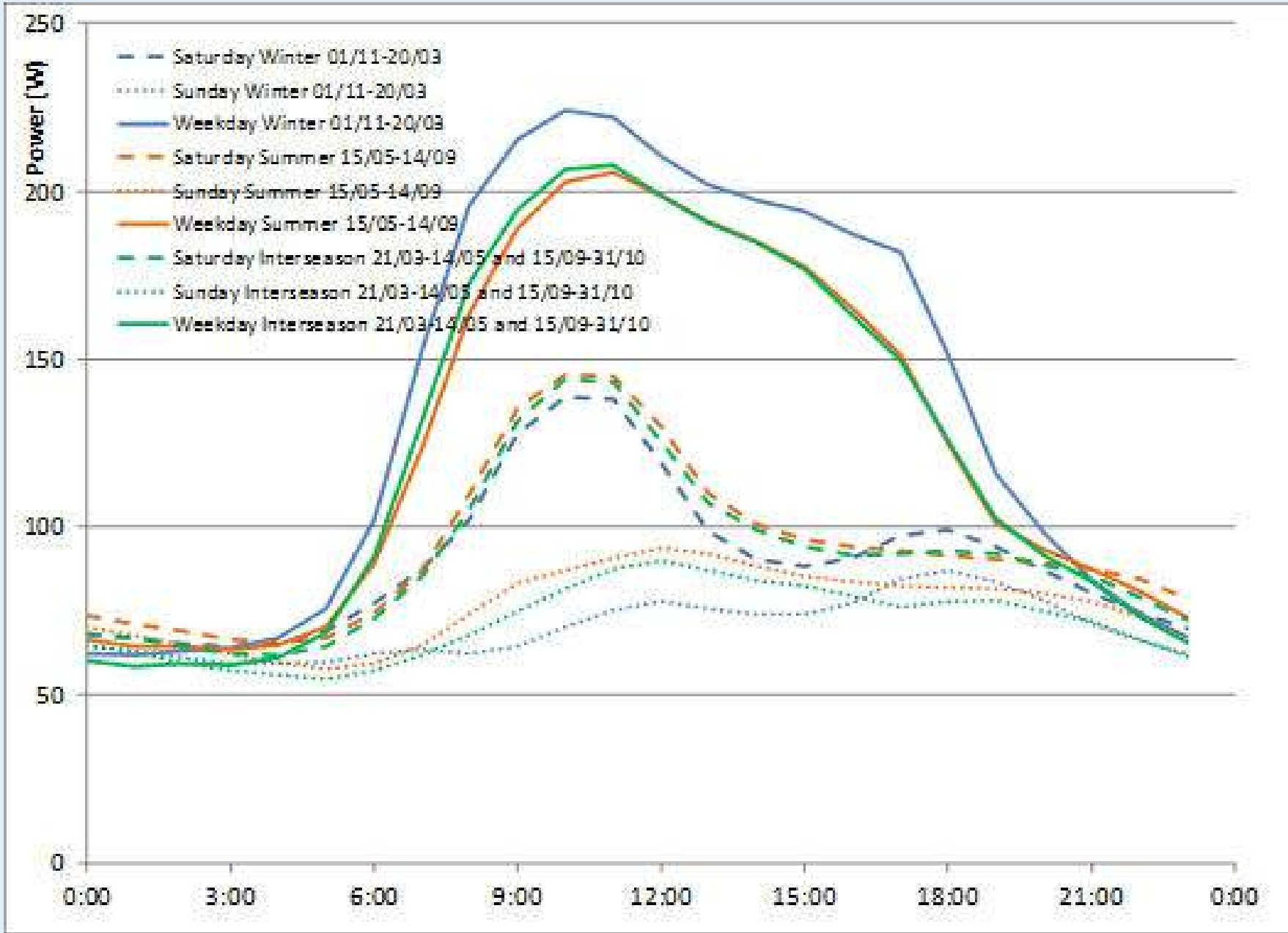
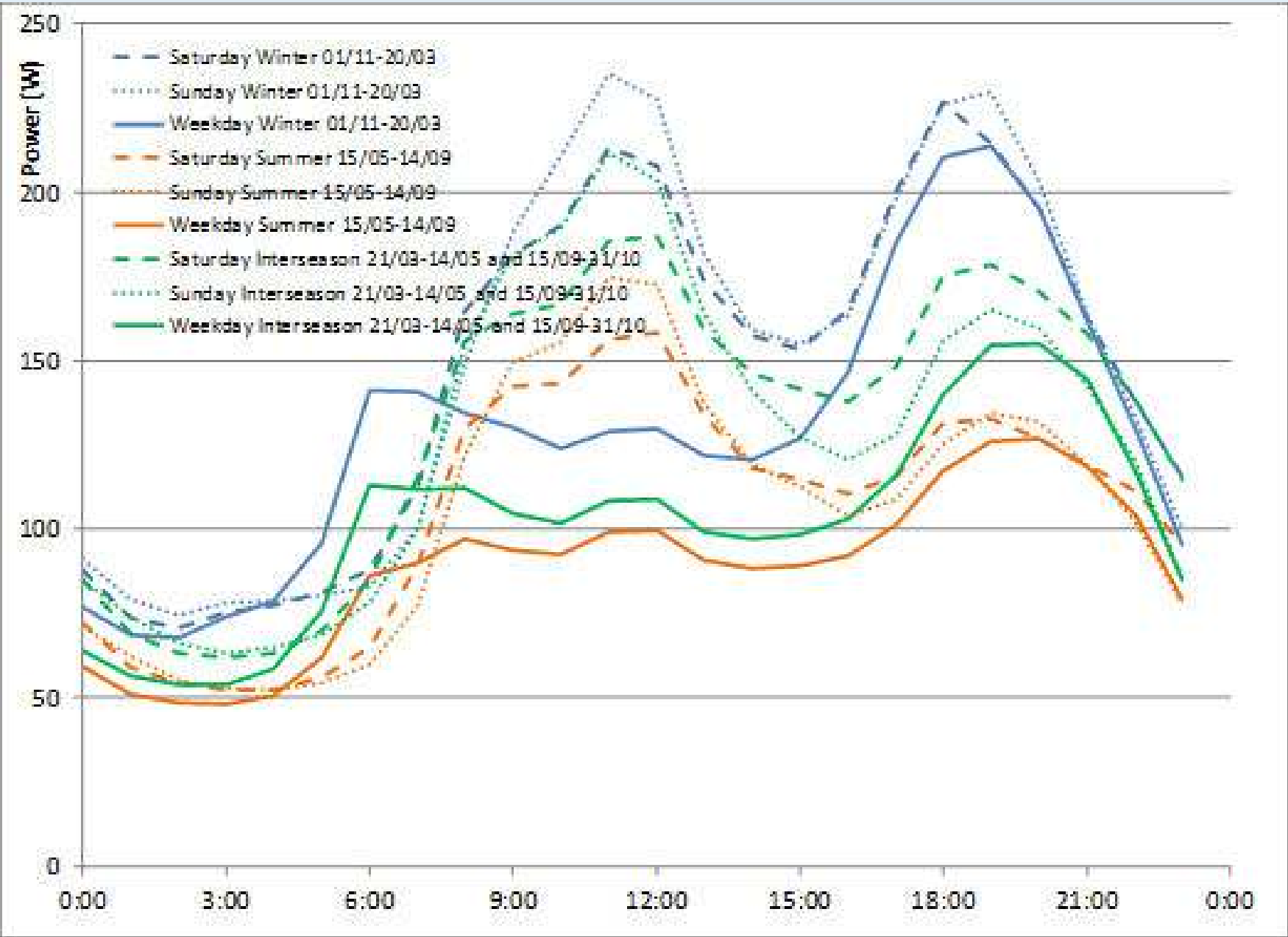


