

Workshop on renewables self-consumption



Webex meeting

June 2, 2021: 10:00 – 13:00

Incentives and challenges in promoting self-consumption

Case of Croatia

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Self-consumption benefits

Saving #1

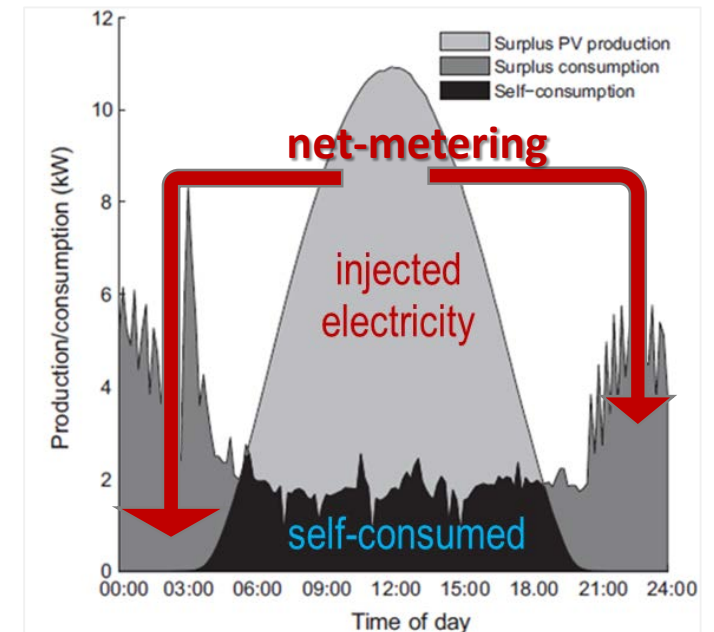
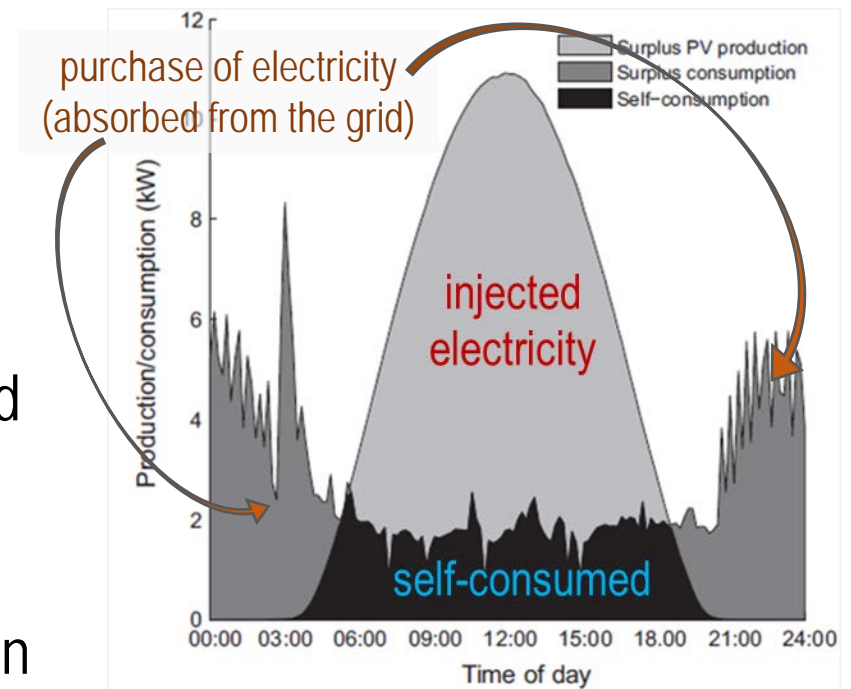
- **Self-consumption** → consumers can save money by generating their electricity rather than buying it from the grid (PV economically viable if grid parity achieved)

Saving #2

- **Net-metering** → excess electricity injected into the grid can be used later to offset consumption during times when on-site RE generation is absent or not sufficient (*grid as a virtual storage for excess power*)

Saving #3

- **Net-billing** → invoice based on the value of withdrawn energy decreased by the value of injected energy



RES Law - Croatia

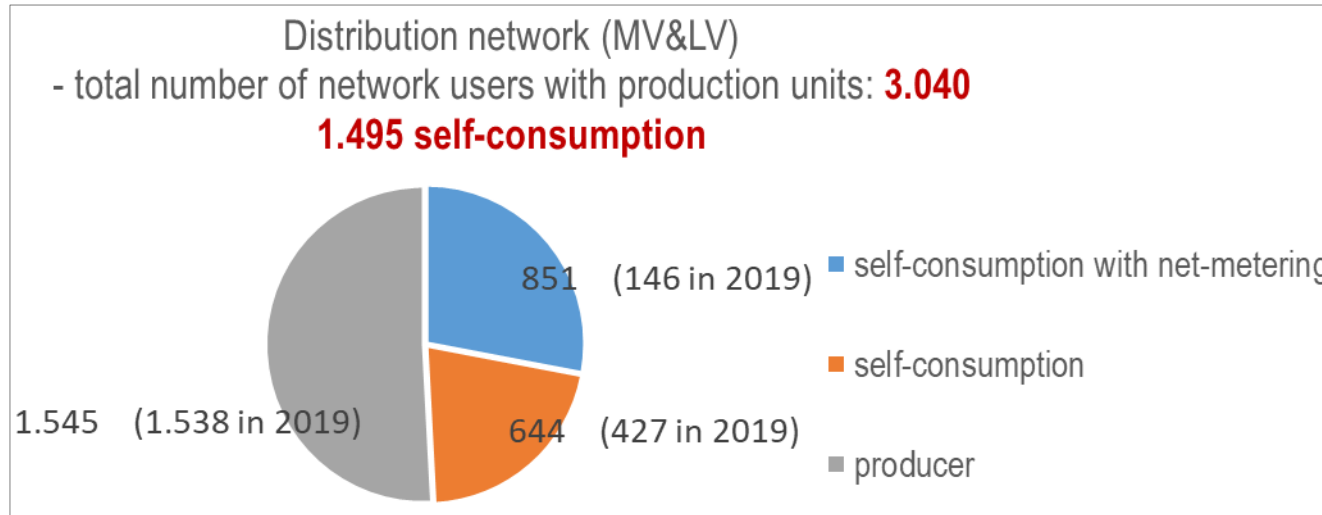
CROATIA (in force since January 2016)

