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PV self-consumption regulation in Spain

profitability analysis and alternative regulation schemes

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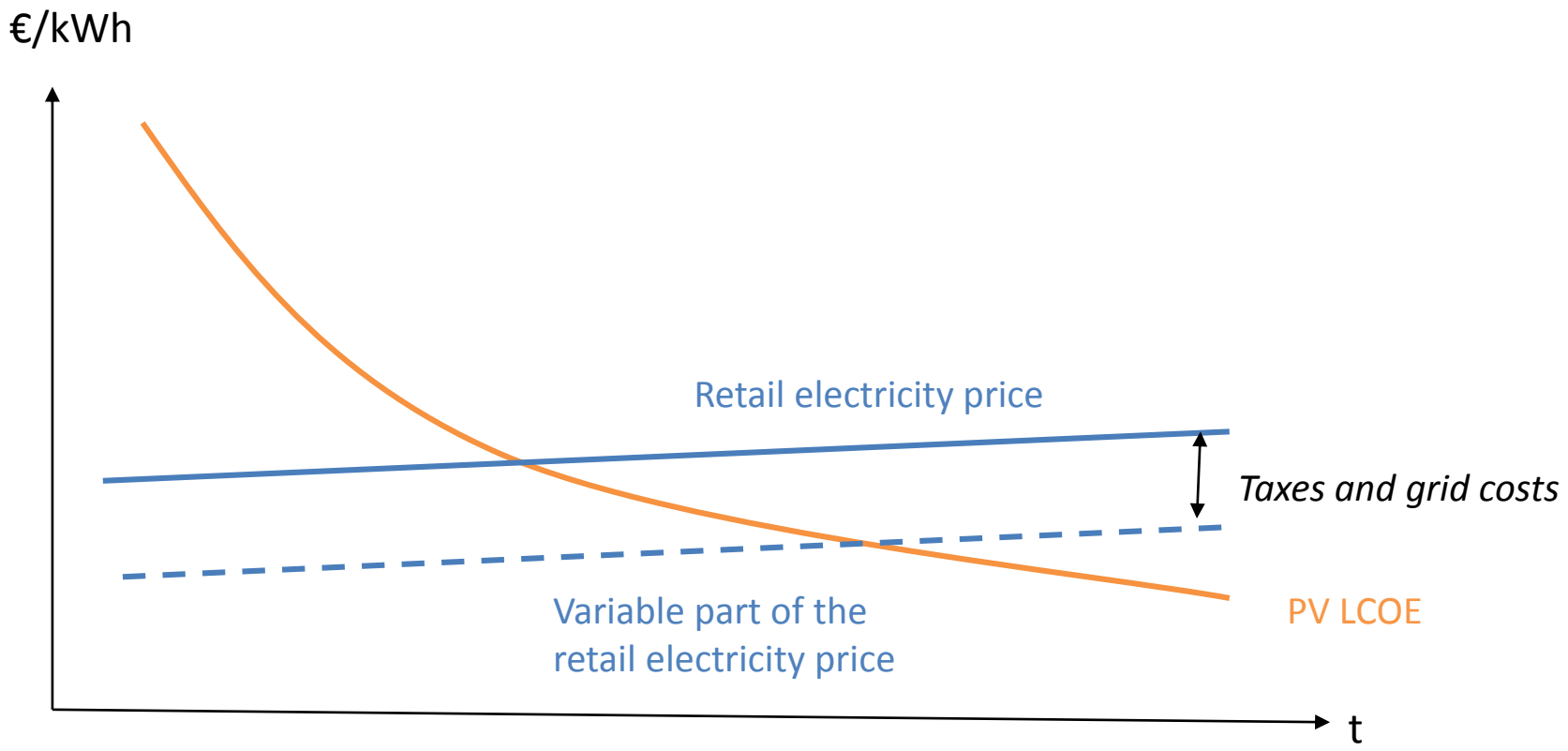
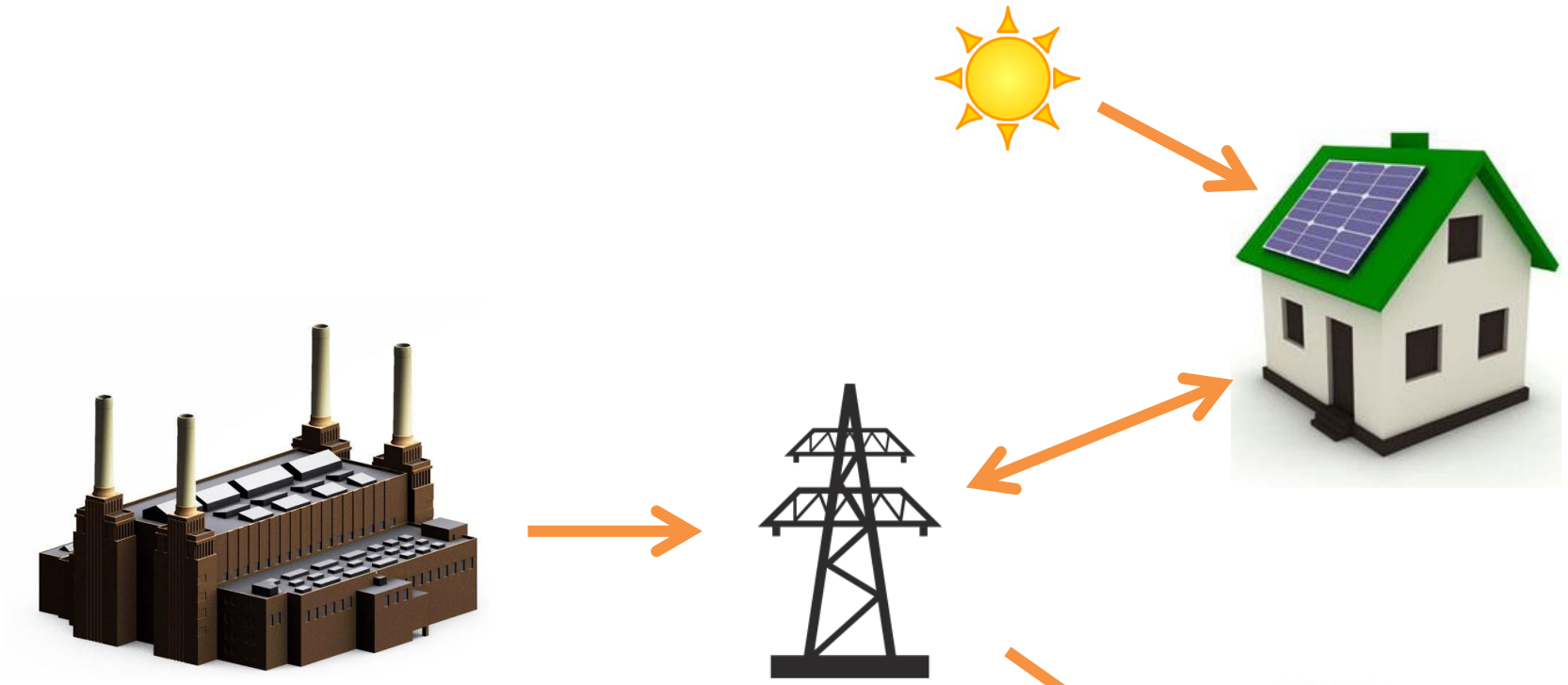
Outline