Figure 23. Consumption profiles of household (first) and commercial (second) activity in Germany (source E-On)



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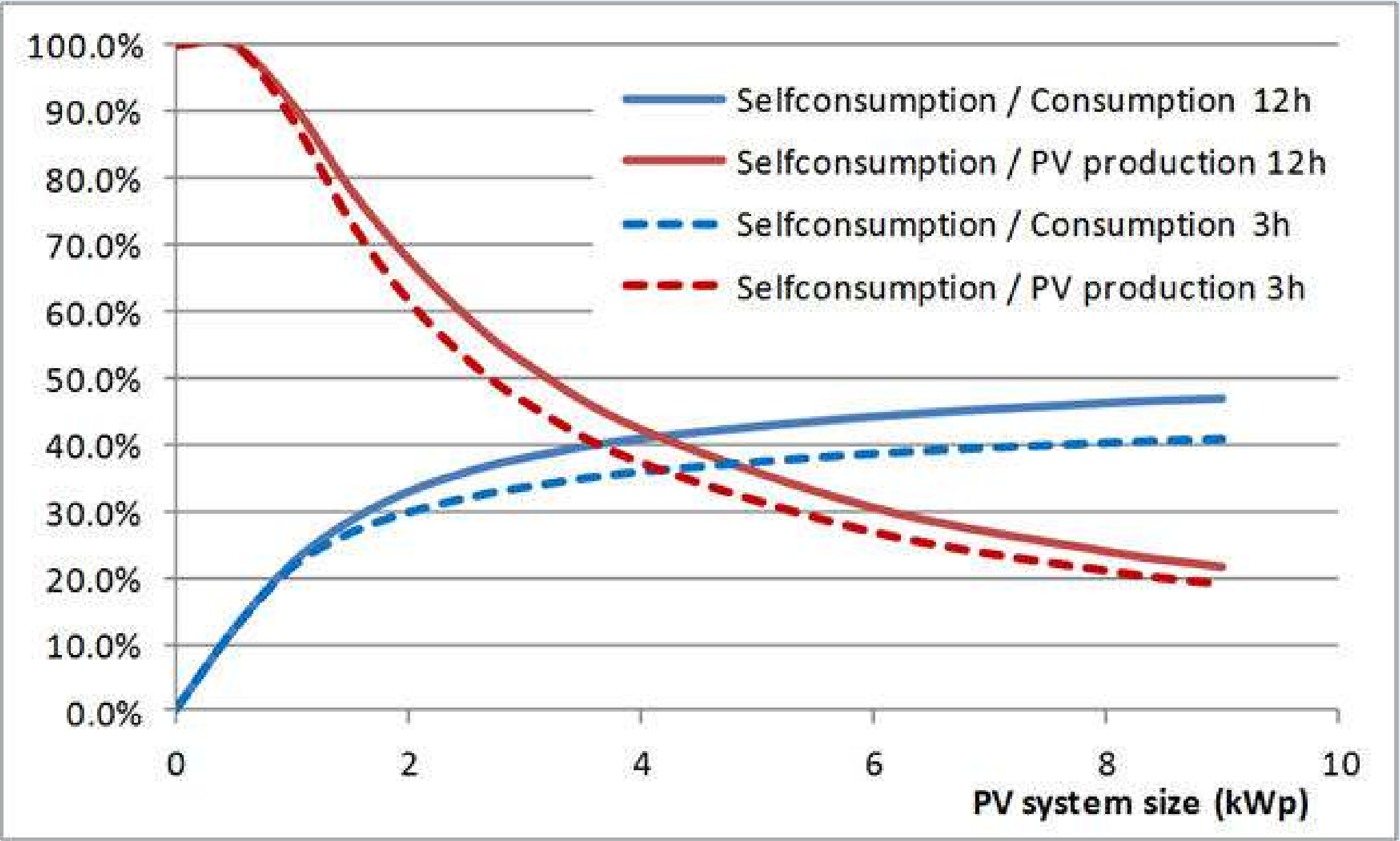


Figure 24. Effect of moving a washing machine or a dish washer from night to noon on self-consumption ratios (source: Total, V. Cassagne)