self-consumption is related to the renewable generation & high-efficiency cogeneration for SG < 500 kW RE Law obliges the prosumers supplier to purchase excess electricity injected to the grid at the 90% supply tariff (**net-billing**)
gen. rated capacity \leq contracted power

CROATIA (in force since January 2019)

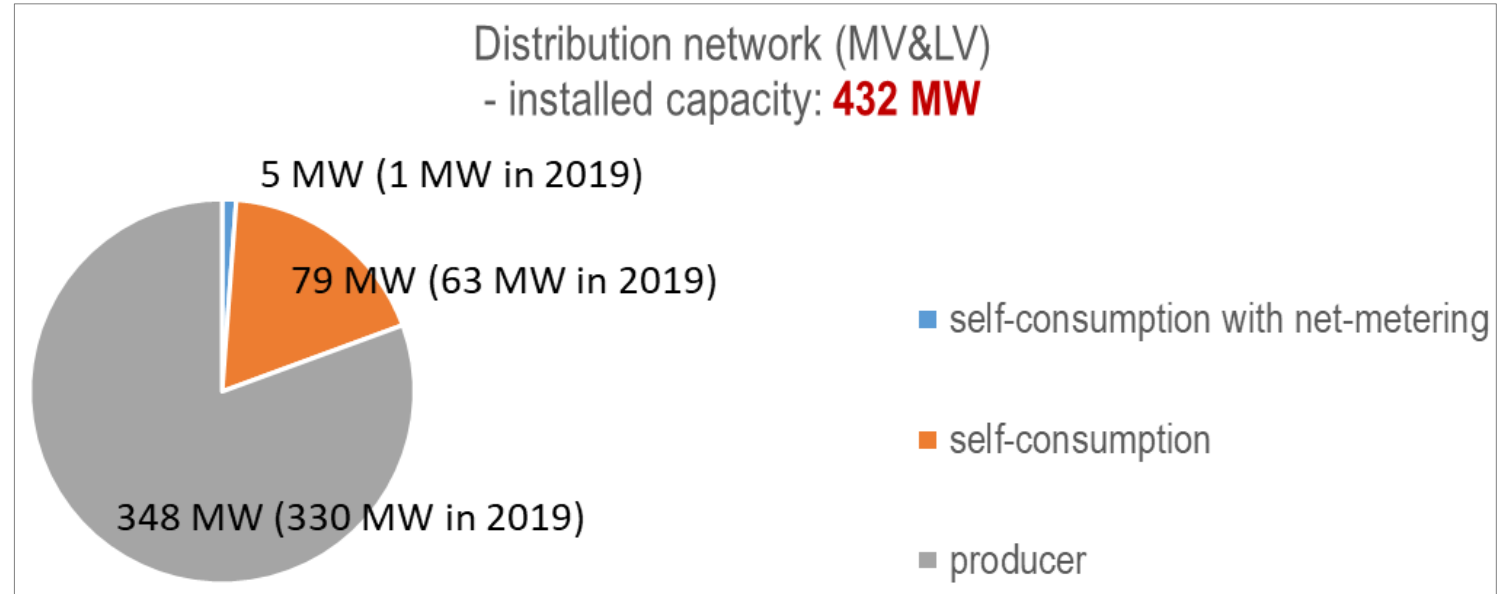
net-metering/billing is limited to **households** with self-generation provided that the **annual injected electricity** is lower than electricity **absorbed** from the grid
supplier purchase excess electricity injected to the grid at the 80% supply tariff
gen. rated capacity \leq contracted power

Distributed generation & self consumption landscape – Croatia end of 2020



- in 2020 **60 households per month** → self-consumption with net-metering
- at the end of 2020 **43** households lost the right to net-metering

- at distribution level **9%** of total installed capacity of producers located in Croatia
- self-consumption **2%** of total installed capacity of producers located in Croatia



Distributed generation & self consumption landscape – Croatia end of 2020

Production in 2020:

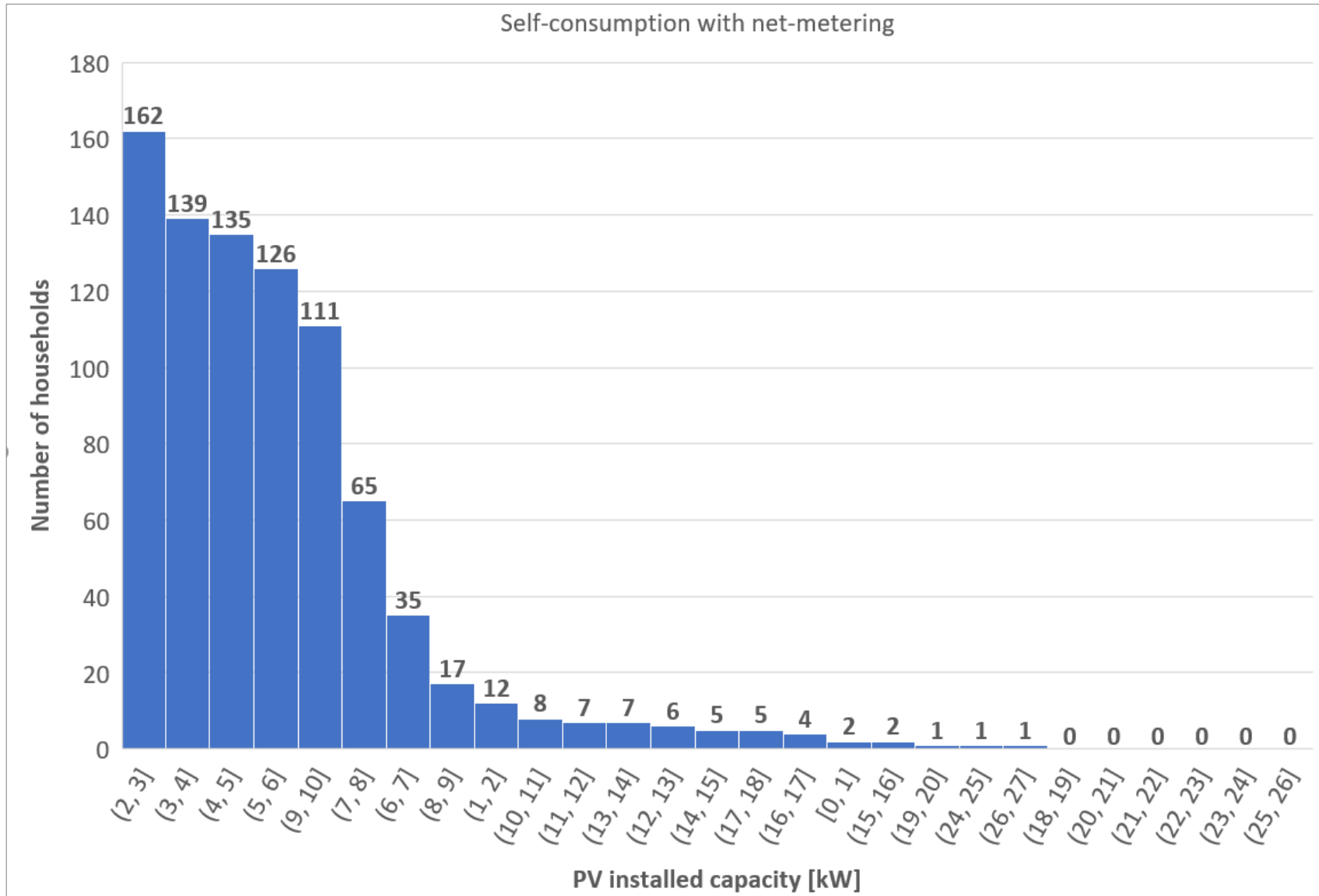
- total in Croatia: **12 TWh**
- at the distribution level: **1,4 TWh** (12%)
- self-consumption: **0,03 TWh** (0,3%)

Self-consumption in total number of:

- Households: **0,04%** (851)
all PV
- Commercial customers: **0,3%** (644)
PV (620), biogas (15), HPP (9)

