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Steering demand response and renewables in distribution grids via network charges?

Enerday-Conference

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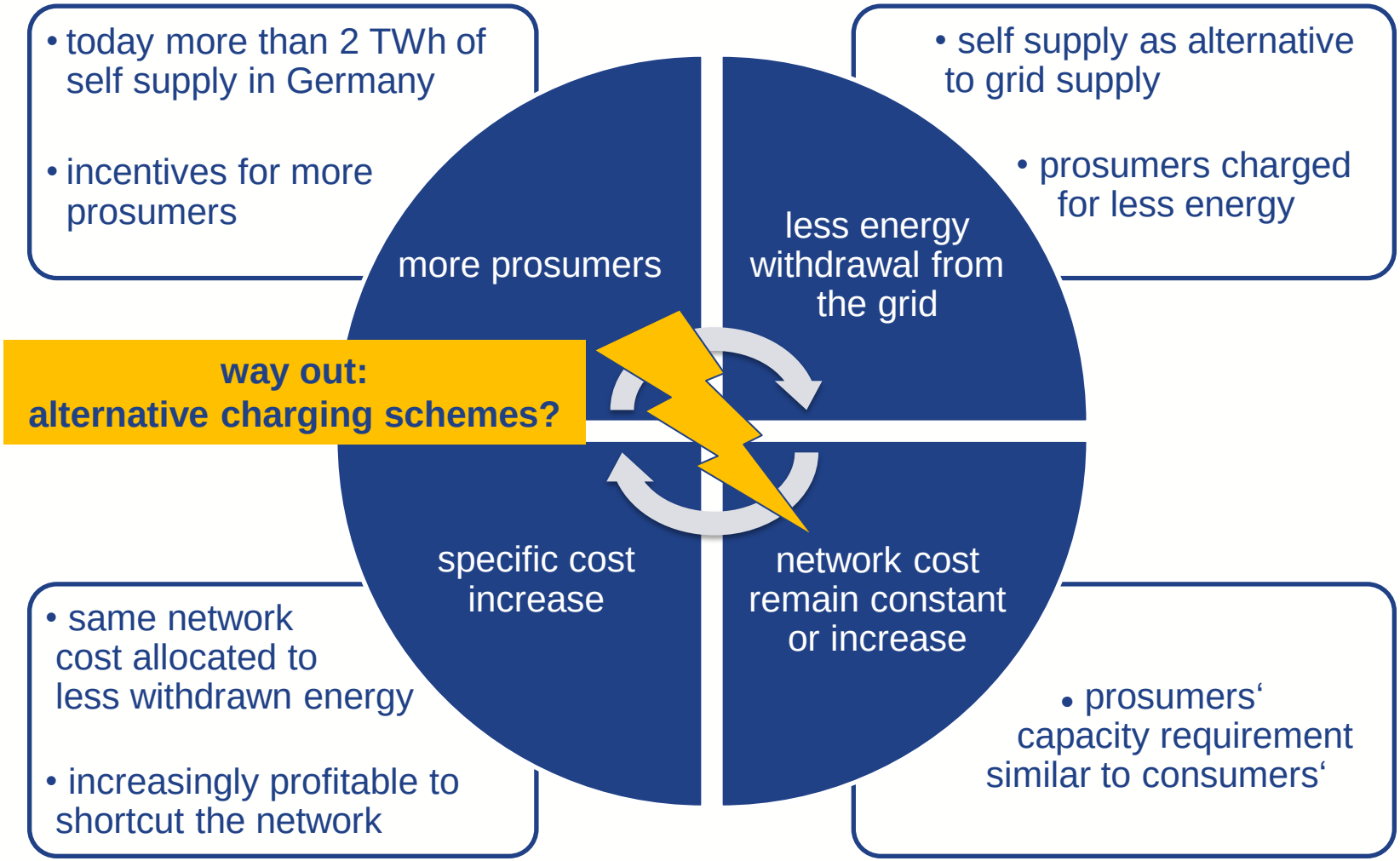
Agenda

1. Prosumers and network charges
2. Modelling network charges
3. Incentives for prosumers with different charging schemes
4. Conclusions and outlook

Prosumers‘ vicious circle



Modelling network charges

Inputs

network structure

- network level cost
- users per network level (number, type, consumption, capacity, …)

load profiles

- quarter hourly load profiles
- randomly individualized standard profiles for consumers, PV and storage

charging schemes

- current German scheme (StromNEV)
- acutal (net) peak simultaneity
- net energy consumption
- load or capacity flat