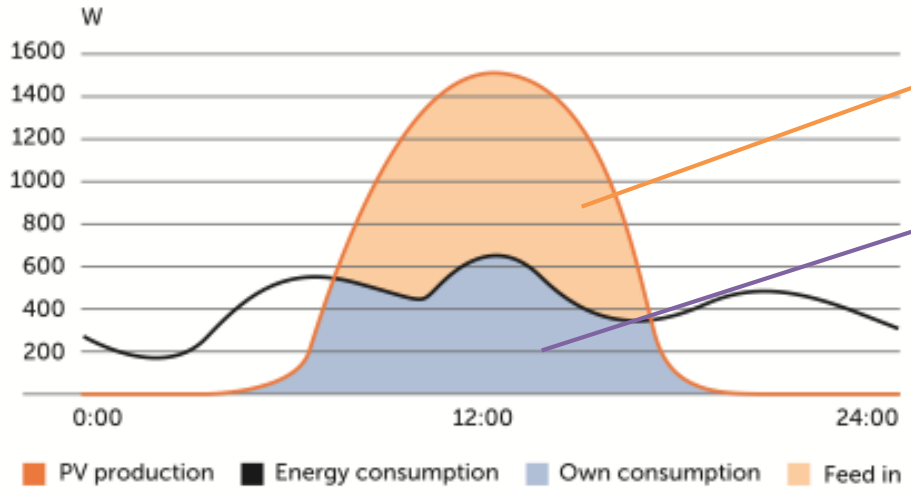
1. PV self-consumption
2. Method
3. Profitability analysis
4. Economic impacts of PV self-consumption
5. Conclusions

Towards grid parity





Generation and load profiles

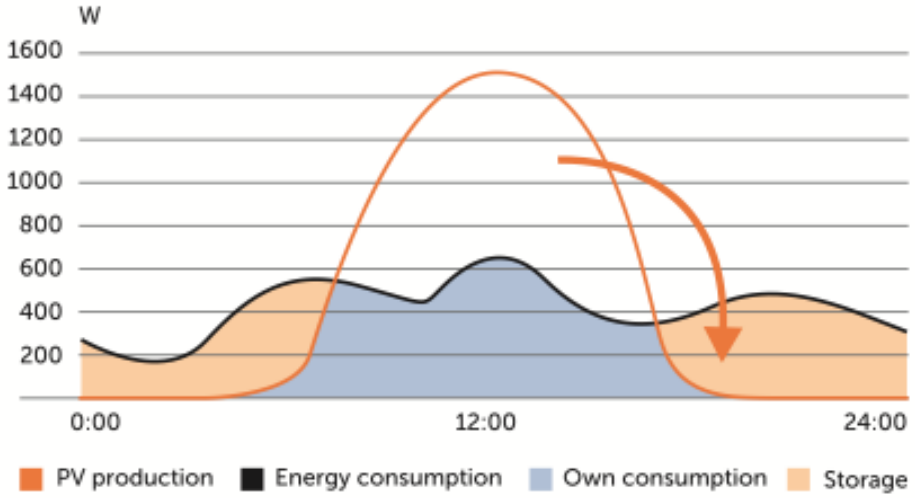


Electricity surplus

Electricity self-consumption

Electricity consumption

Electricity generation



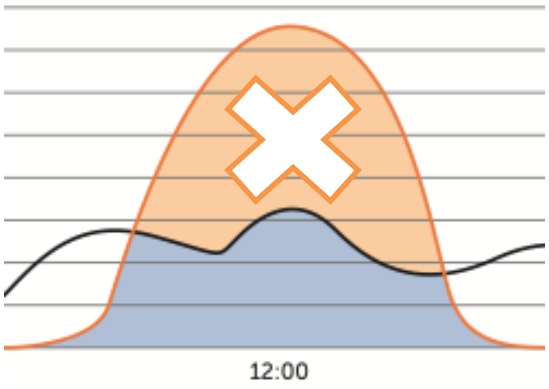
How to value the surplus electricity exported to the grid?

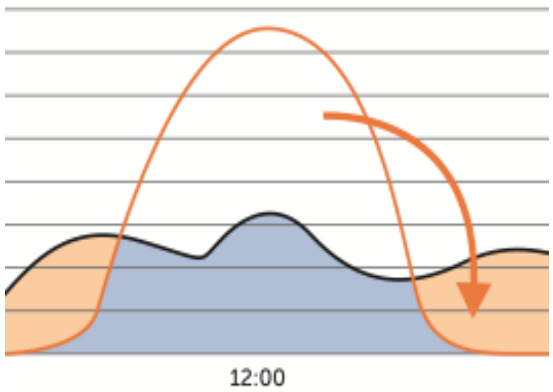
Regulation schemes (Price of surplus electricity):

