POLITECNICO MILANO 1863

ERRA Workshop

RENEWABLE COLLECTIVE SELF-CONSUMPTION: ENERGY COMMUNITIES AND MINI GRIDS

October 14, 2025 | Ankara, Türkiye

ERRA ENERGY REGULATORS REGIONAL ASSOCIATION

Implementation of European Legislation on Self-consumption and Energy Communities in 5 EU Countries

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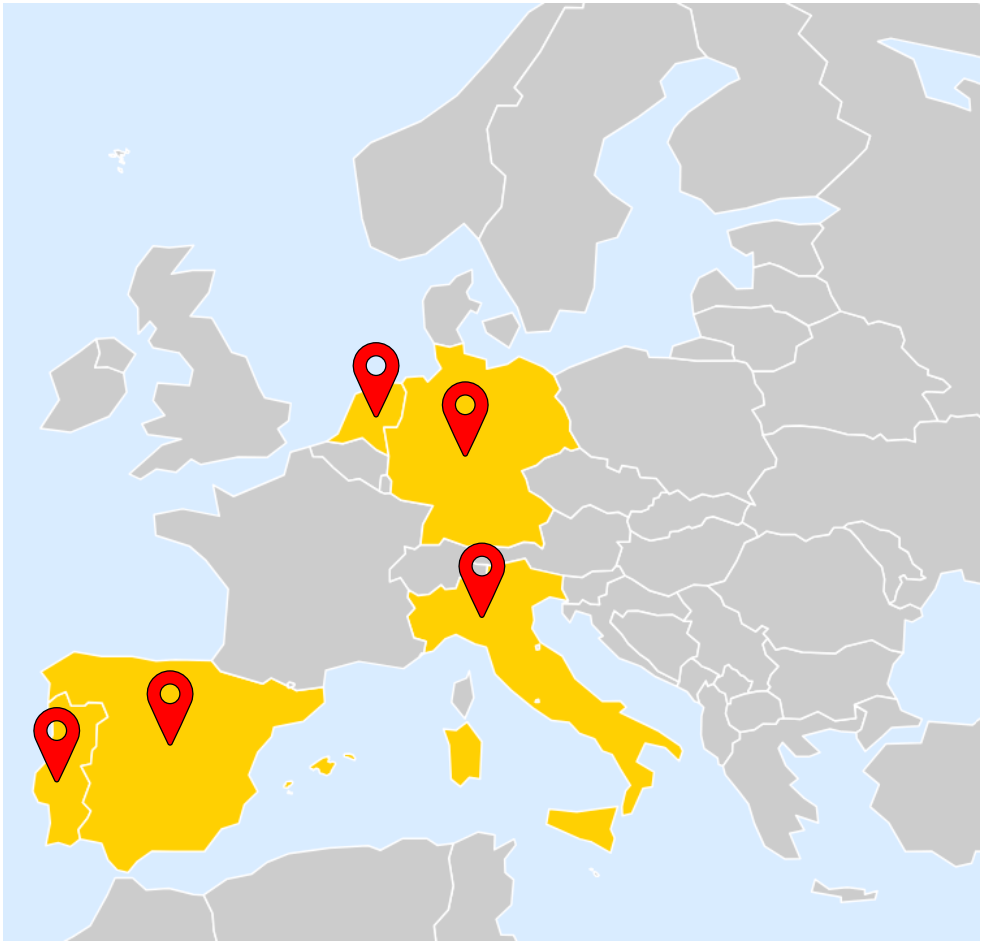
RED II National Transposition

The analysis focused on the regulatory framework of **five European countries**

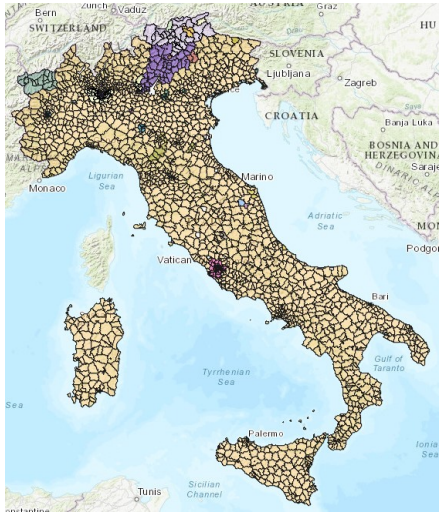
- Italy
- The Netherlands
- Portugal
- Spain
- Germany