Outputs

network load

- quarter hourly sum of user loads to obtain
  - network load profile
  - Network (net) peak load
  - user simultaneity

network charges

- load and energy charges / yearly payments per user group

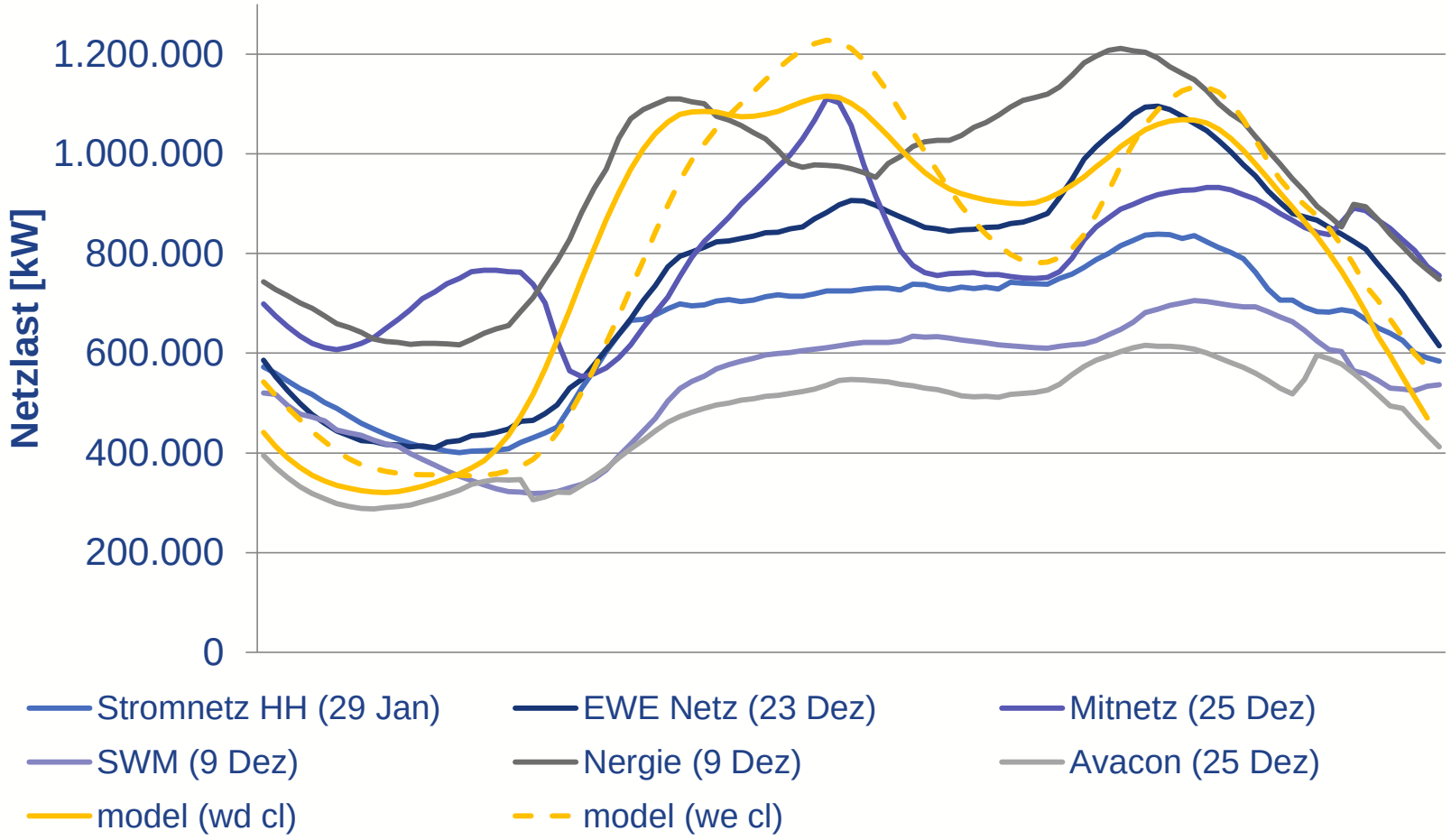
Model network

Input data for low voltage level

	model network	Stromnetz Hamburg	EWE Netz	Mitnetz	Stadtwerke München	Avacon
network level cost	300 Mio. €	?	?	?	?	?
number of users	1.600.000	1.130.828	1.121.496	1.612.699	949.669	1.119.193
Local generation	6%	1,64%	15,24%	7,57%	1,89%	13,91%