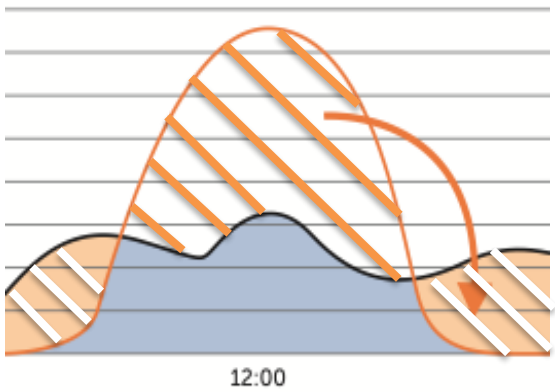
Self-Consumption (SC):
not remunerated

Net Metering (NM):
retail price

Net Billing (NB):
somewhere between
0 and retail price







Segments definition

Residential

- *Higher savings potential due to higher electricity prices*

Commercial

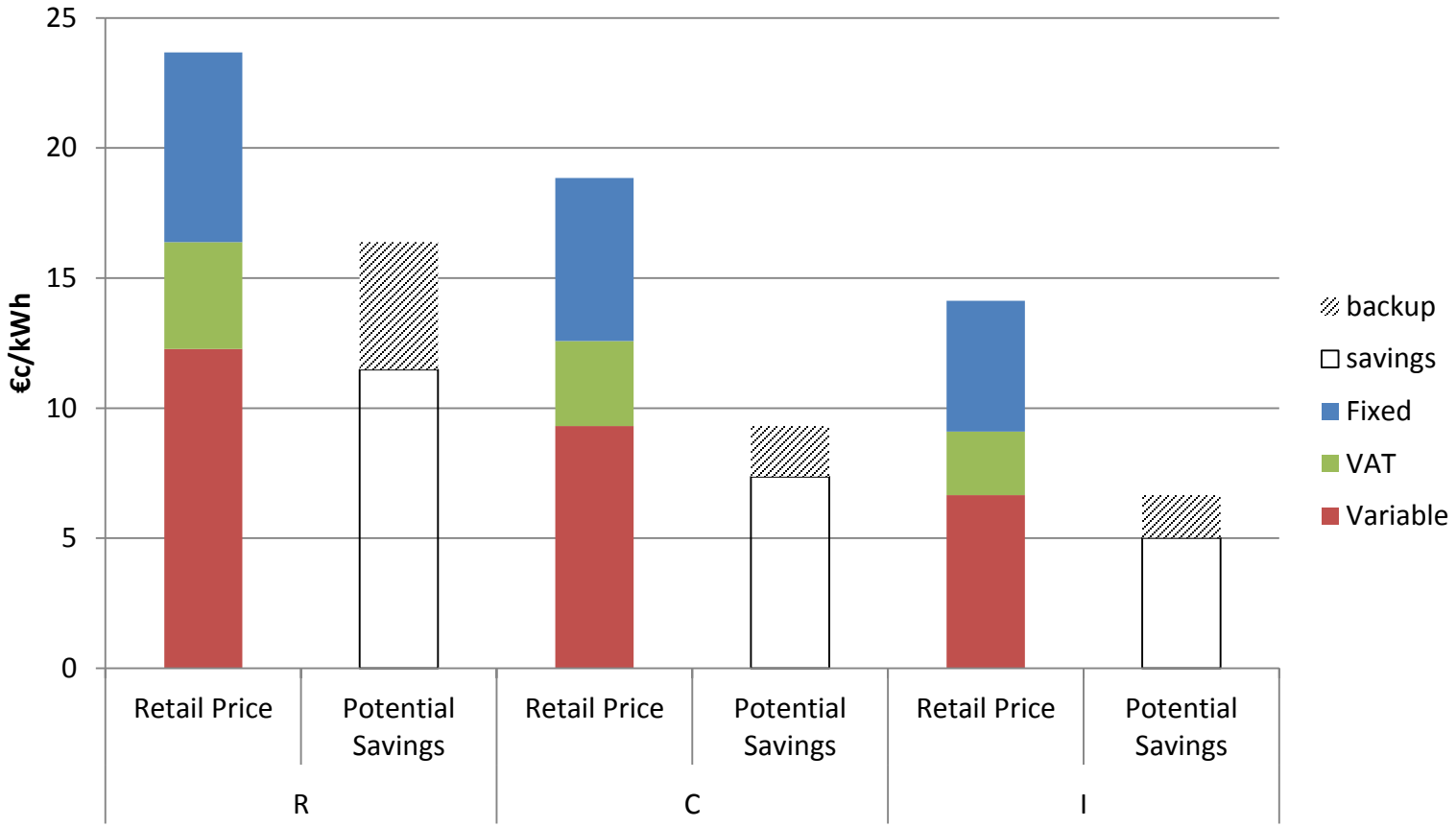
- *Higher costs (interest rates and system price)*
- *Lower share of electricity self-consumed*

Industrial

Self-consumption regulation in Spain

Price of surplus electricity	Backup charge
Self-consumption 0	Exemption for systems <10kW High otherwise
Net Billing Wholesale price - Generation tax (7%) - Grid access charge (5€/MWh)	Medium-high
	Low

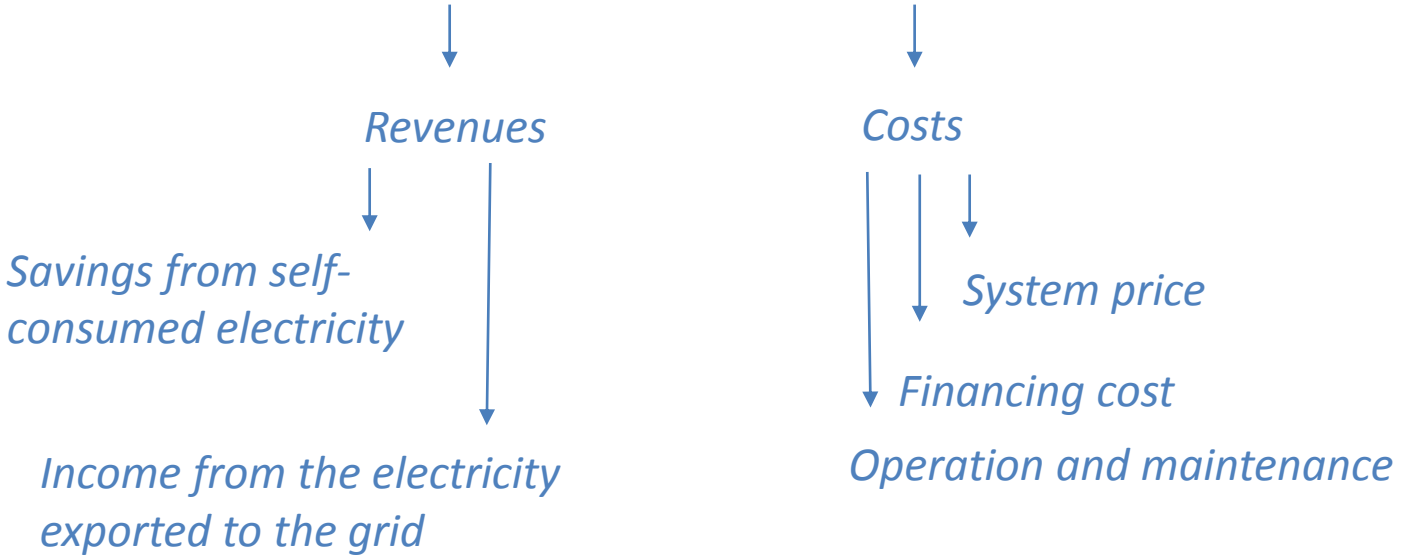
Savings potential in Spain



% self-consumption *33%* *41%* *75%*

Methodology: Internal Rate of Return (IRR): *discount rate at which the net present value of the investment equals zero*

$$NPV = PW[CIF(N)] - LCCusp = 0$$



PW… Present value
CIF…. Cash inflow
N……. Project lifetime

LCCusp: life cycle cost from the user standpoint

$$PW[CIF(N)] = \beta * E_{PV} * (ps - \delta e) * A_s + (1 - \beta) * E_{PV} * [(pg - \gamma) * (1 - \lambda)] * A_g$$