Distributed generation & self consumption landscape – Croatia end of 2020

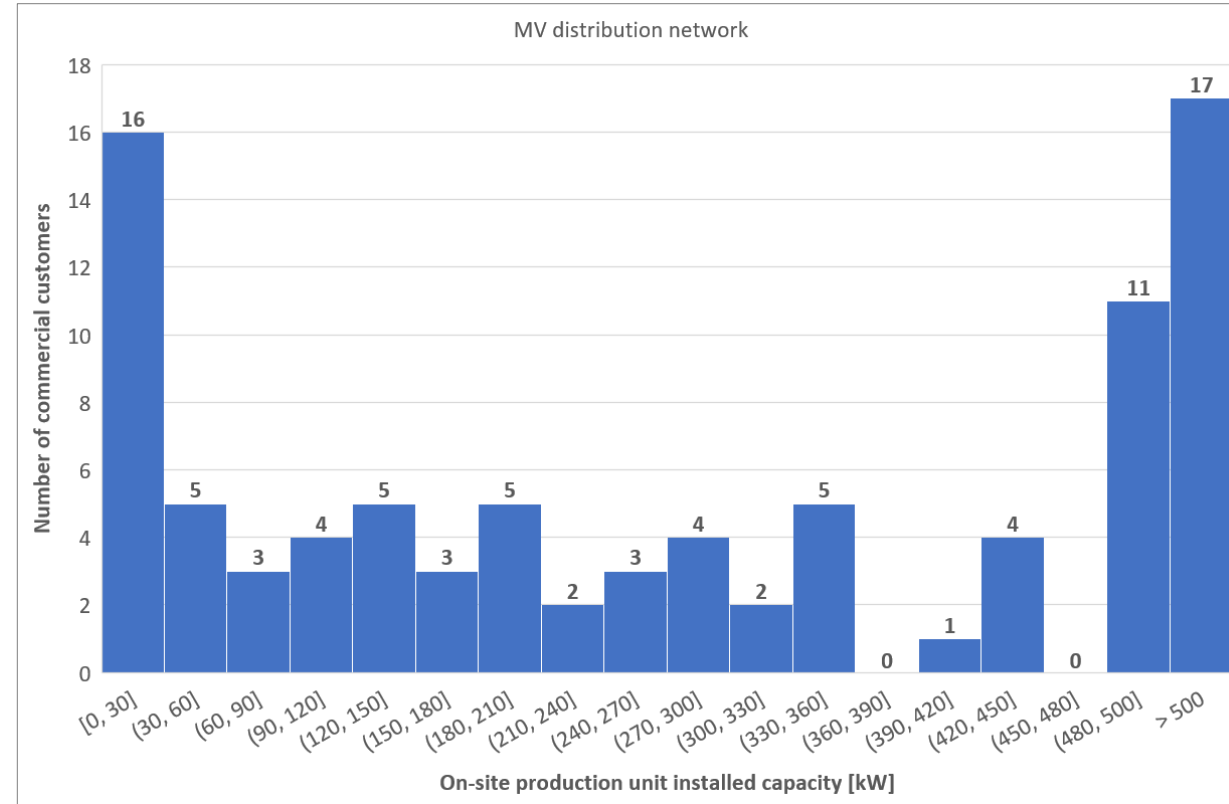
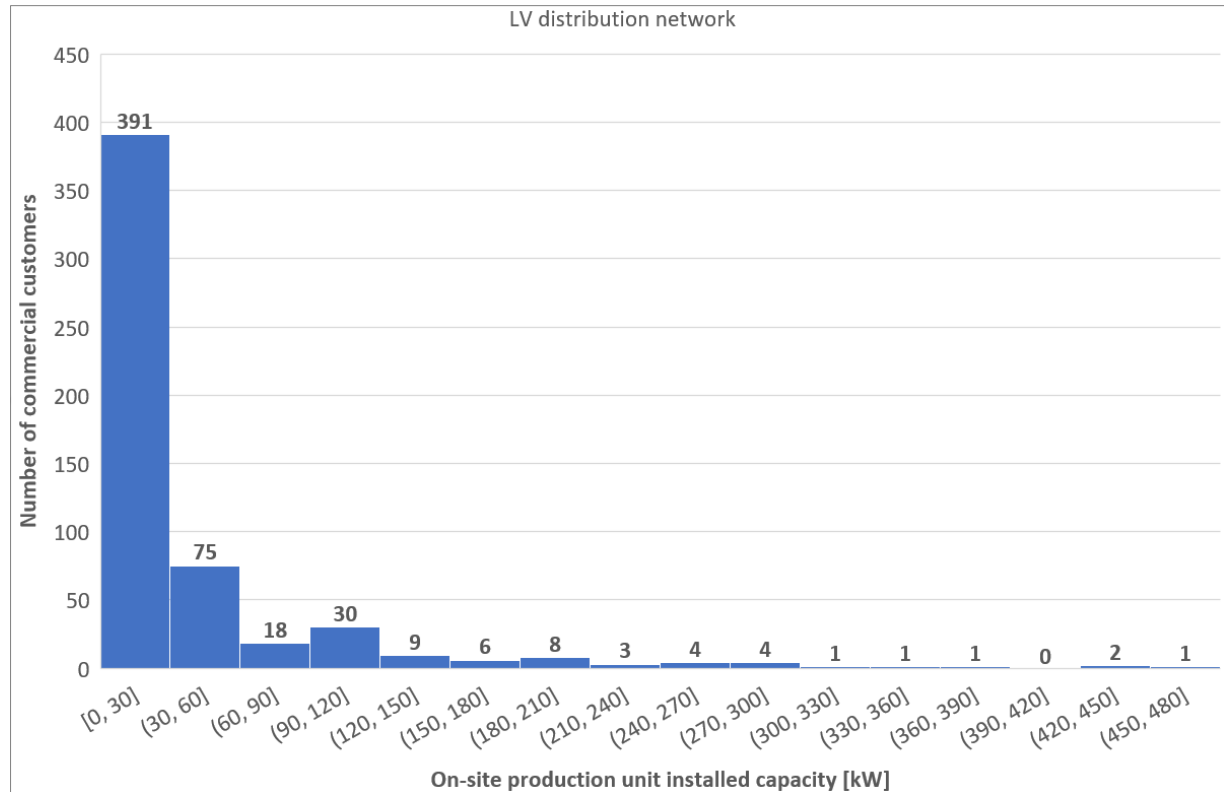
households



- average size of PV: 6 kW
- average consumption of households in Croatia: ~ 2.800 kWh
- specific yield of PVs in Croatia: ~1000 kWh/kWp
- eligibility criteria for net-metering: ~ on average 3 kW PV