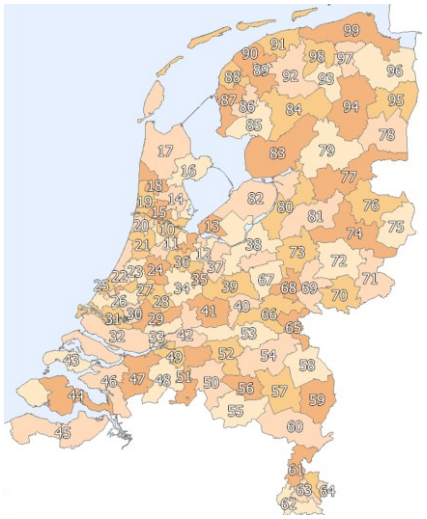


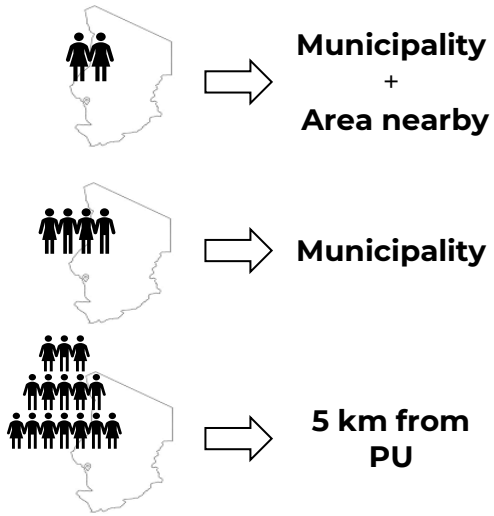
RED II National Transposition

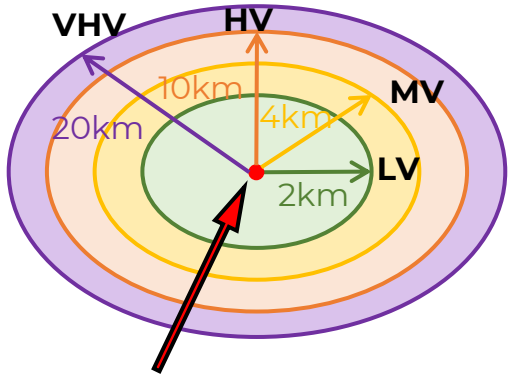
A common point between all regulatory framework is the **local nature** of the community

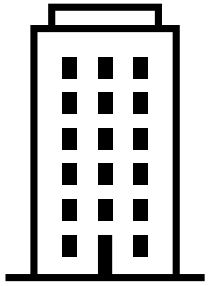
Italy	The Netherlands	Spain	Portugal	Germany
Primary substation	CAP	Number of inhabitants + Distance from PU	PU connection voltage + Distance from PU	Distance from PU or condominium







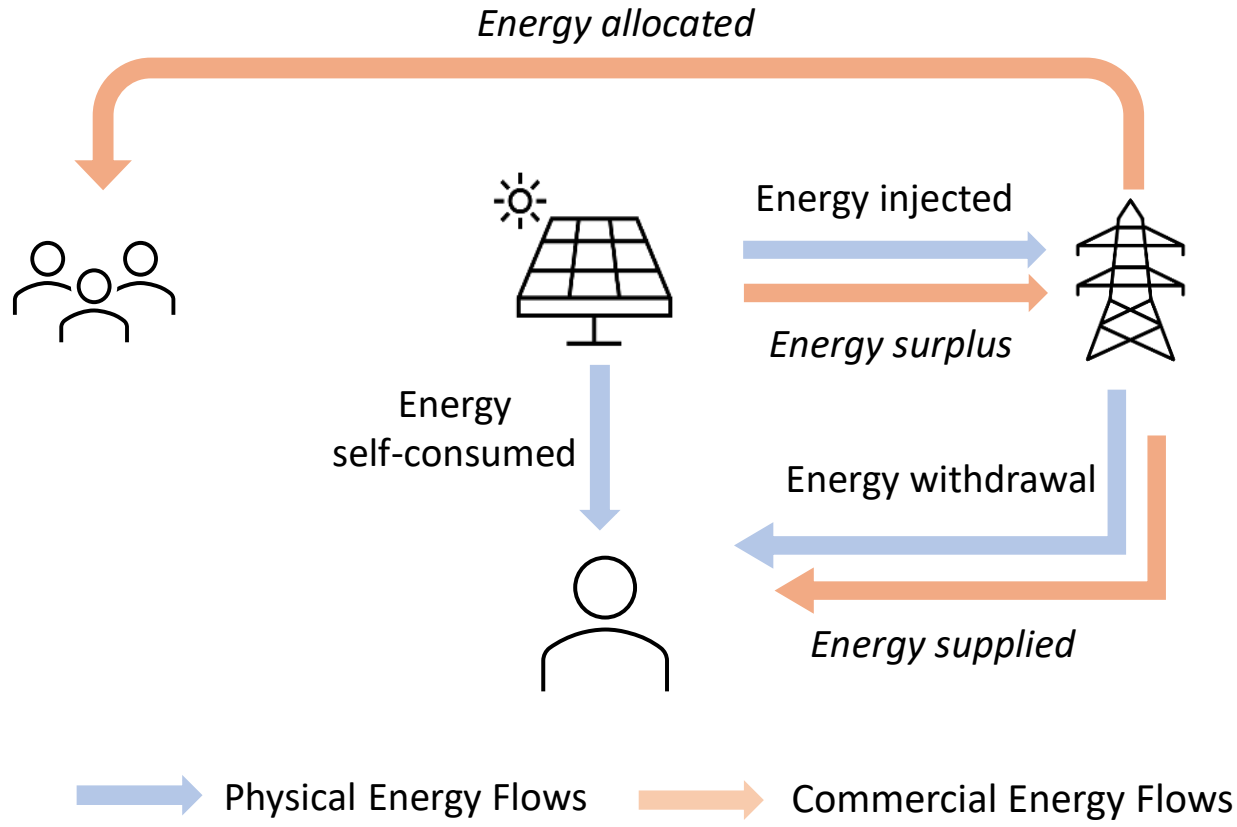




Archetypes for Energy Sharing

PHYSICAL energy fluxes
Energy that **flows**.