Backup charge — *Grid-access charge* — *Generation tax*

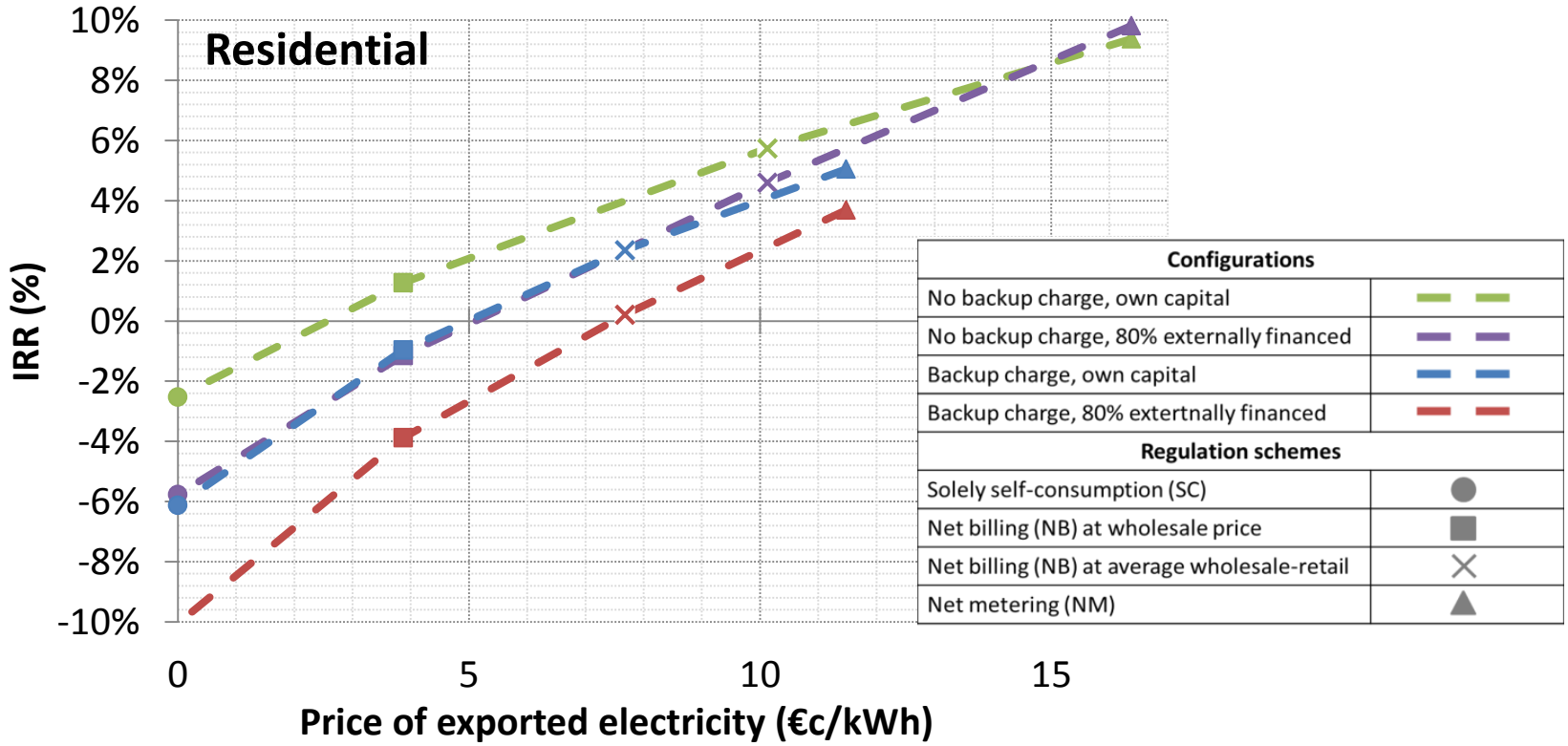
Self-consumed electricity — *Electricity exported to the grid*

$$LCCusp = PW[PV_{IN}] + PW[PV_{OM}] + PW[\delta c]$$

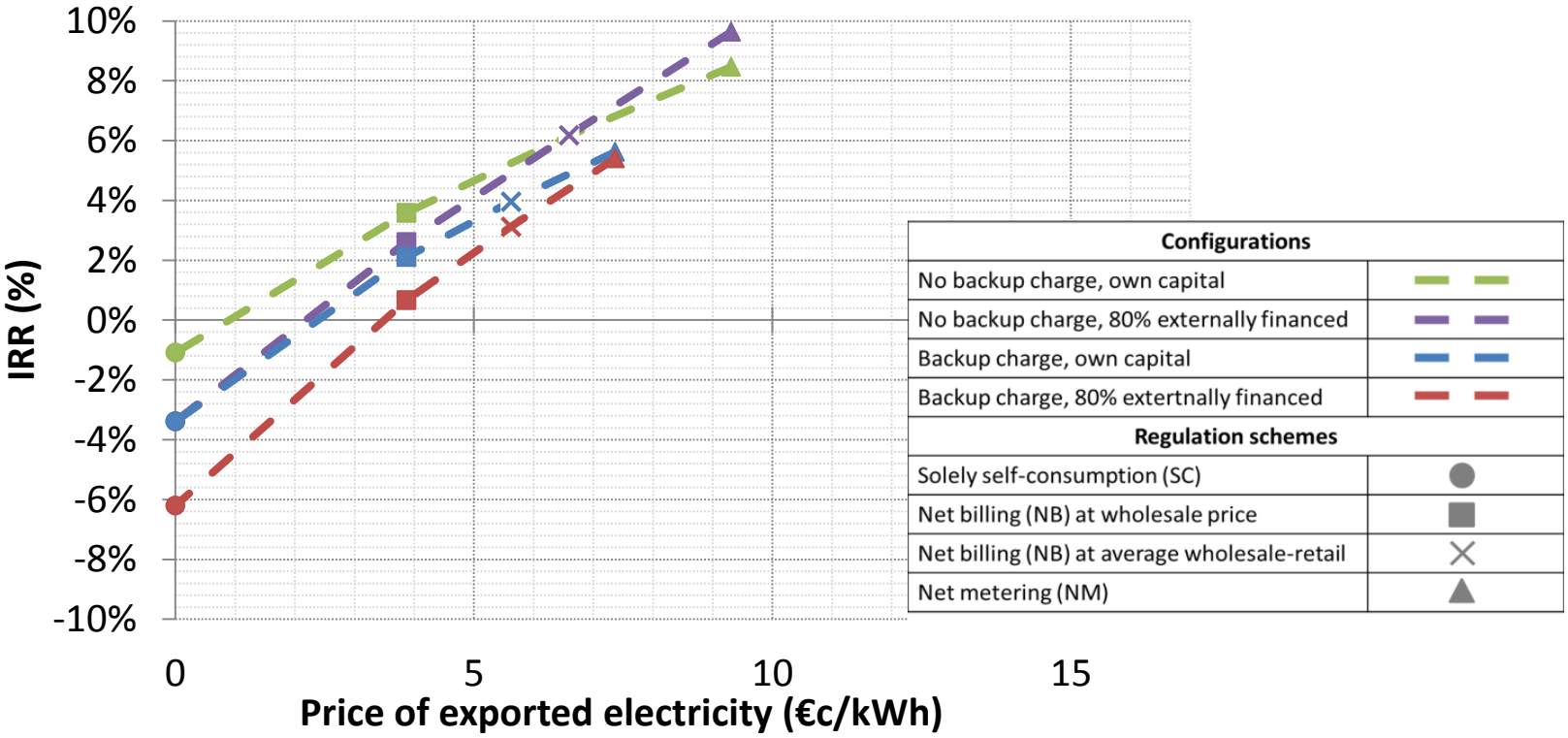
$$(1 - \alpha) * PV_{IN} + PV_{IN} * \alpha * i * \frac{(1+i)^{Nl}}{(1+i)^{Nl}-1} * \frac{1-q^{Nl}}{1-q}$$