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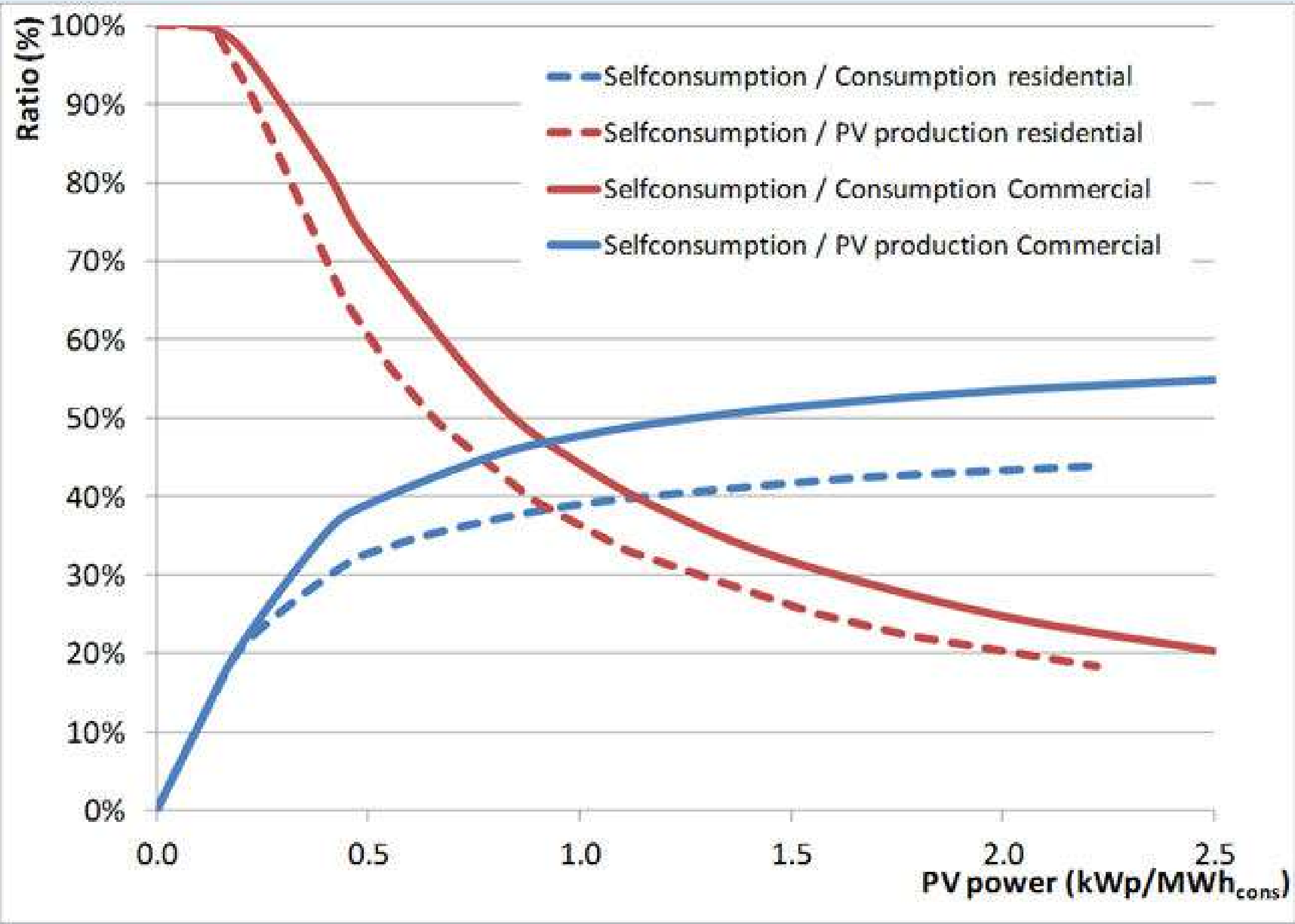


Figure 25. Self-consumption ratios comparing residential and commercial application in Germany (source: Total, V. Cassagne)