Distributed generation & self consumption landscape – Croatia end of 2020

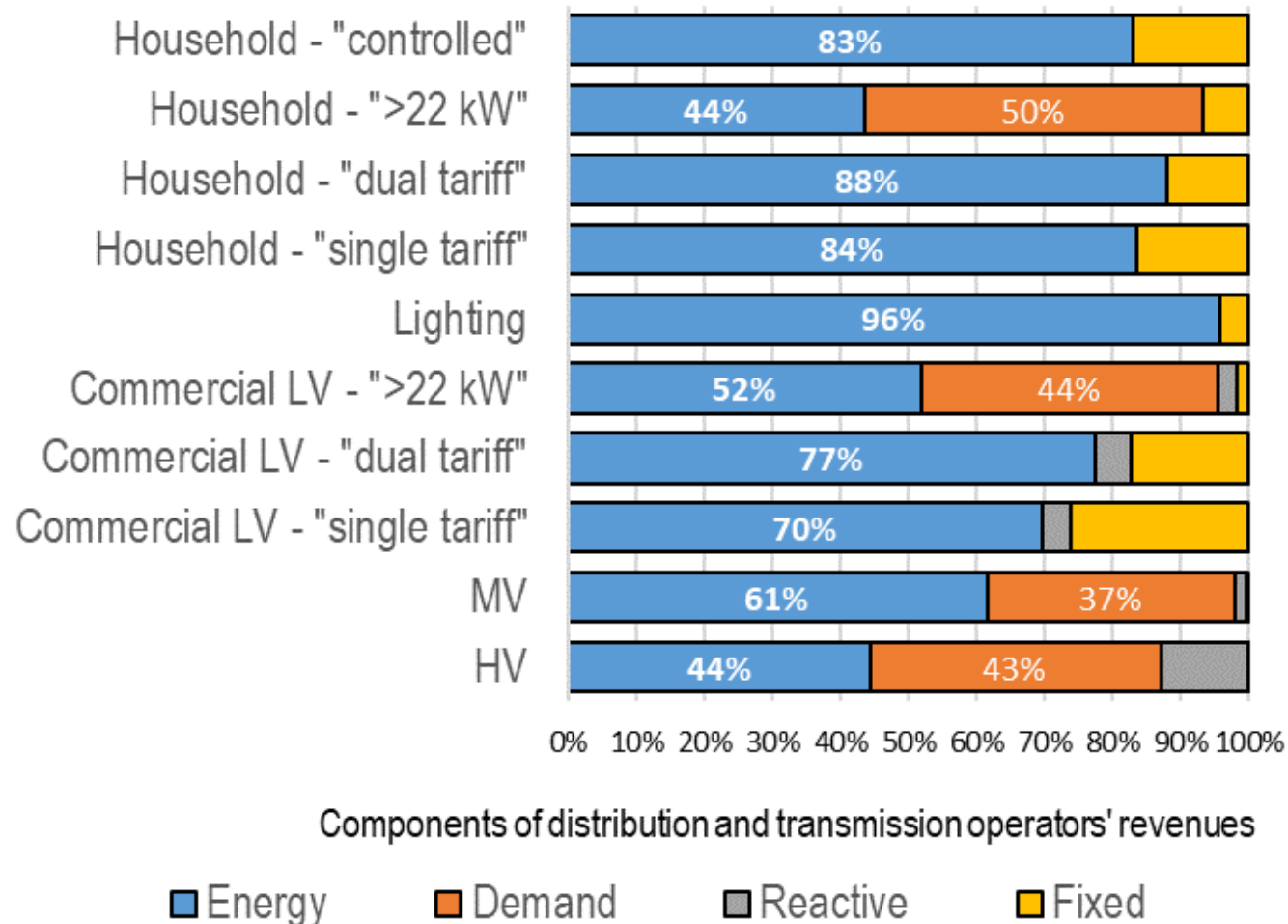
commercial



- 2 kW – 476 kW
- average size of 554 (86%) PU at LV: **43 kW**

- 10 kW – 10.000 kW
- average size of 90 (14%) PU at MV: **677 kW**

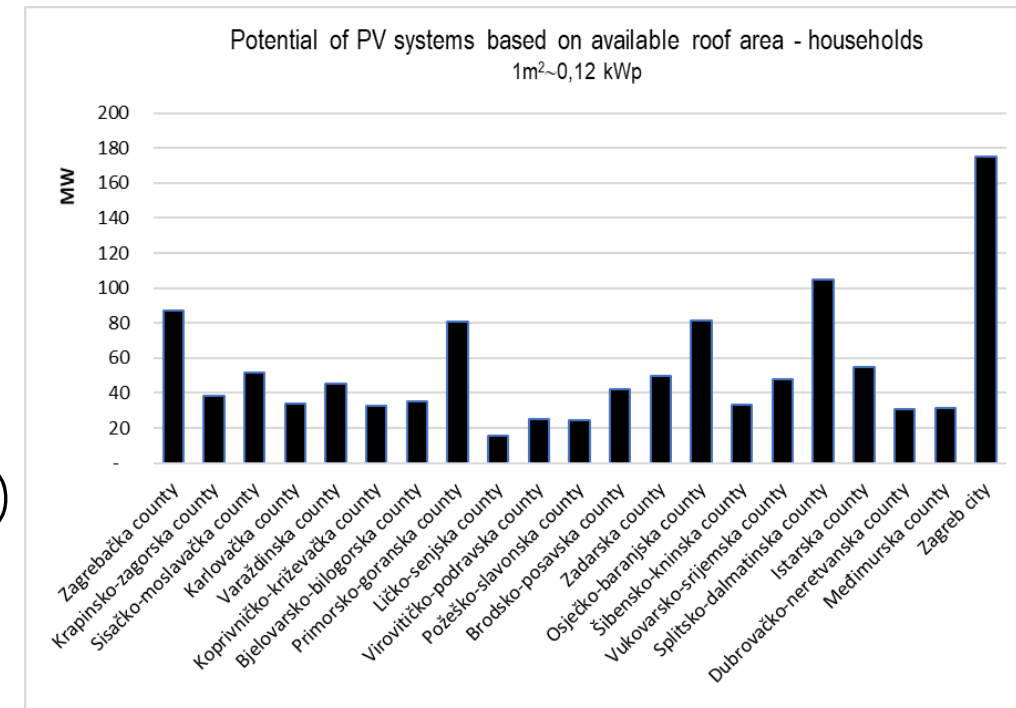
DSO & TSO revenues (network charges)



- network tariffs are the main method for covering network costs from network users
- the majority of TSO&DSO revenues from households and small commercial customers relates to volume (energy)
- „prosumers“ contribute less to the grid cost recovery because of self-consumed electricity and also injected electricity exempted from paying grid tariffs
- when the net metering scheme is applied this effect is even aggravated
- detrimental to TSO and DSO revenues
- prosumers should pay their share of the network and other system costs
- otherwise prosumers network costs would be shifted to other customers

Study initiated by the HERA (regulator)

- existing tariff methodology is largely based on volumetric charges → emergence of a larger number of self-consumption may result in a reduction in the revenues of TSO and the DSO
- **study** analyses in detail the impact of self-consumption in Croatia on the revenues of TSO and DSO
- **focus on LV consumers:** households: 2,3 mil. and businesses: ~200.000
- **aassumption:** they will install **photovoltaic (PV) systems**