	B	HH	B Pro	HH Pro	B ProSto	HH ProSto
share (%)	1,4	93,6	2,5	2,5	0,04	0,04
yearly energy (kWh)	100.000	3.000	1.389	76.255	76,184	1.115
peak load (kW)	30	4	29,7	3,6	29,6	3,5
capacity (kW)	75	25	75	25	75	25

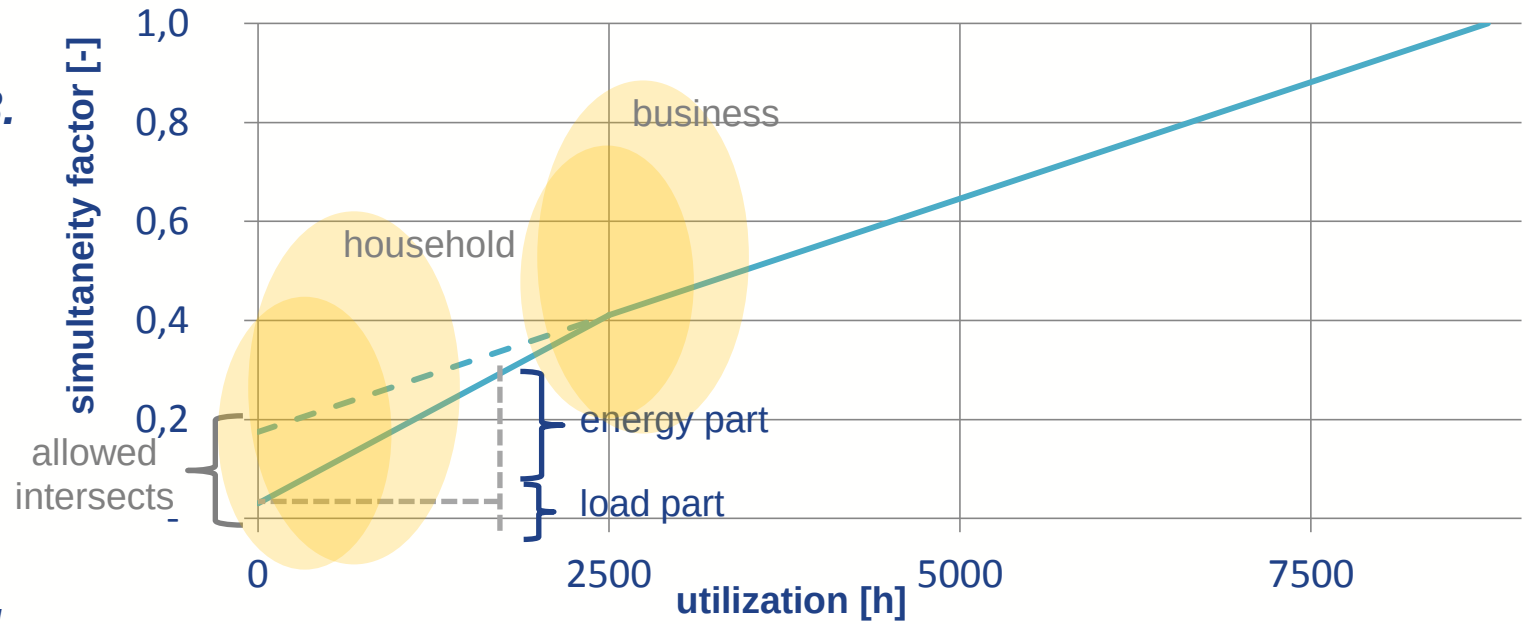
Validation of modelled network load



Current charging scheme in Germany (StromNEV)

1. $charge_{level} = \frac{cost_{level}}{peak\ load_{level}}$

2. $payment_{user} = charge_{level} \cdot simultaneity\ factor_{user} \cdot peak\ load_{user}$

3. 

4.

   a. $Leistungsentgelt_{Nutzer} = Lastteil \cdot Entgelt_{Ebene}$

   b. $Arbeitsentgelt_{Nutzer} = Energieteil \cdot Entgelt_{Ebene}$

Alternative charging schemes

Current network charges are based on utilization-approximated peak simultaneity.