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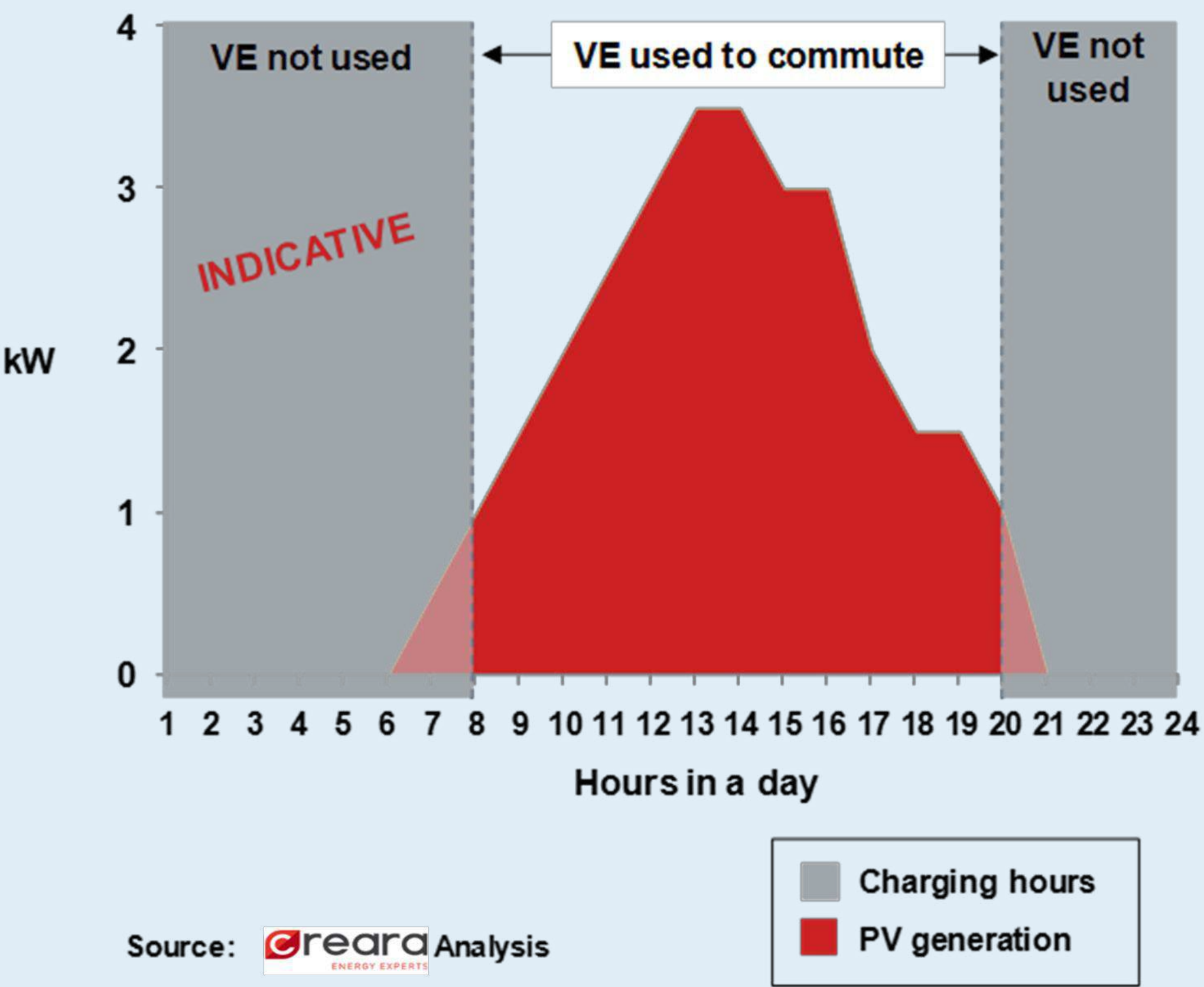
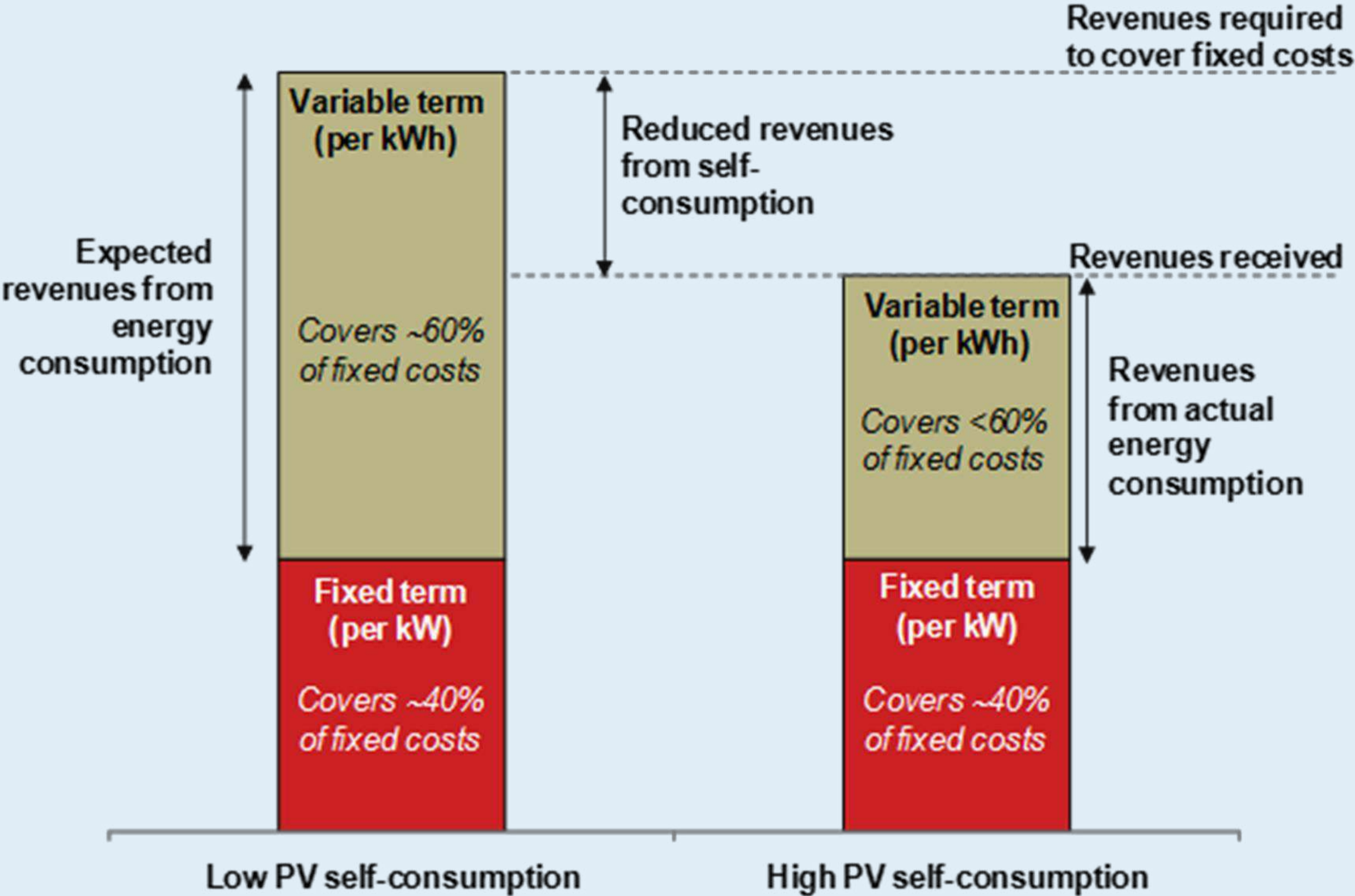