- **input data:**
 - billing data ≤ 500 kW for 2018, tariff category, tariff model, connected power, number of phases
 - PVSol database for specific yield and PV production modelling
 - data on buildings (population & housing census in 2011; energy audits of buildings)



Study – sample of customers

- existing legal framework in Croatia currently does not regulate sharing of PV systems energy in multi apartment and multi apartment & commercial buildings → Criteria No.1: up to three customers at the same address
- current electricity prices (~13€/kWh) and specific costs of the PV system does not make them profitable for customers with low yearly consumption → Criteria No.2: minimum annual consumption
 - households: ≥ 1.500 kWh/year (single-phase) & ≥ 2.500 kWh/year (three-phase)
 - LV commercial: ≥ 5.000 kWh/year

Households

Population: 2.229.612

Sample: **792.098** (36%)

LV commercial

Population: 200.379

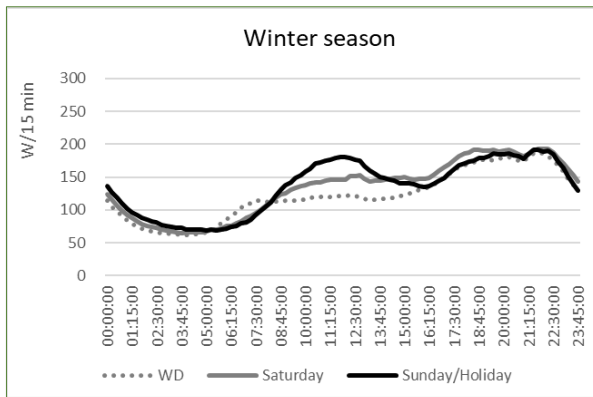
Sample: **63.976** (32%)

Study – production & consumption modeling

LV COMMERCIAL

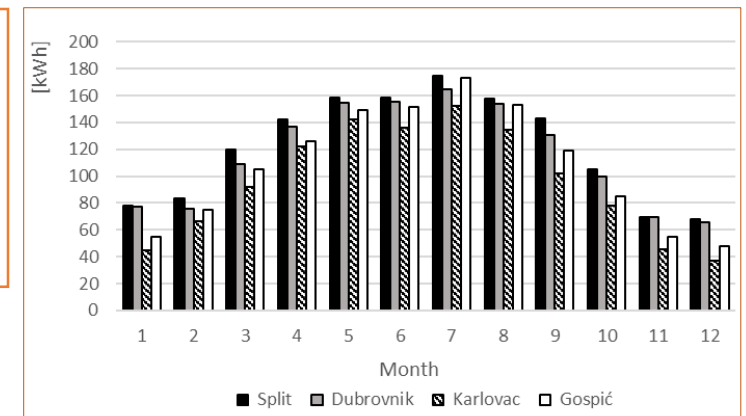
HOUSEHOLDS

- data important for the evaluation of households' savings (semi-annual meter readings):
 - monthly consumption
 - distribution of monthly consumption on peak (7(8) - 21(22)) and off-peak hours
- hourly values not decisive due to monthly net-metering
- standard load profiles applied for modelling