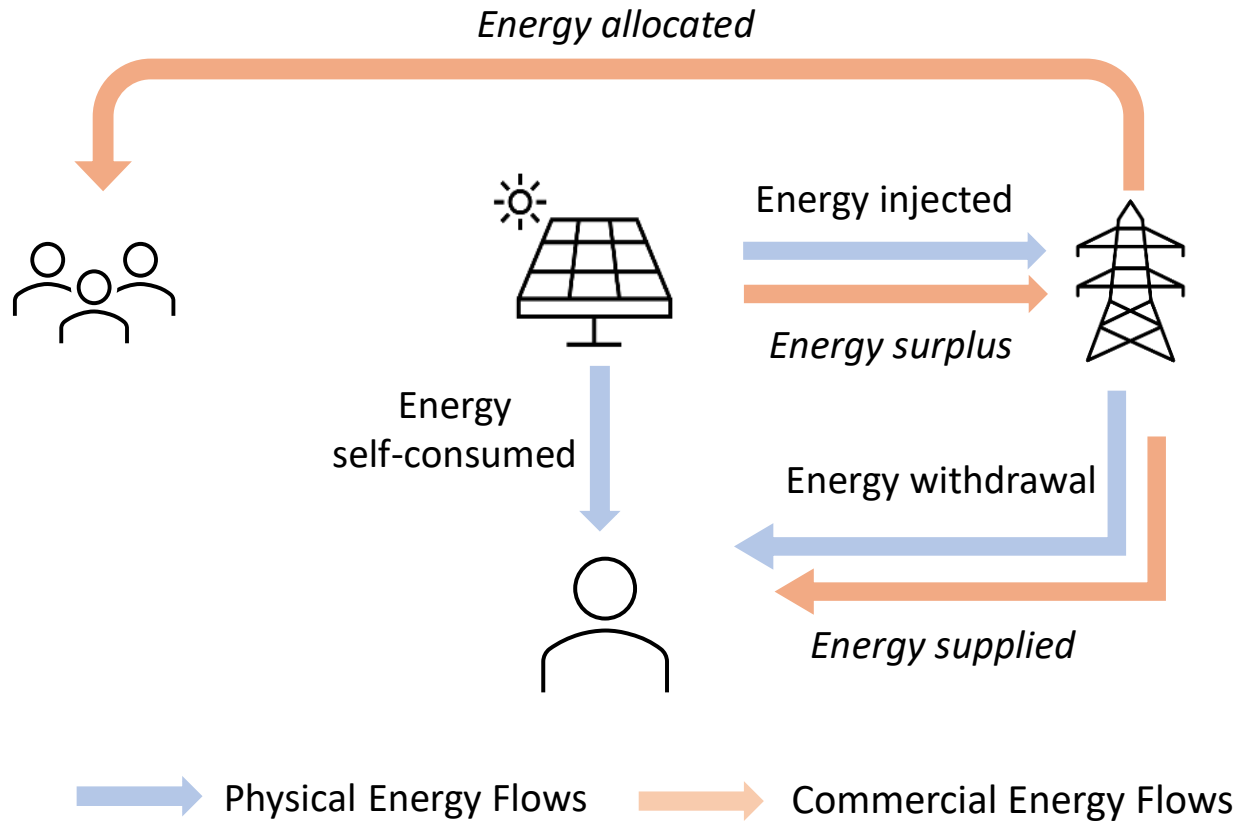
- Withdrawal: energy physically withdrawn from the grid
- Injection: energy physically injected into the grid



Archetypes for Energy Sharing

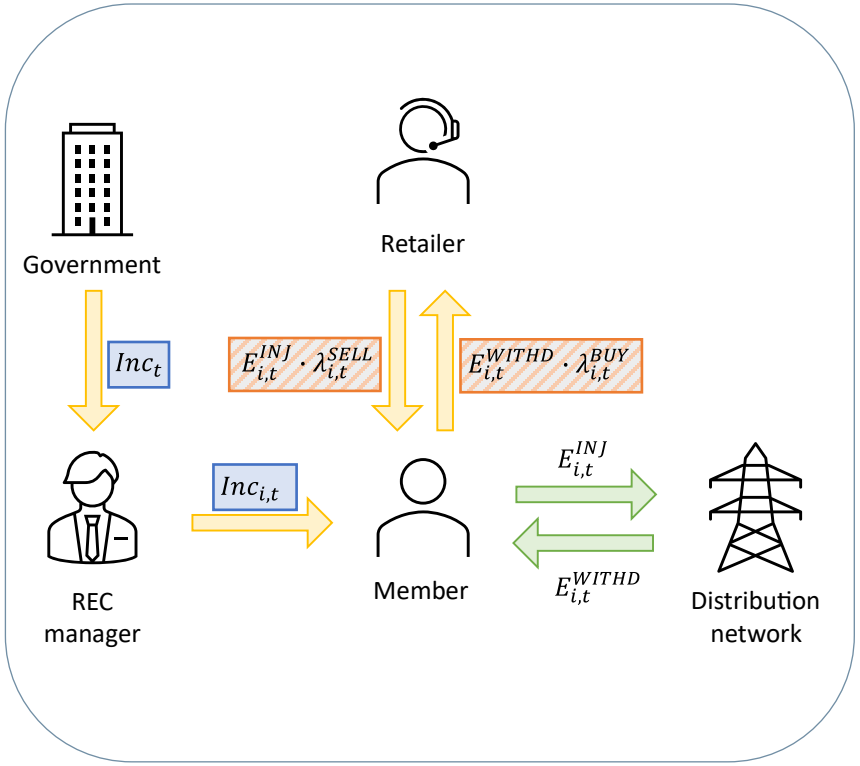
COMMERCIAL energy fluxes
Energy for **bill computation**.