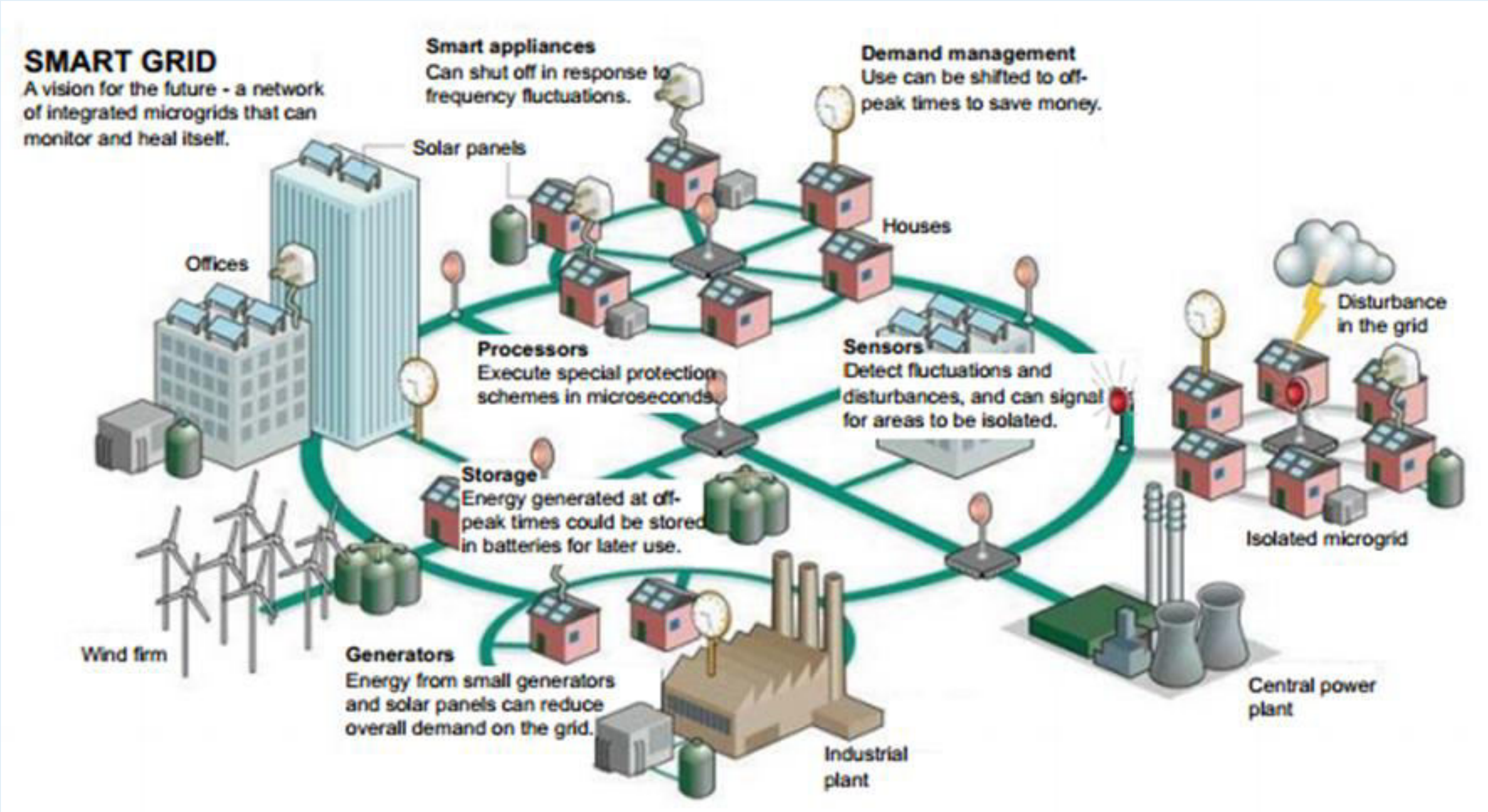
Figure 26. Daylight hours and EV charging hours



Source:  Analysis

Figure 27. Illustration of T&D revenues with low and high penetration of PV self-consumption

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Figure 28. Smart Grid Illustration



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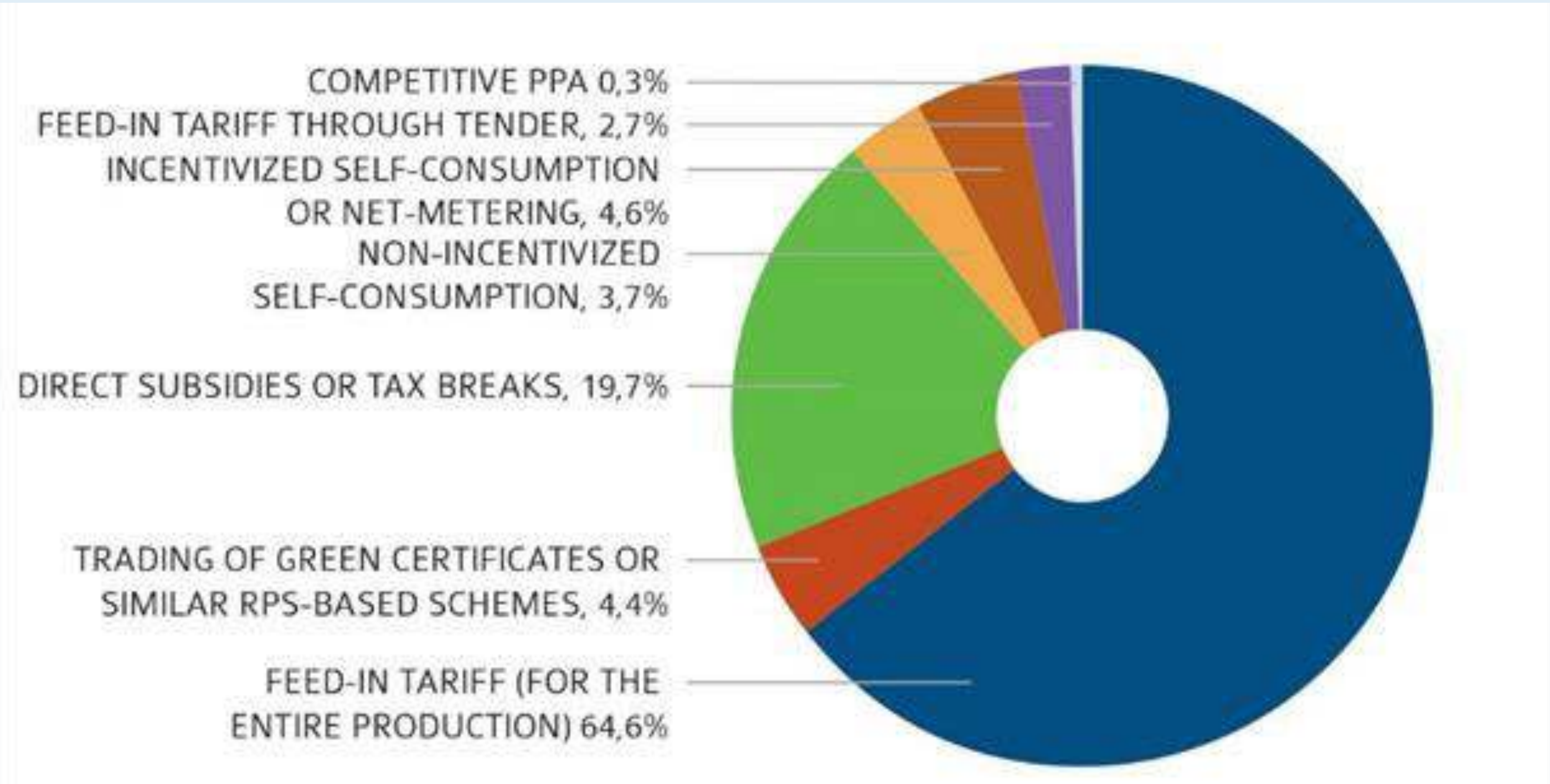