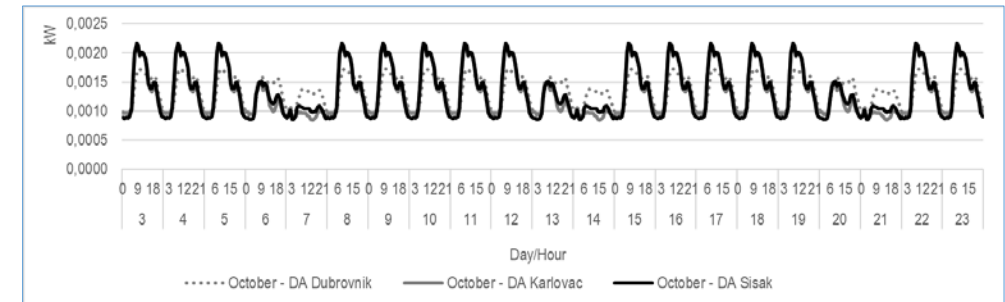


PV PRODUCTION

- commercial tool PVSol
- two orientations of modules (S, 30° & E/W, 20°)
- specific yield: kWh/kWp



- data important for the evaluation of LV commercial customers savings (monthly meter readings):
 - hourly values decisive (not known for ≤ 22 kW)
- HEP DSO had a representative sample (~ 22.000) of 15-min load curves for LV commercial customers



Study – input data and decision making assumptions

INPUT DATA ASSUMPTIONS

- cost of the PV system:
 - ≤ 20 kWp: **1,500 €/kWp** (including VAT)
 - > 20 kWp: **1,250 €/kWp** (including VAT)
- cost of inverter: **0,1 €/Wp** (replacement after 12 years)
- OPEX: **1%** of total investment

- economic life of PV systems: **25 years**
- degradation of PV modules: **0,5%/yr**
- discount rate: **8%**

- households: universal service tariff
- LV commercial: weighted average of 4 suppliers

OPTIMAL PV RATED POWER & DECISION MAKING

Households:

- single phase: 3 kW
- three phase: 3 kWp, 5 kWp, 7 kWp i 10 kWp
- PV rated capacity \leq contracted power of customer
- annual injected electricity \leq electricity absorbed from the grid

LV commercial:

- single phase: 3 kW
- three phase: 3 - 500 kW

500	450	400	350	300	250	200	150	100	50	30	25	20	15	10	7	5	3
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- PV rated capacity \leq contracted power of customer

- for each customer simulations with different rated powers for both PV system orientations
- the optimal rated PV capacity is the largest for which it is met:
 - households: PBP < 10 years
 - LV commercial: PBP < 12.5 years, dPBP ≤ 25 years and IRR $\geq 8\%$