Alternative approaches simulated with the model are:

- charges based 80% on actual simultaneity with network peak withdrawal and 20% on energy withdrawn from the network
- charges based 80% on actual simultaneity with network net peak load and 20% on energy withdrawn from the network
- charges based 80% on actual simultaneity with network net peak load and 20% on yearly net energy withdrawn from the network

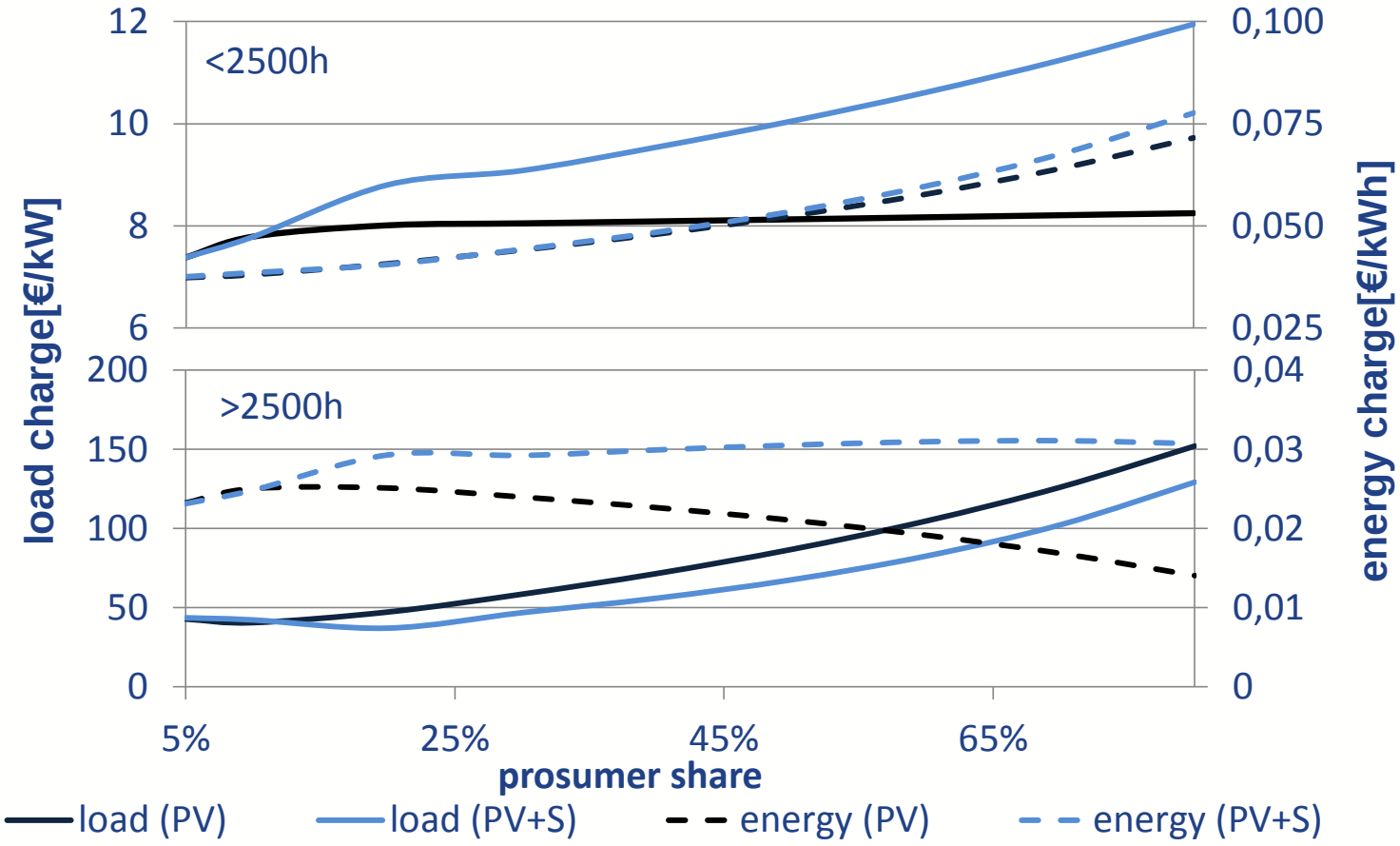
- a flat charge based only on peak load
- a flat charge based only on connected capacity