Share externally financed

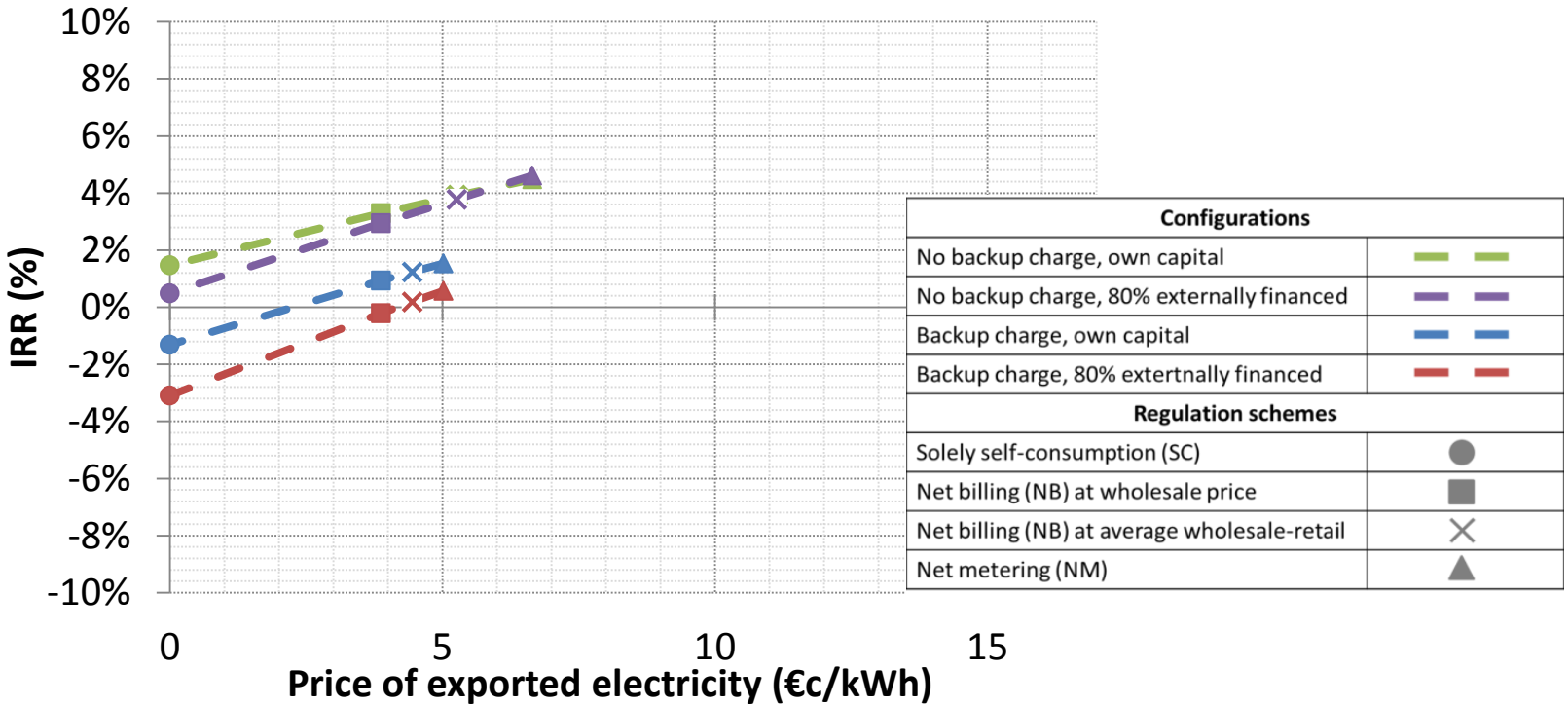
Results residential



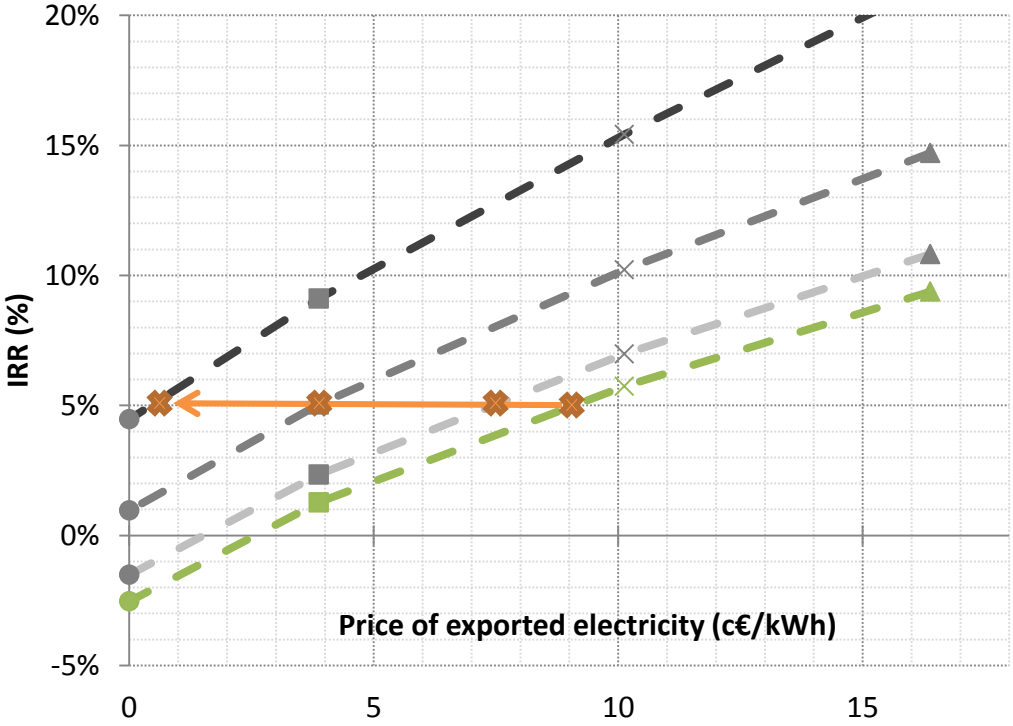
Results commercial



Results industrial



Declining PV system costs



1 €/Wp (-50%)