- Supplied: part of withdrawal accounted for bill computation
- Surplus: part of injection paid at market price



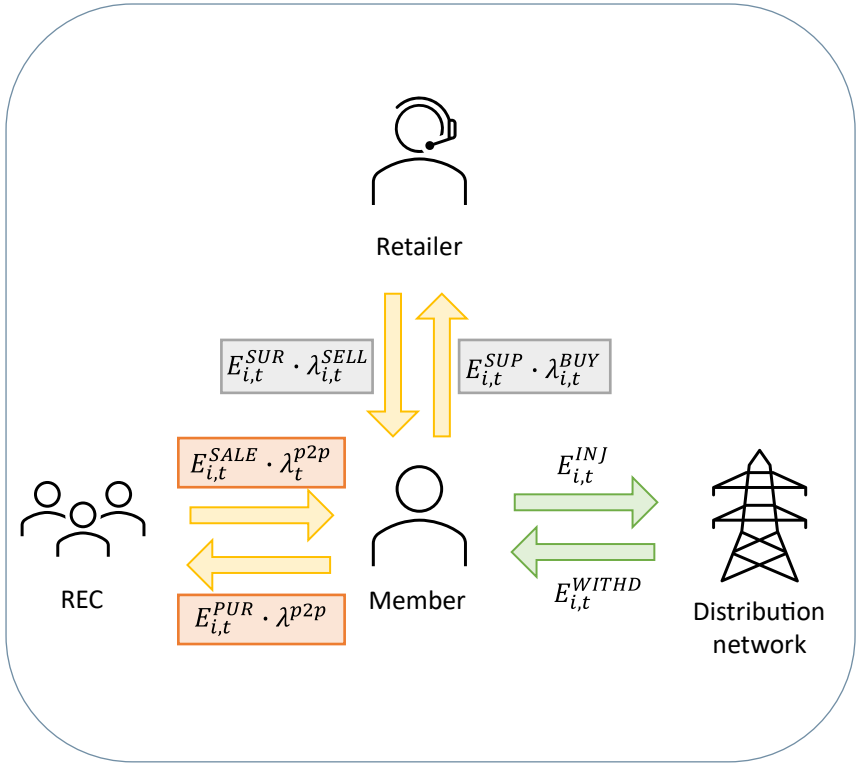
Archetypes for Energy Sharing

Cash-back Model



No direct bill discount.
Commercial and physical fluxes coincides

Discount Model



Direct bill discount.
Commercial and physical fluxes do NOT coincide

Energy fluxes:
- Commercial
- Physical

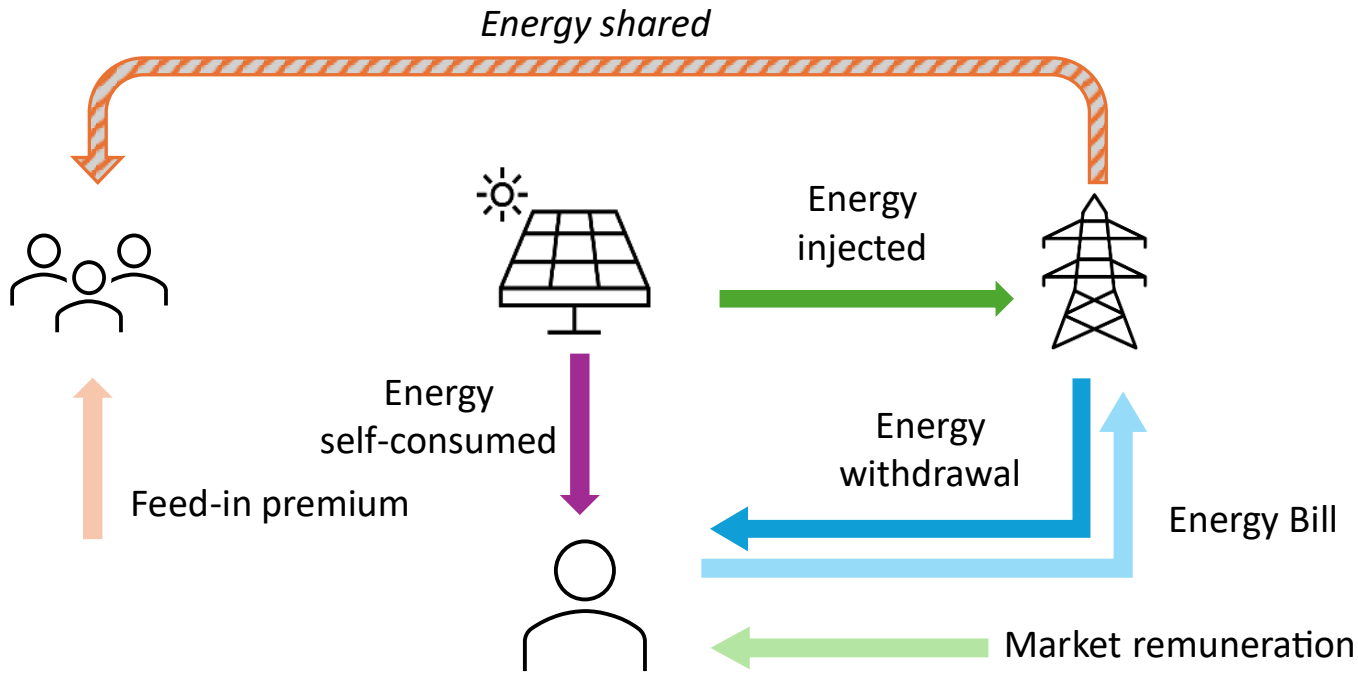
Bills:
- Energy from/to grid
- Energy from/to REC
- Energy from/to both grid and REC
- Incentive