Figure 29. Historical Market Incentives And Enablers (IEA PVPS Trends 2015)



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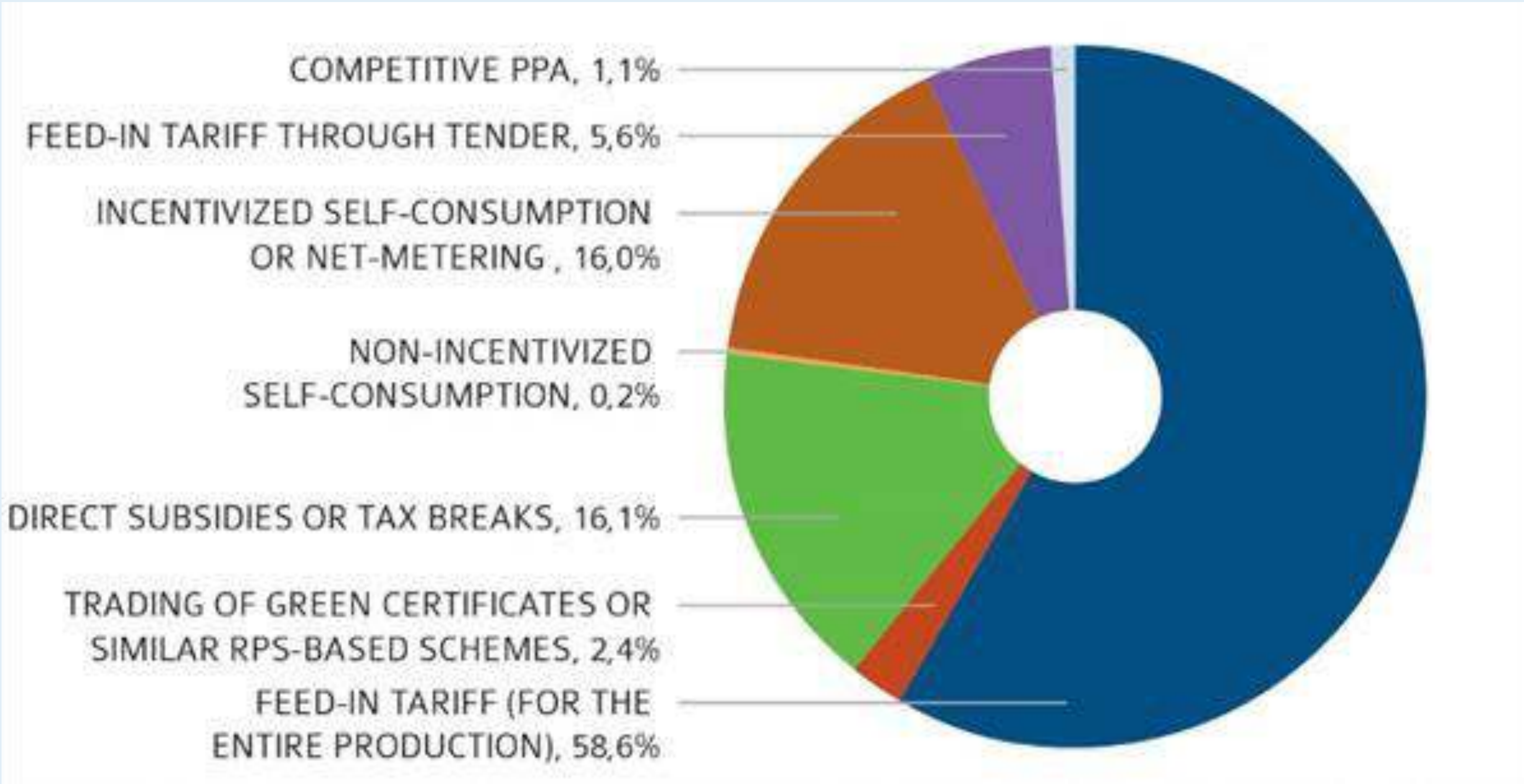


Figure 30. 2014 Market Incentives And Enablers (IEA PVPS trends 2015)