1.5 €/Wp (-30%)

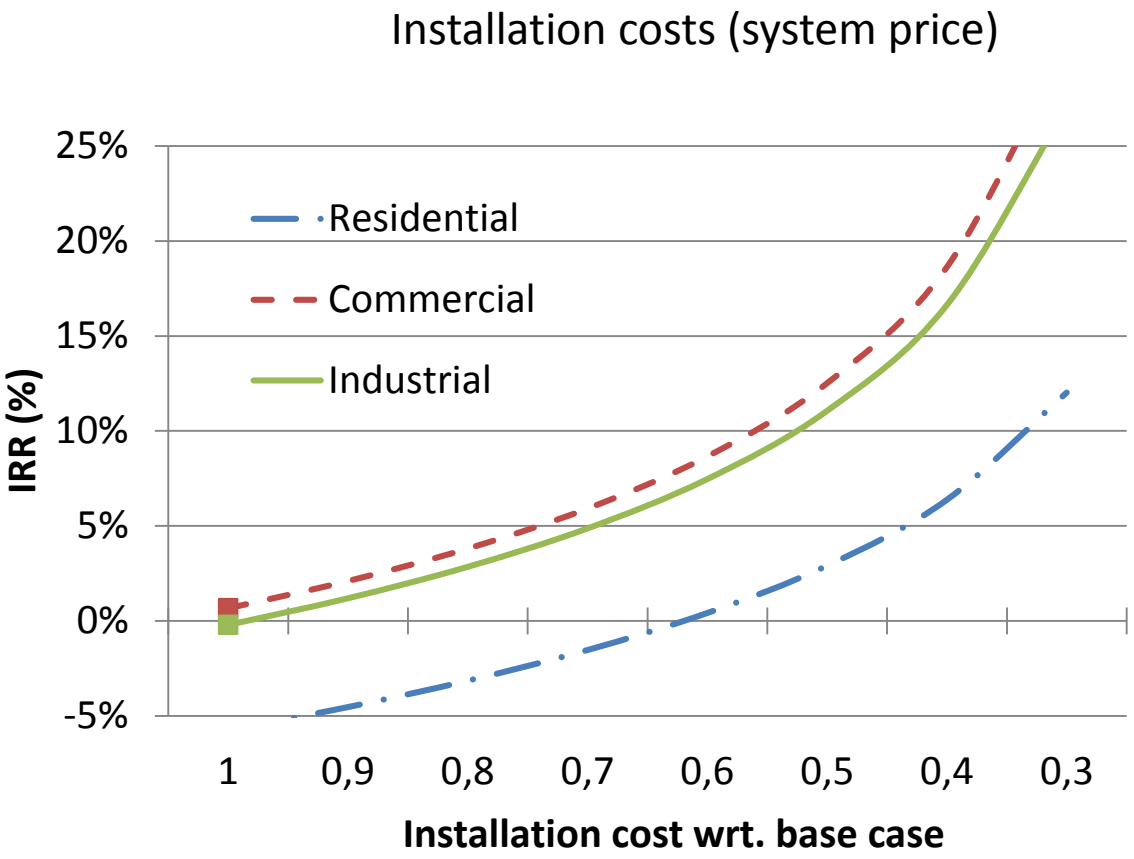
1.9 €/Wp (-10%)

2.1 €/Wp (current)*

Lower PV System Price (€/kWp), higher profitability

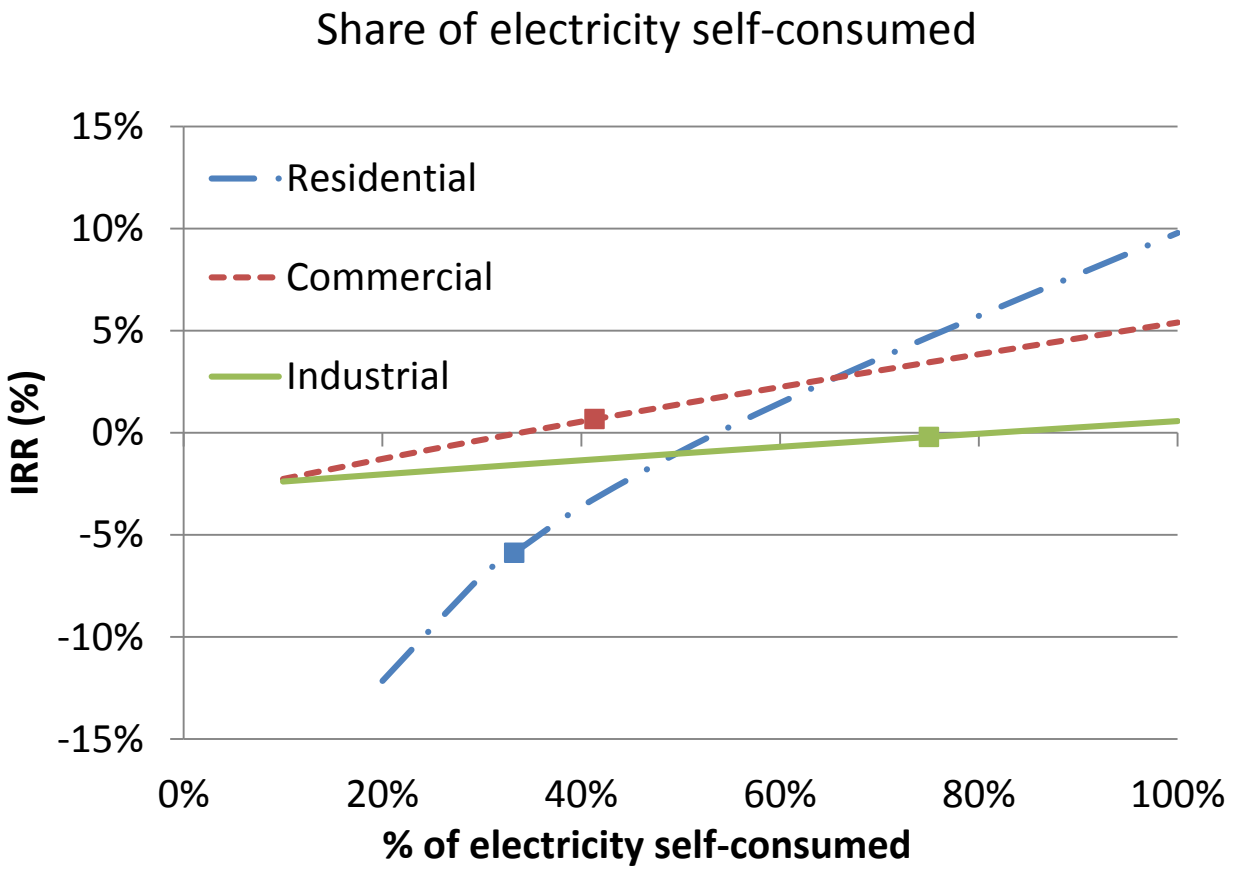
*Base case: own capital without backup charge. *May 2015*