Cash-back Model: Italy

Injection: Sold at market price

Withdrawal: Bought at retailer price

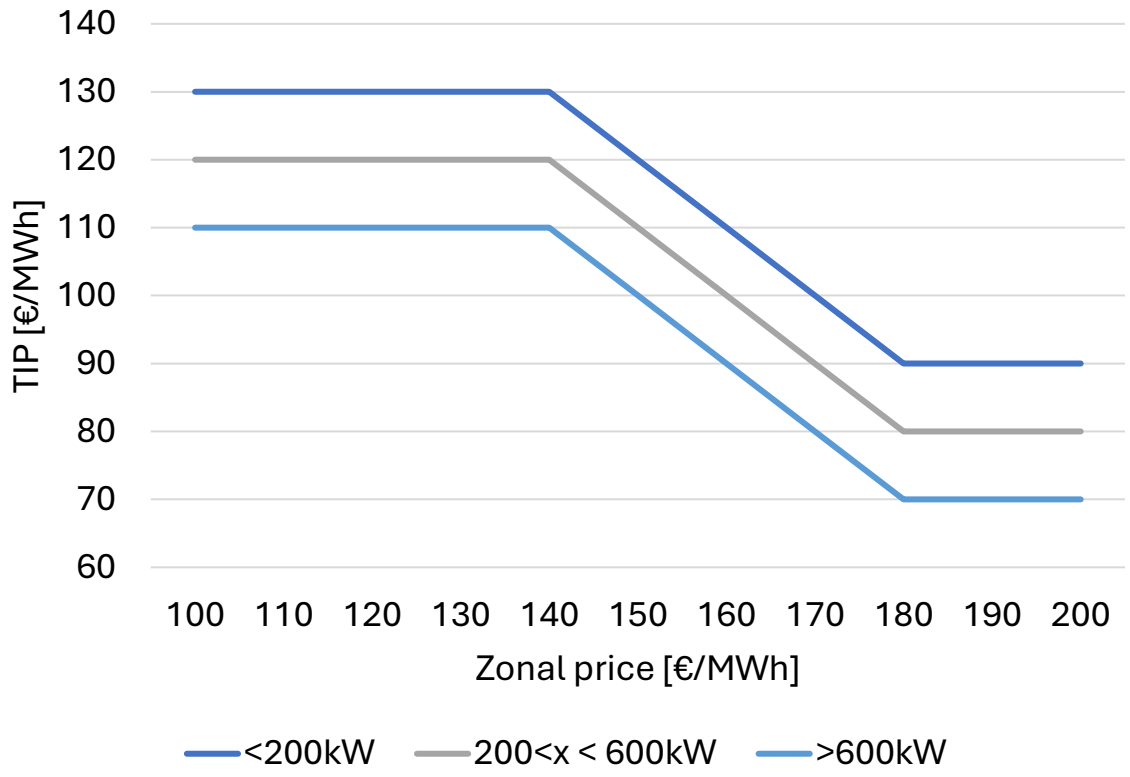
Physical self-consumption
Direct bill discount on all variable components



Energy shared
Incentivised with:

- Premium tariff (**TIP**)
- Discount on HV network charges (**cost-reflective network usage**)

Cash-back Model: Italy



CASH-BACK MODEL!

The incentive is recognised to the **community**, which needs to redistribute it among the members!

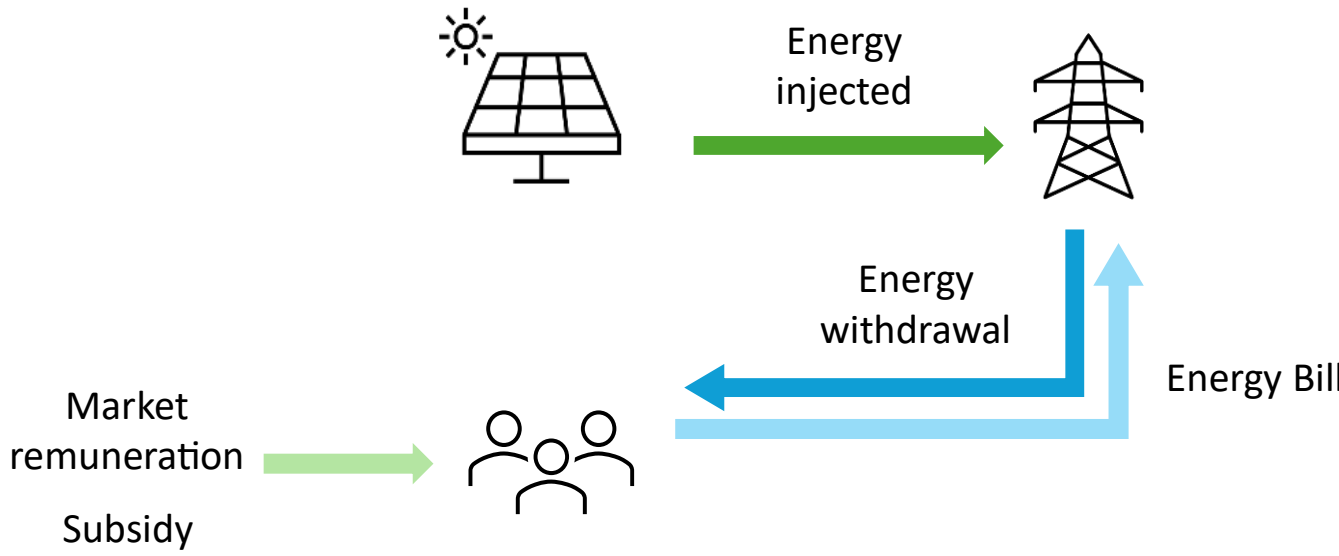
- Applied to **energy shared** for **20 years**
- Depend on installed capacity and zonal price