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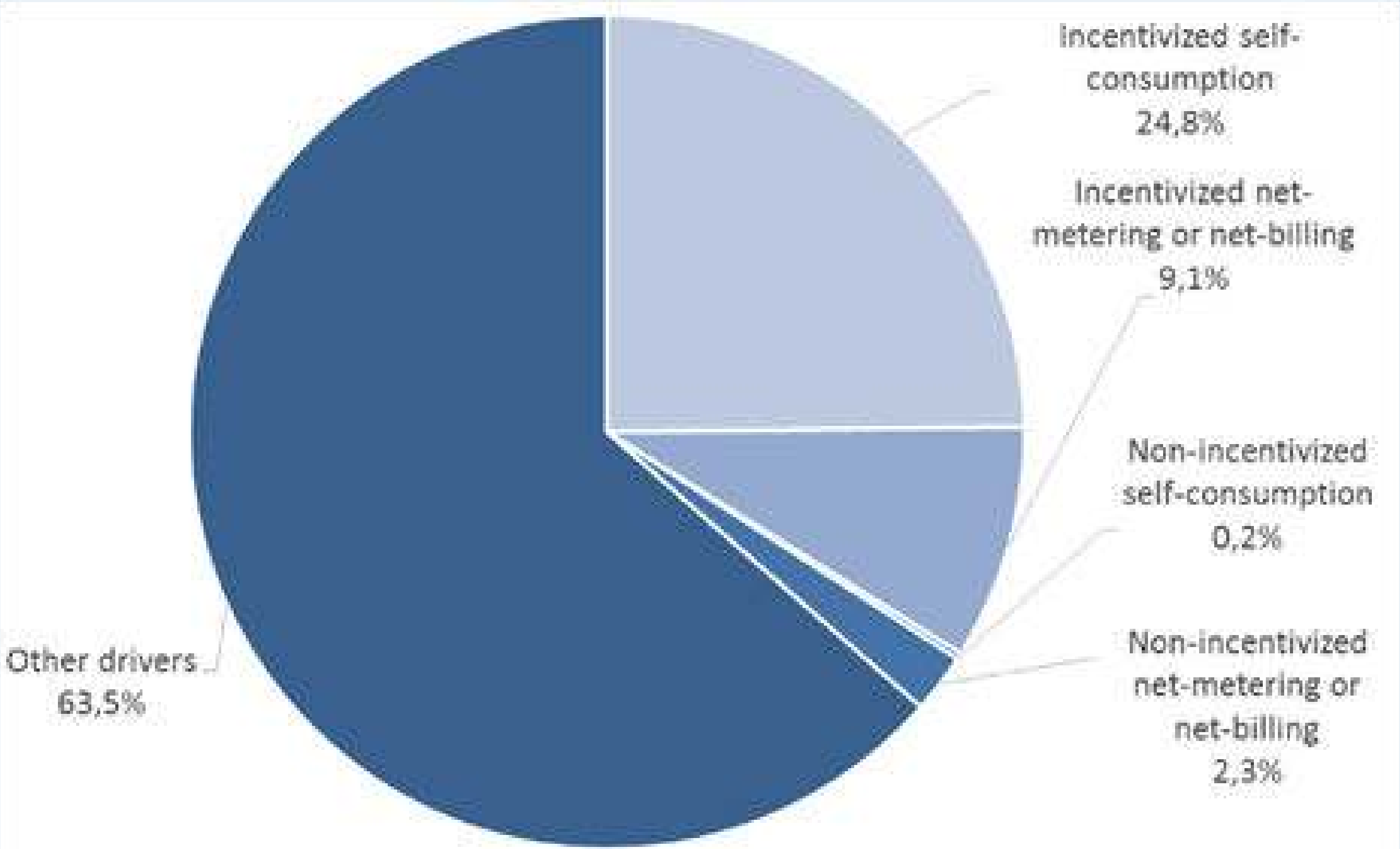
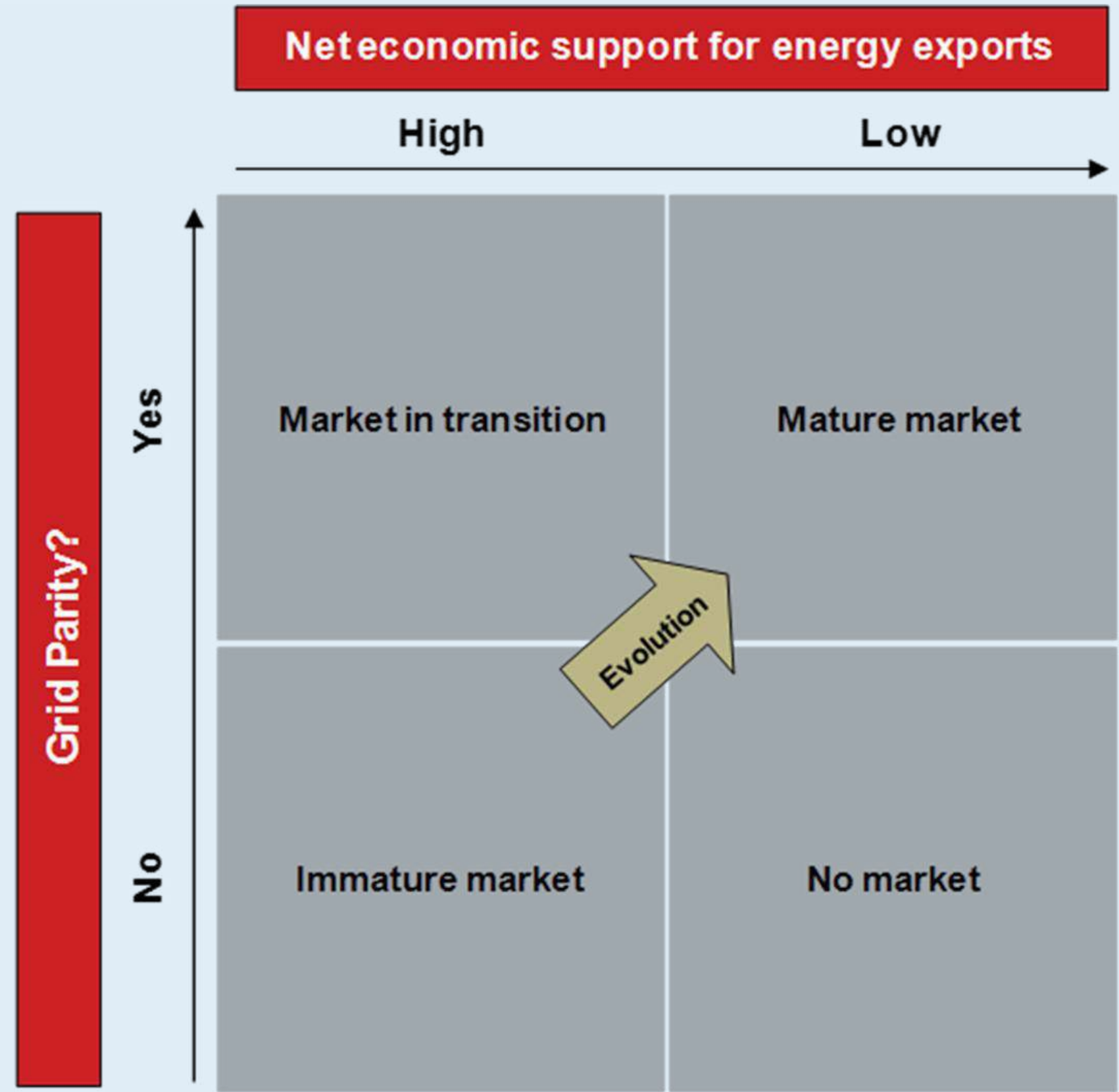