Sensitivity analysis



Base case: 80% externally financed with backup charge for C and I

Sensitivity analysis



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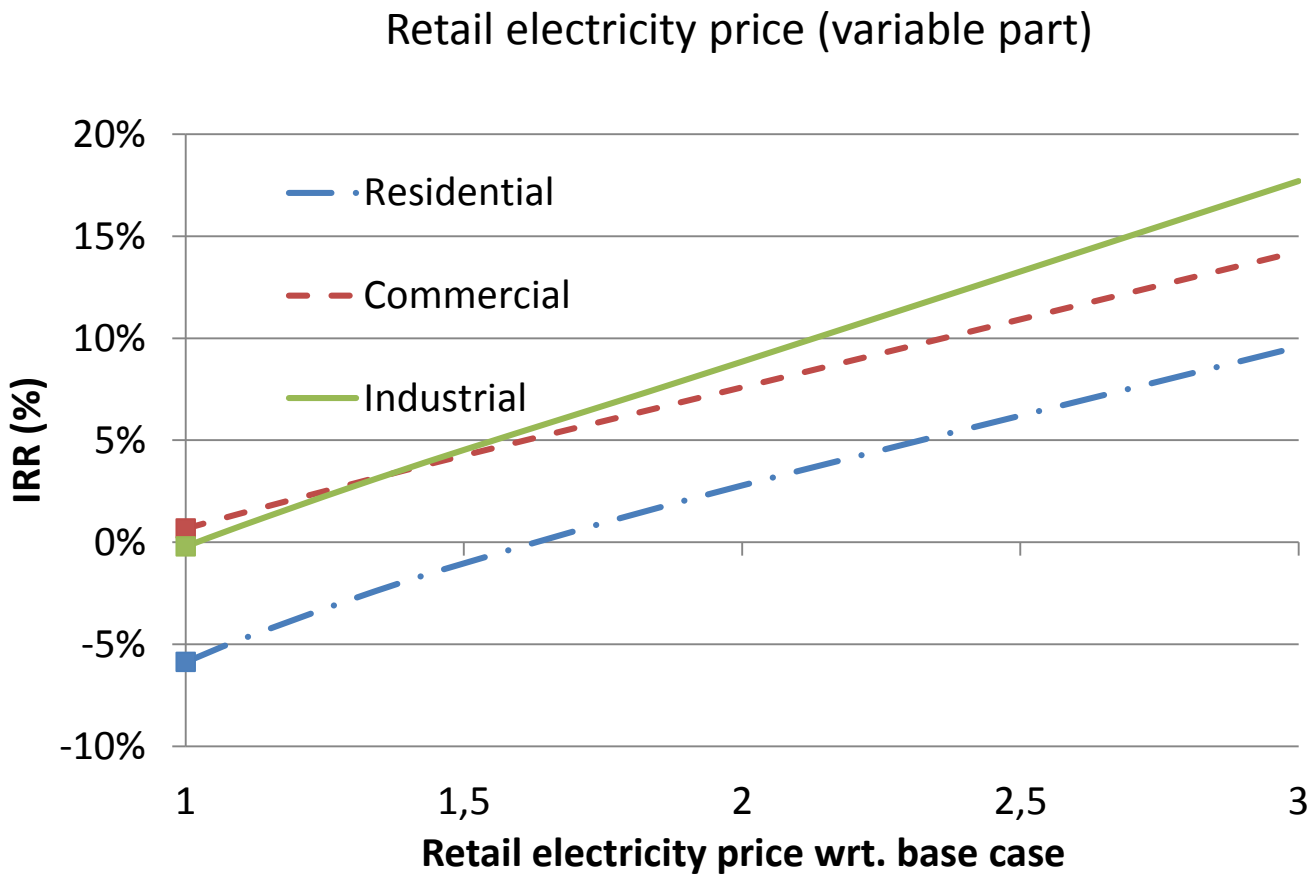
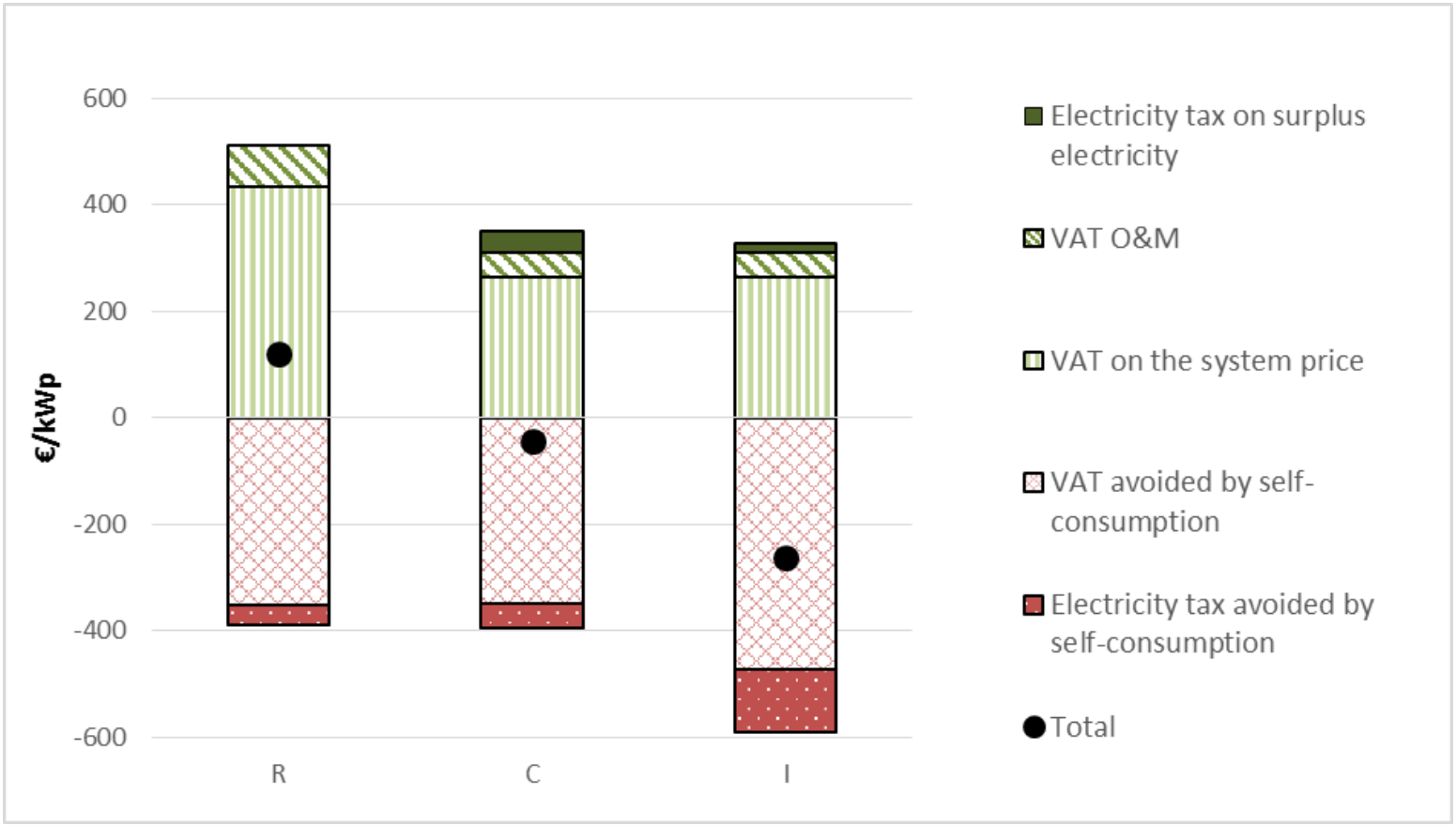