Validation of modelled network charges

network charges at low voltage

		model network	Stromnetz Hamburg	EWE Netz	Mitnetz	Stadtwerke München	Avacon
Load charge >2500h	€/kW	43,11	41,63	46,75	116,98	105,74	103,32
Energy charge >2500h	ct/kWh	2,3	2,22	2,43	1,16	0,42	1,70
Load charge <2500h	€/kW	7,39	12,98	12,99	43,73	12,81	9,84
Energy charge <2500h	ct/kWh	3,8	3,37	3,78	4,09	4,13	5,44

Effects of increasing prosumption I: charges



- no strict proportional increase of network charges with rising prosumer share
- increasing importance of load part

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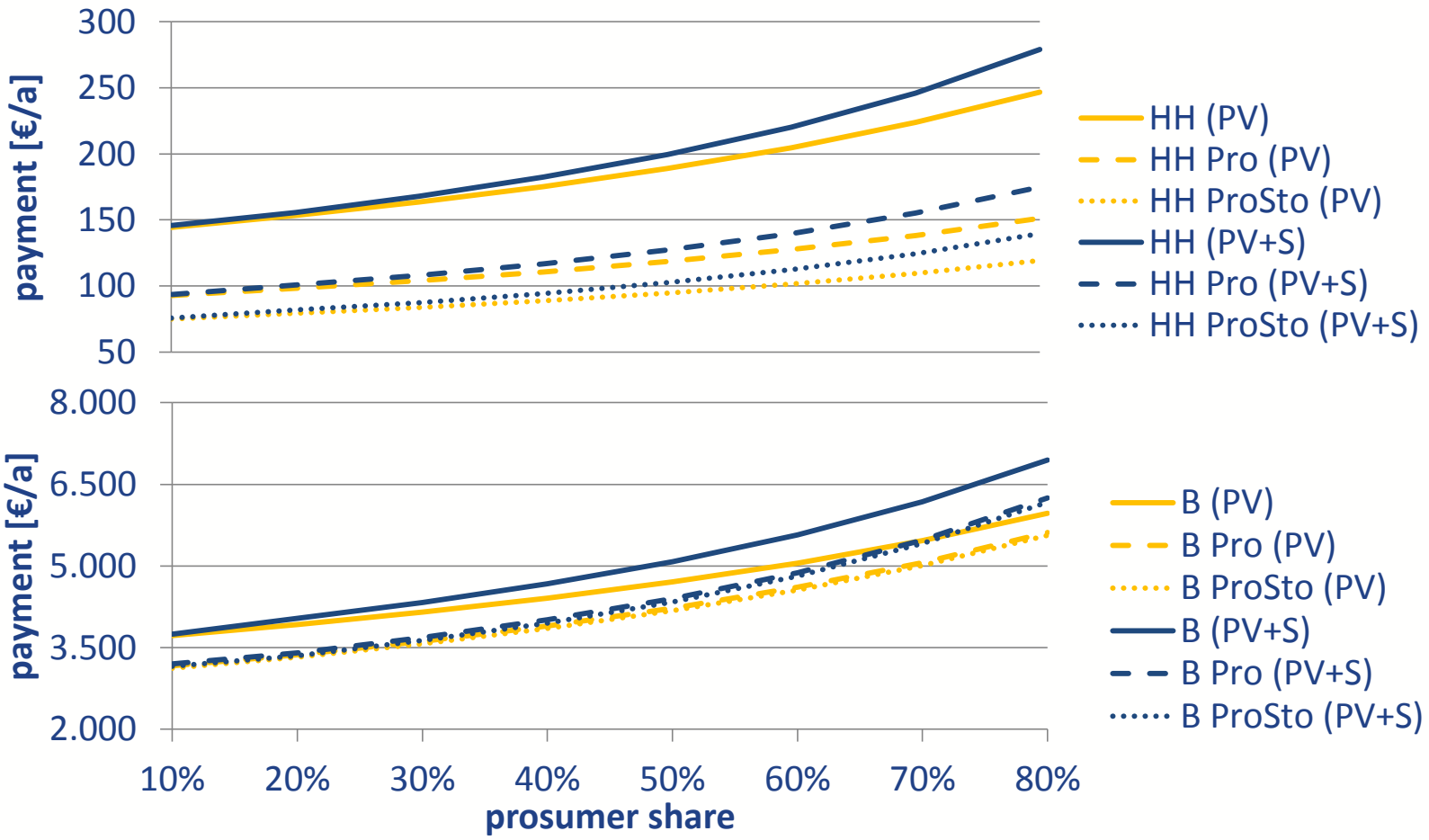
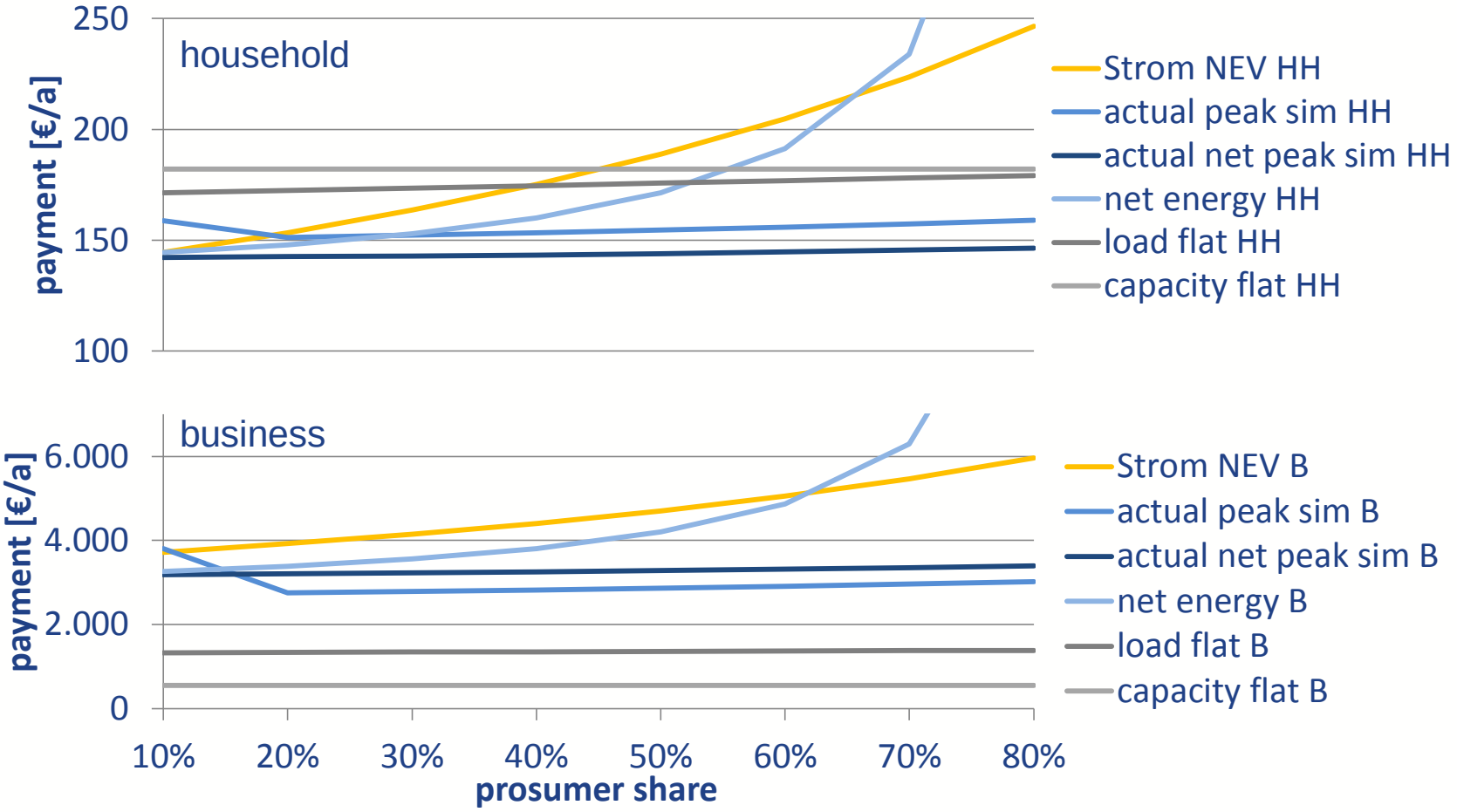
Effects of increasing prosumption II: payments