Cash-back Model: The Netherlands

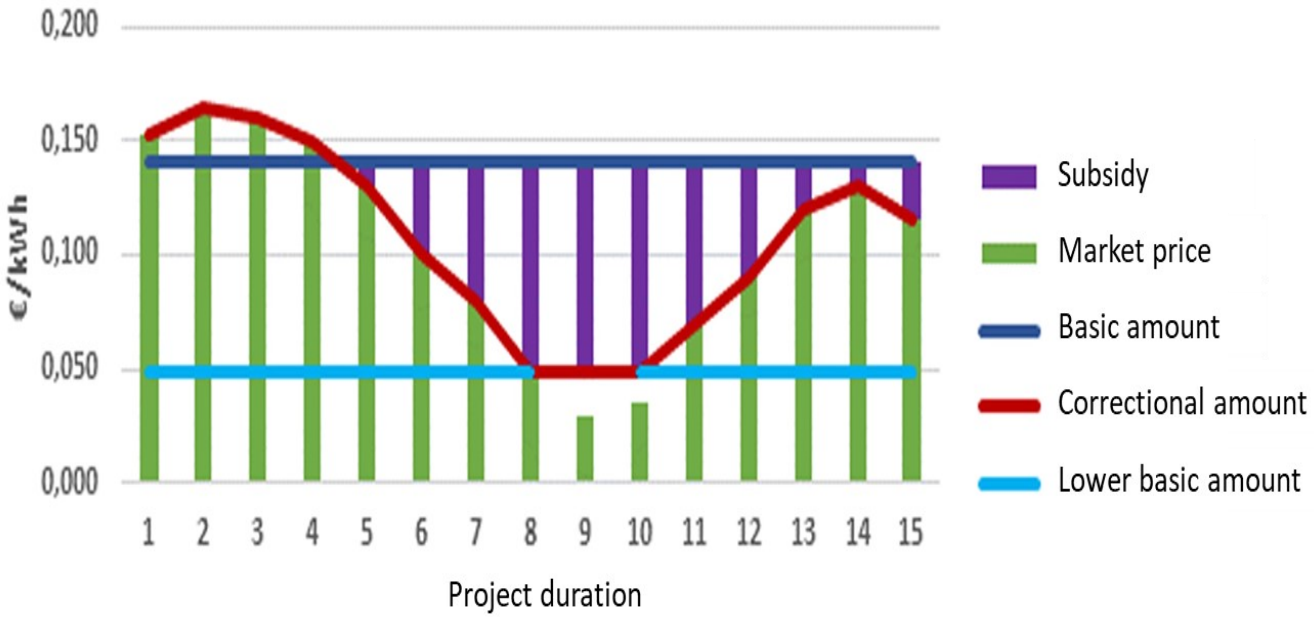
Injection: Sold at market price plus a **subsidy**

Withdrawal: Bought at retailer price

The concept of energy sharing do NOT exist!



Cash-back Model: The Netherlands



CASH-BACK MODEL!

The incentive is recognised to the **community**, which needs to redistribute it among the members!

$$\begin{cases} SUB = SUB_{min} = 0 & market\ price > BA \\ SUB = BA - market\ price & LBA < market\ price < BA \\ SUB = SUB_{max} = BA - LBA & market\ price < LBA \end{cases}$$