Study – results for households

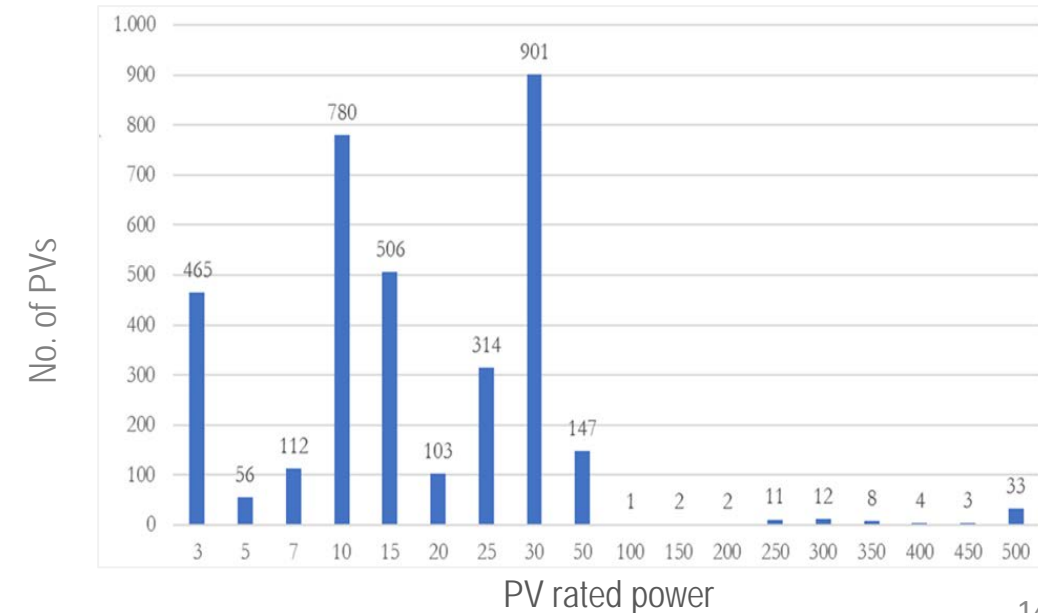
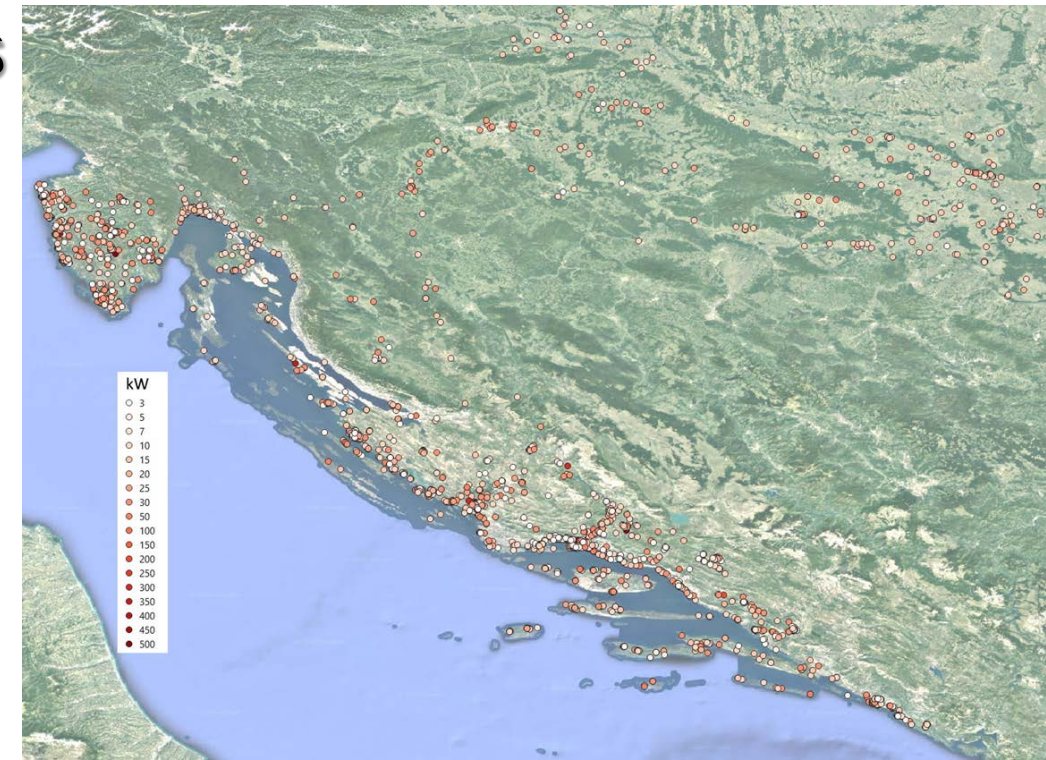
- PBP <10 years & available roof area of family houses by counties
 - for **63.321** households (**2,8%** of total) profitable → **276 MW**
 - profitable only in 6 out of 21 counties
 - avrg. consumption: **10.500 kWh/year**
 - avrg. rated power of PV: **4,4 kWp**
 - for individual customers savings up to **74%**
 - PBP: **7-10 years**
-
- estimated total annual revenue decrease for DSO: 10 -12 mil.€ (2,4% - 2,8%)
 - estimated total annual revenue decrease for TSO: 4,5 - 5,4 mil.€ (2,5% - 2,9%)



Study – results for LV commercial customers

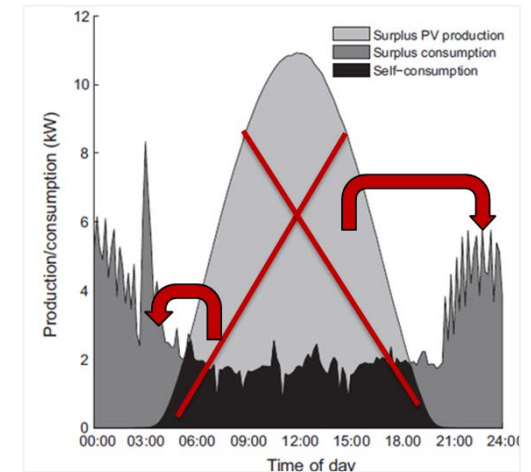
- PBP <12.5 years, dPBP ≤25 years and IRR ≥ 8%
- for **3.460** commercial customers (**1,7%** of total) profitable → **92 MW**
- profitable in all counties
- avrg. consumption: **105.000 kWh/year**
- avrg. rated power of PV: **26,5 kWp**
- PBP: **5,4-10,2 years**
- IRR: **8 - 18%**

- estimated total annual revenue decrease for DSO: 2,4 - 3 mil.€ (0,6% - 0,7%)
- estimated total annual revenue decrease for TSO: 0,9 - 1 mil.€ (0,5% - 0,6%)



Key messages

- low retail electricity prices → incentives for self-consumption in SEE are limited → net metering / billing
- net metering **may be used in a transitional phase & limited to very small-scale installations, with yearly system quotas**
- **allow only real time netting** of withdrawals and injections (hourly)
- ACER/CEER strongly recommend „not to allow net-metering“
- **Directive (EU) 2019/944 (Art. 15(4)) calls for a phase-out of net metering** → *no new rights for schemes that do not account separately for the electricity fed into and consumed from the grid are to be granted after 31 December 2023*
- due to self-consumption **cross subsidization is of particular concern if volumetric grid tariffs are used** → revisiting network tariff designs to ensure system fixed-cost recovery & prevent cross-subsidies (capacity-based tariffs)
- net-metering undermines efforts to enhance **flexibility** and DSR → **time value of generated energy is completely lost**
- preferable → direct support (investment aids) instead of via network tariffs
- savings easily determined → consumers can easily decide to invest in small-scale self-generation





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