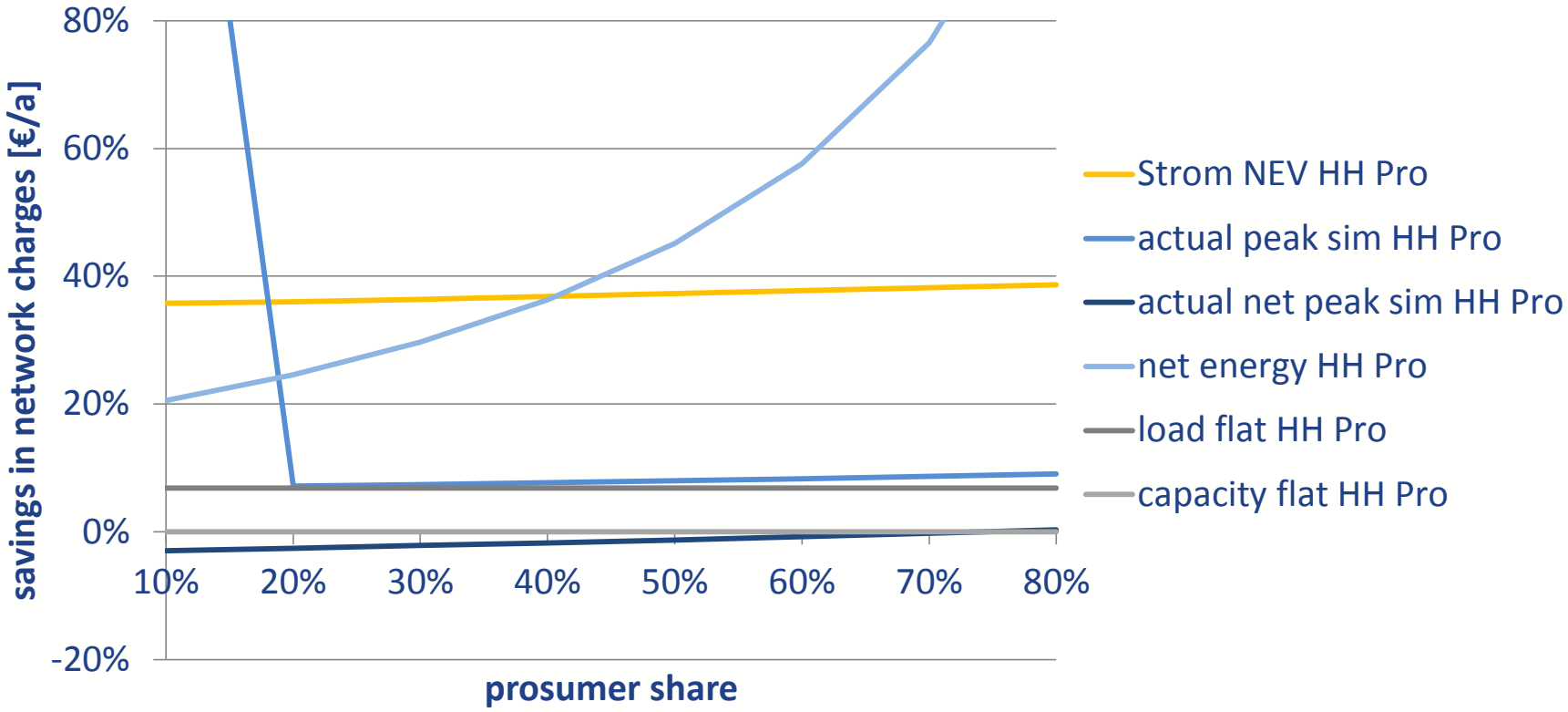
- yearly total payments rise with prosumer shares for all customers