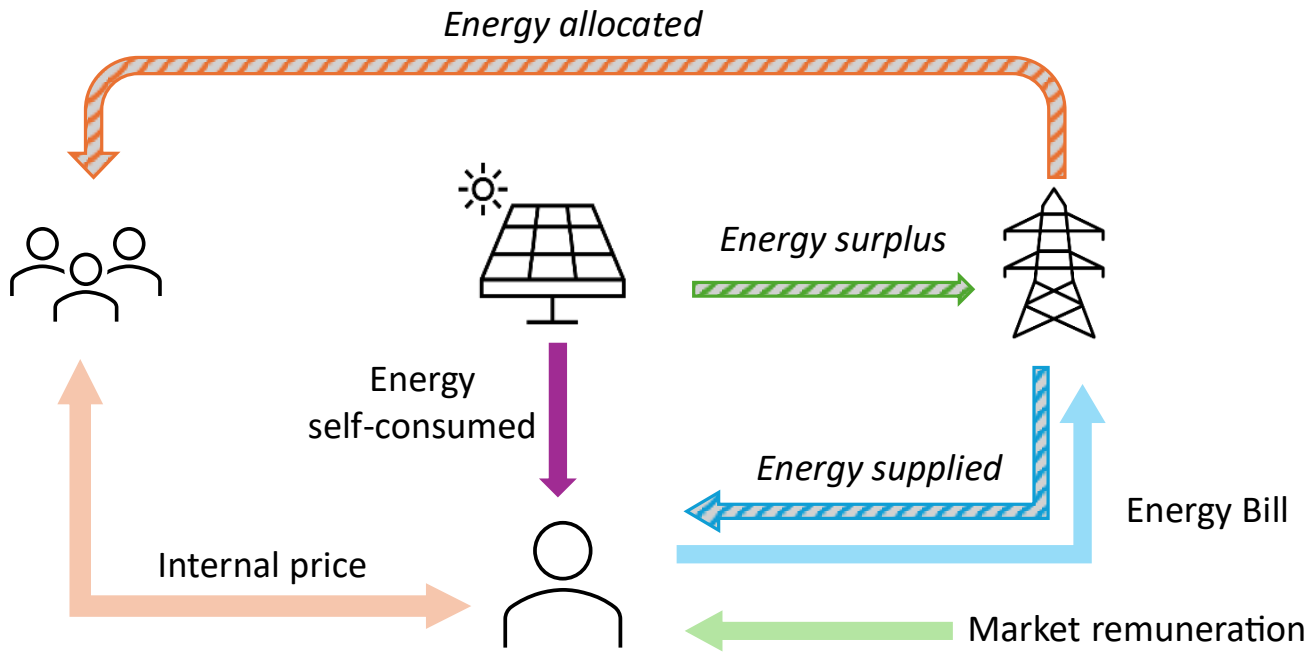
- Applied to **energy produced** for **15 years**

Discount Model: Portugal and Spain

Surplus: Sold at market price

Supply: Bought at retailer price

Physical self-consumption
Direct bill discount on all variable components



Energy allocated
Paid at **internal price** with reduced network charges

- Internal > Market → Benefits for sellers
- Internal < Retailer→ Benefits for buyers

Market price < Internal price< Retailer price

DISCOUNT MODEL!

Discount Model: Portugal and Spain

Energy allocated: part of energy physically injected/withdrawn that is sold/bought within the community

Allocation Coefficients **h = 15min**

		
Fixed	**Constant per 15-min interval**	**Constant throughout the year**
Variable	Proportional to members' injection/withdrawal in each 15-min interval	Proportional to members' contractual power
Dynamic	Computed to optimise energy sharing	**Not allowed**