Figure 32. Different types of self-consumption schemes



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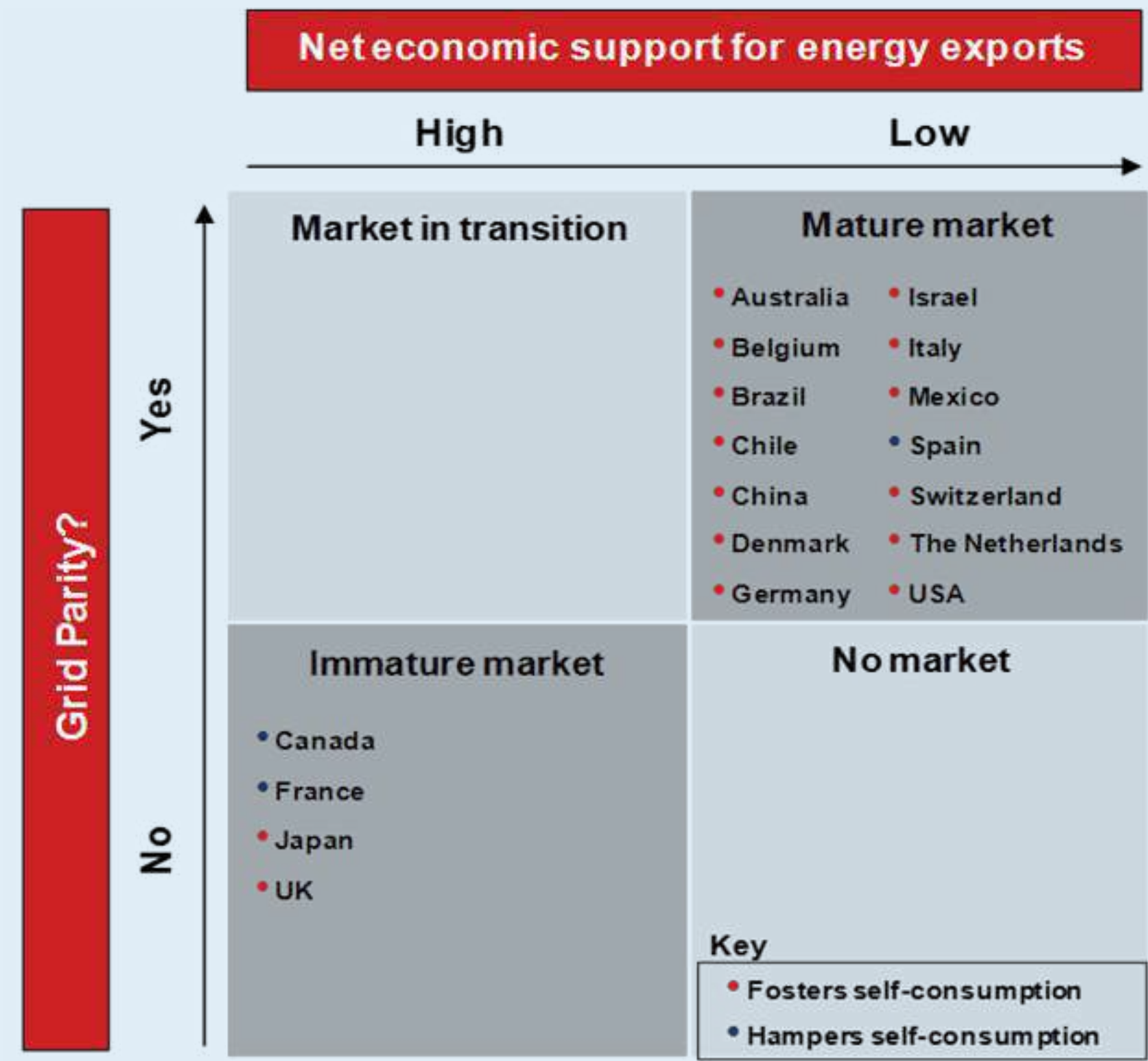


Source:  Gredra Analysis
ENERGY EXPERTS

Figure 33. Illustration of market types according to market characteristics



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Source: Grear Analysis

Figure 34. Country positioning according to PV market characteristics



The Red Oak Park a neighborhood in Boulder, CO features renewable energy design / NREL

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THANK YOU!