Alternative charging schemes



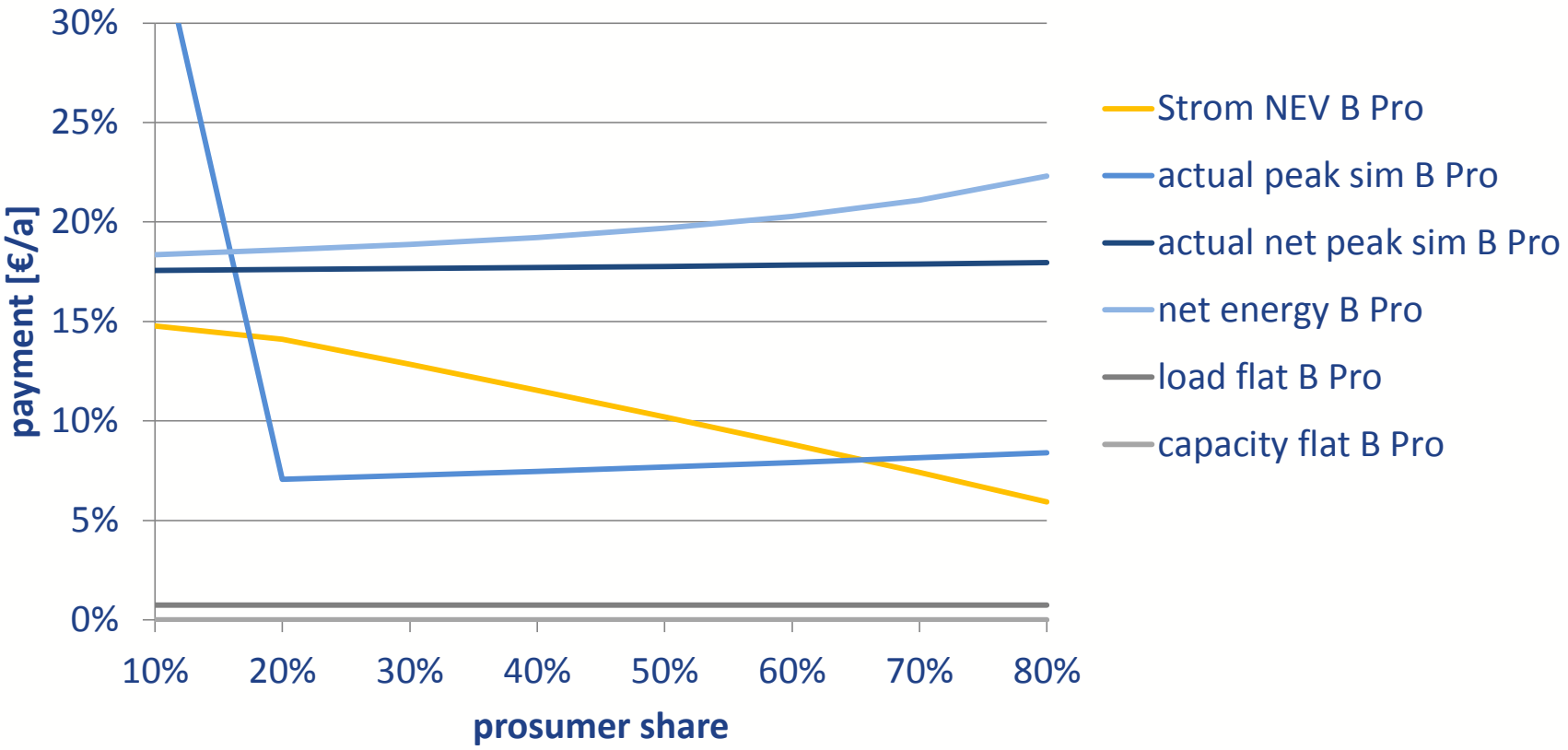
- regular customers‘ payment increase strongest for StromNEV and net metering

Incentives for household prosumers



- incentives for self supply rise for StromNEV and net metering but decrease for charging schemes based on actual simultaneity

Incentives for business prosumers



- incentives for self supply decrease with rising prosumer shares for StromNEV and rise more moderately for net metering

Comparison of charging schemes

	adaptivity of incentives	transparency of incentives	complexity of charging	transparency of charging
StromNEV (approximated peak simultaneity)	+	++	- -	- -
actual peak simultaneity & withdrawn energy	+	-	-	+
actual net peak simultaneity & withdrawn energy	++	-	-	+
actual net peak simultaneity & yearly net energy	- -	-	-	+
peak load flat	-	-	+	-
capactiy flat	/	/	+	-

Conclusion & Outlook

Conclusions

- regular users‘ network payments rise with increasing prosumer share
- charges based on actual peak simultaneity preserve payment level for regular users and provide better incentives for prosumers
- flat charges convince only with respect to complexity

Outlook

- other incentives for prosumers may be more substantial
  - other energy price components (taxes, EEG, …)
  - decreasing levellized cost of PV (grid-parity)
- ‘natural’ threshold for self supply
  - availability of appropriate locations
  - Investment opportunities

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