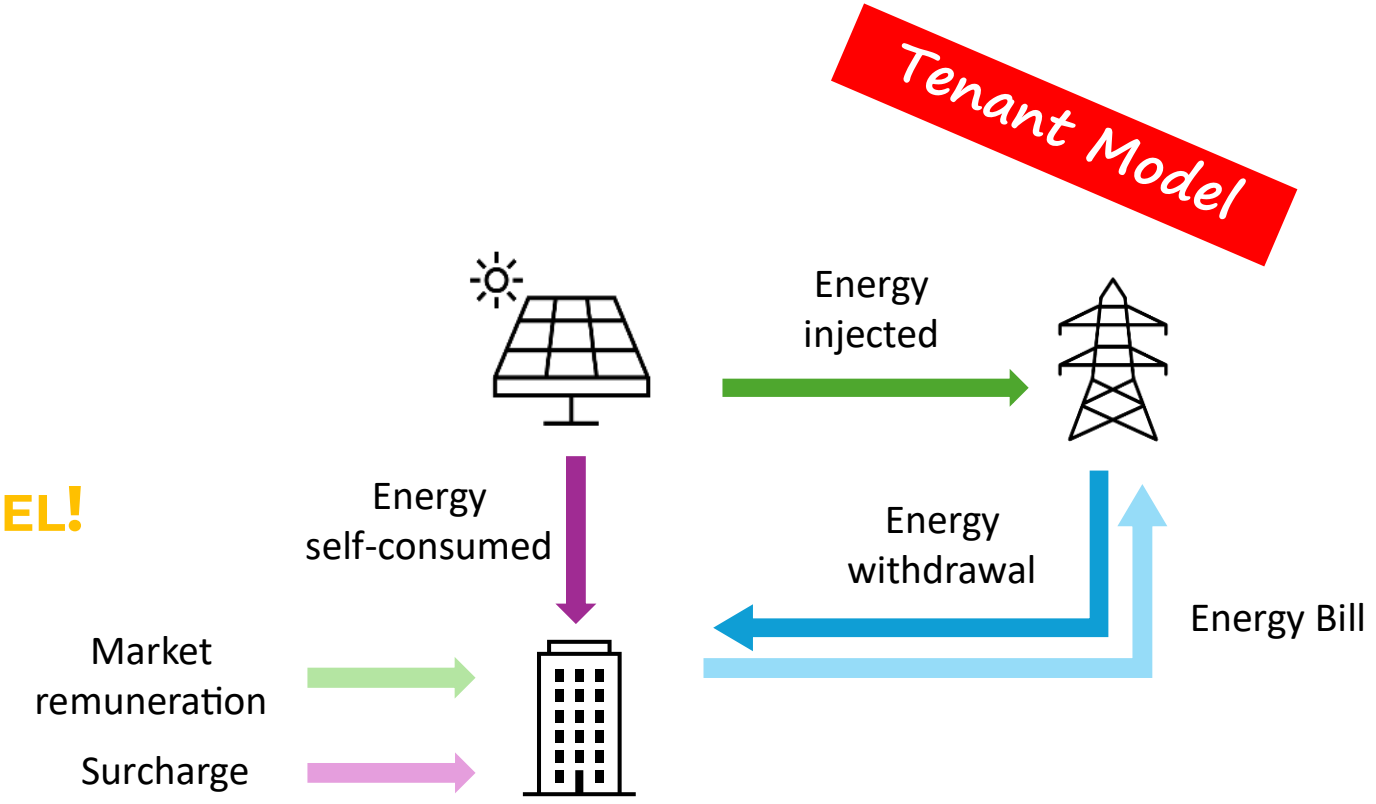
A Special Country: Germany

Surplus: Sold at market price

Supply: Bought at **discounted** retailer price

DISCOUNT MODEL!

Physical self-consumption
Direct bill discount on all variable components

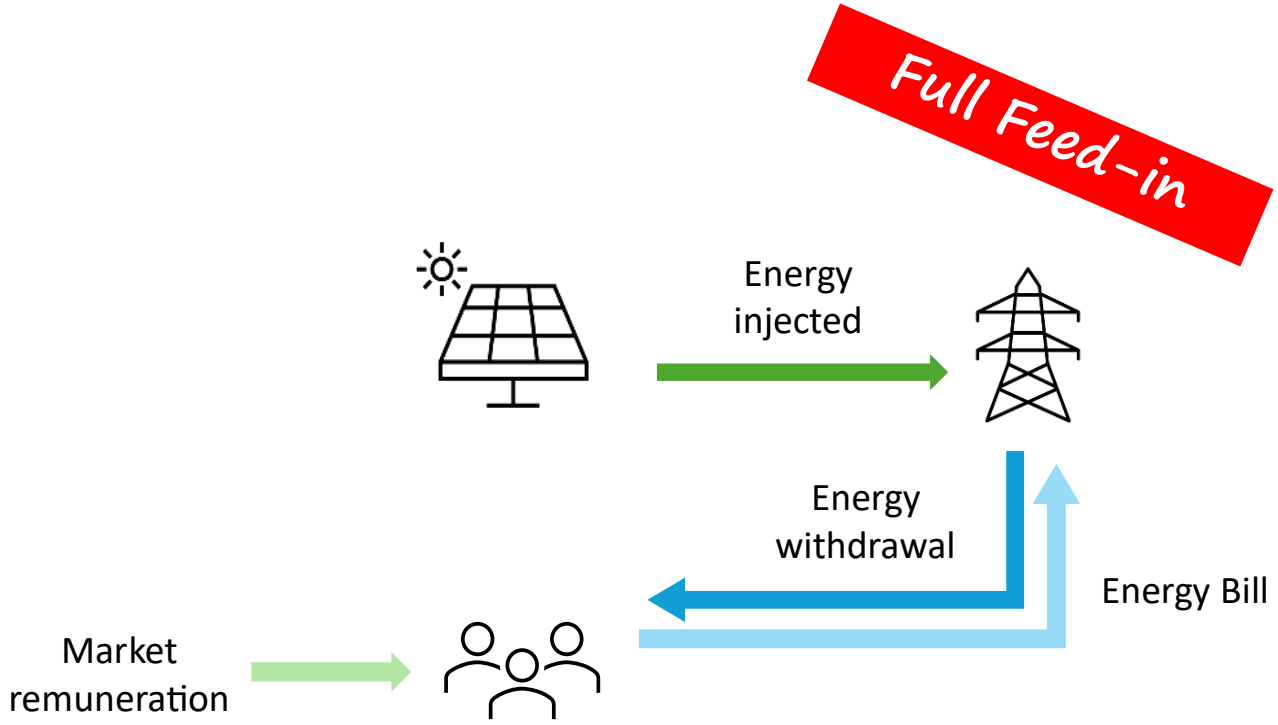


- A subsidy (**tenant surcharge**) is recognised to the landlord for **20 years**

A Special Country: Germany

Injection: Incentivised with **feed-in premium**

Withdrawal: Bought at retailer price



CASH-BACK MODEL!

The incentive is recognised to the **community**, which needs to redistribute it among the members!

Impact of Regulatory Framework

Considered energy community:

- **20 users**: 15 residentials, 4 tertiary and 1 non-residential
- Annual electricity consumption: **120.7 MWh/year**
- PV installed capacity: **100 kW**

Impact of Regulatory Framework

Two scenarios:

Base scenario

- **Same** energy community **structure**
- **Different** regulatory **frameworks** tested
- **Data** (PV production, energy costs) from **Frankfurt, Germany**

Country-specific scenario

- **Same** energy community **structure**
- **Different** regulatory **frameworks** tested
- **Data** (PV production, energy costs) **specific for each country**

Impact of Regulatory Framework

More beneficial incentivisation schemes in countries where energy community are **less widespread** (e.g. South of Europe)

EU Member State		PB time [years]	
		General scenario	Country-specific scenario
No incentive		22	22
Italy		12	11
Portugal		14	10
Spain		11	8
The Netherlands		18	22
Germany	TEM	18	20
	Full feed-in	22	22

Cash-back model

Discount model

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THANK YOU
FOR YOUR ATTENTION!

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