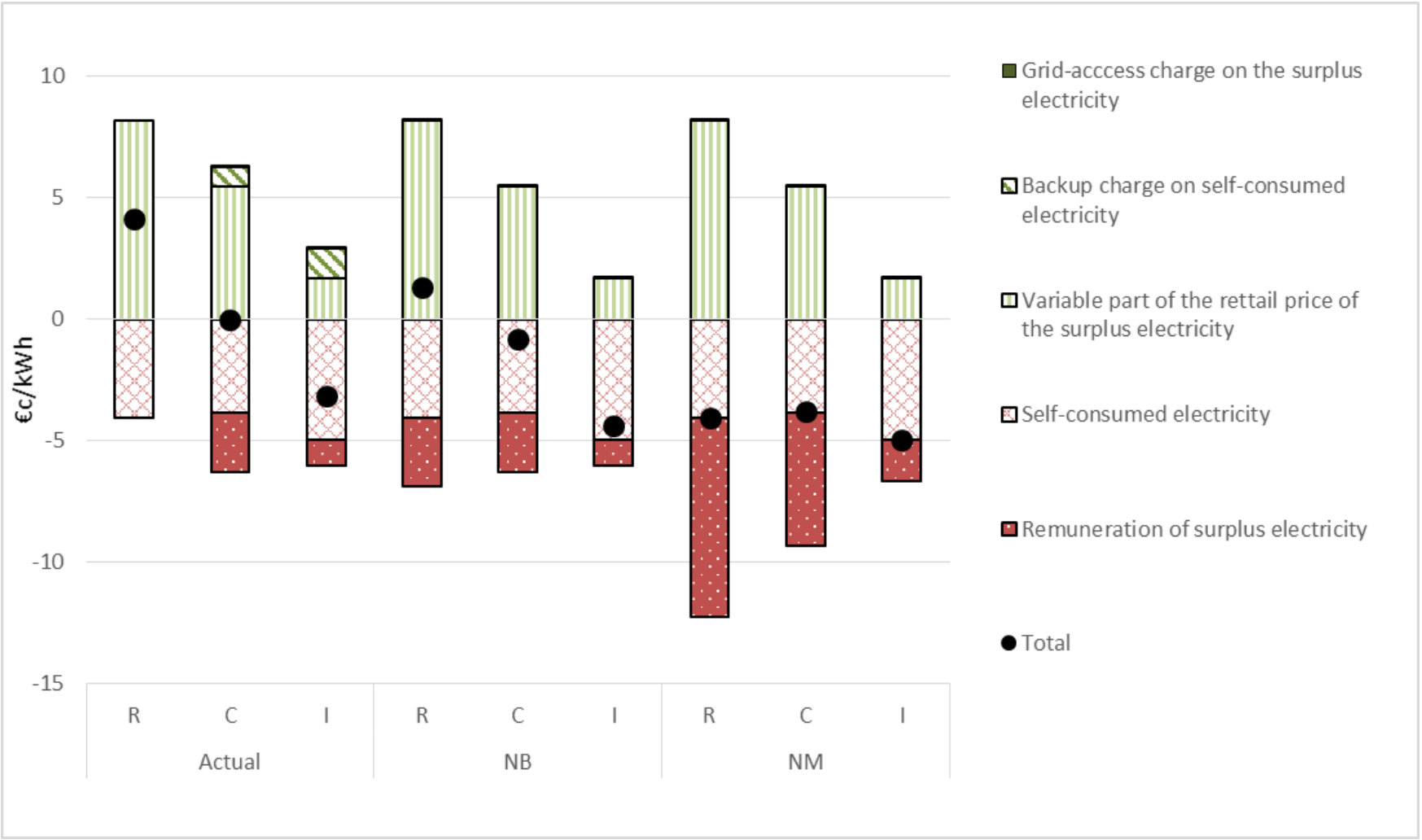
Base case: 80% externally financed with backup charge for C and I

On government revenues

At 5% discount rate. € per kWp of installed capacity during the lifetime of the system (25 years)



On the electricity system*



*comprising generators, suppliers, TSO, DSO, regulators and consumers. € cents per kWh generated by the system.

Conclusions

- This regulation will hinder the difussion of PVSC applications by making them economically infeasible

- It sets inefficient incentives

- Recommended Dynamic Net Billing without backup charge

- With the current regulation, residential PV self-consumption has a positive impact on both government and ´electricity system´ revenues

Thank you for your attention