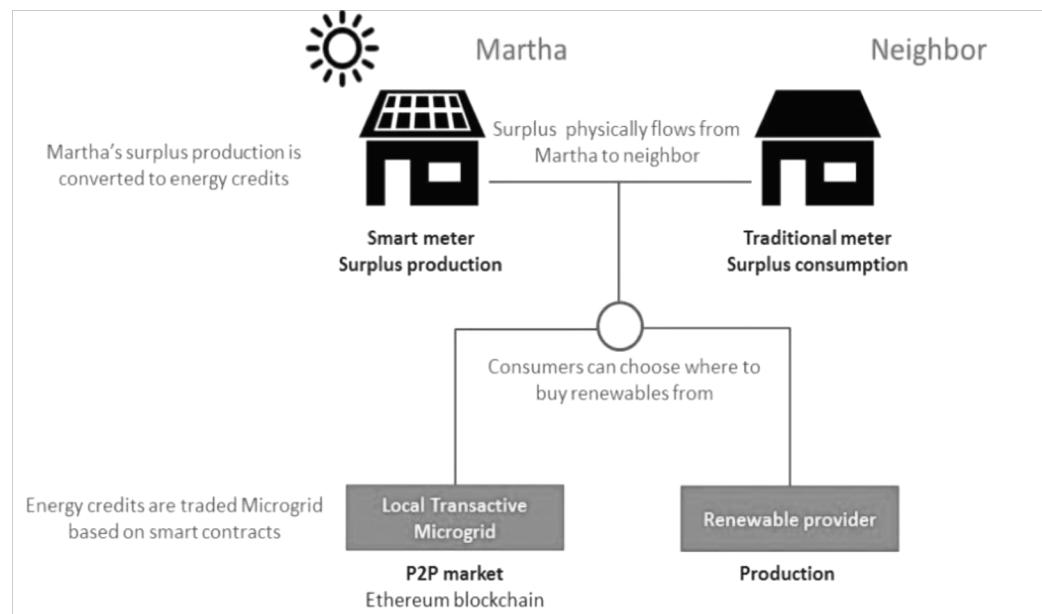


PEER-TO-PEER TRADING WITH
LOCAL ENERGY
INTELLIGENT ENERGY SMART CONTRACTS

Our platform provides a flexible **renewable** energy company fundraising, which saves time, effort and delivers higher returns to the renewable energy generation facility developers, energy industries and our customers.

LOCAL ENERGY

How Peer-to-Peer transactions work?



ELECTRICITY TARIFF

LOYALTY PROGRAM

Nordic Energy developed an electricity [tariff](#) with a loyalty program allowing every electricity customer to do micro investments into renewable energy generation facilities (REGF). Primary purpose of Nordic Energy Token (NGY) is a profit distribution coming out of those micro investments. NGY shareholders get their energy bills deducted by the shared profit automatically.

Each Nordic Energy (NGY) token represents one kilowatt-hour of consumed electricity. As consumption behaviors differ the amount of Nordic Energy's collected during a month is different as well. A single-family household with 3 persons for example might consume around 200 kWh of electricity and therefore collect 200 currently's per month. These token's can then be spent to purchase NGY tokens which in turn grants a shared profit of the REGF's profit. The micro investment mechanism works directly off the customers electricity bill. The NGY Tokens are native assets backed tokens which are based on the ERC-20 Token Standard. That means that they are compatible with the Ethereum Blockchain. However, as the public Ethereum Blockchain is not yet suited to handle small scale and high-volume energy transactions **Nordic Energy** developed the Fury Network – an open-source, Ethereum based blockchain specially designed for energy market needs.

In contrast to platform approaches (e.g. putting a wind-mill on a platform and granting the members of the platform a share of the wind-mills profits) **Nordic Energy** does not act as a man in the middle. Yes, the REGF's are selected by us and yes we decide the amount of NGY tokens which are equivalent to the REGF's value. But once you buy NGY's you are the owner. So, we cannot revoke your access, your ownership and therefore your profit claim. We are no middle man because blockchain technology enables you to create your own energy generation portfolio. And that is the reason why we established Nordic Energy.

SMART METER

3 % ENERGY SAVINGS ON AVERAGE

As a remote-communicating digital electricity meter, they enable direct transmission of measured values to consumers, network operators, energy suppliers and energy service providers. The consumer receives a precise visualization of his consumption behavior and sees every "wasted" kilowatt hour. This can motivate him to energy-saving behavior. On the other hand, intelligent metering systems allow the implementation of variable tariffs in which the consumer receives economic incentives to use electricity when it is cheapest. In addition, intelligent measuring systems enable network operators to have a precise view of their power grid, enabling them to control generation and consumption systems.

ELECTRICITY POLICE

- **End consumer:** Transparency and efficiency increase through visualization.
- **Electricity supplier:** Optimization of procurement also needs recognition.
- **Network operators:** Higher operational reliability through data.

Blockchain-based Decentralized Capacity Market

Ethereum Blockchain Wallet implementing Green Energy semantics for blockchain-based decentralized capacity market:

"Making digital energy infrastructure of tomorrow accessible to anyone today using distributed ledger technology it should be easy to buy energy generation capacity (parts of PV plants, Windparks, etc...) and gain value (electricity) from this digital this property. Aim of Nordic Energy Wallet is to have a library that takes advantage of Blockchain, Renewable Energy Generation and modern Web Technology."

What is a grid connection?

Transactions are activities that alter the consensus

- Forget bilateral activities
- Forget Entity Relation Model.

NORDIC ENERGY TOKEN

WALLET

CORE

- ID Key Management
- Market Access
- Requiltory compliance
(GDPR)
- Signed Meta Information

ENERGY

- Capacity Trading
- Balancing and Aggregation
- Discpatch
- Technical Due Delligence

FINANCIAL

- Micro Investment
(Capacity)
- Digital Asset Management
- Cryptocurrency (Nordic Energy Token)

Who gets to play on the grid?

An entity qualifies as a Grid Actor only, if there is proof that:

- A *trusted* Distribution Service and
- A *trusted* Meter Point Operation are being provided.

A consensus system for energy markets

- CONSENSUS MACHINE FOR ENERGY TRANSACTIONS -

A machine created to create consensus between market participants and irrevocably maintain. With Blockchain technology, energy transactions of any kind can be reproduced and reproduced without exception.

CONSENSUS

MACHINE FOR ENERGY TRANSACTIONS

What is a grid connection?

- Forget bilateral activities
- Forget Entity Relation Model
- Transactions are activities that alter the consensus. Only that what matters for everyone, matters.

Who gets to play on the grid?

An entity qualifies as a *Grid Actor* only, if there is *proof* that:

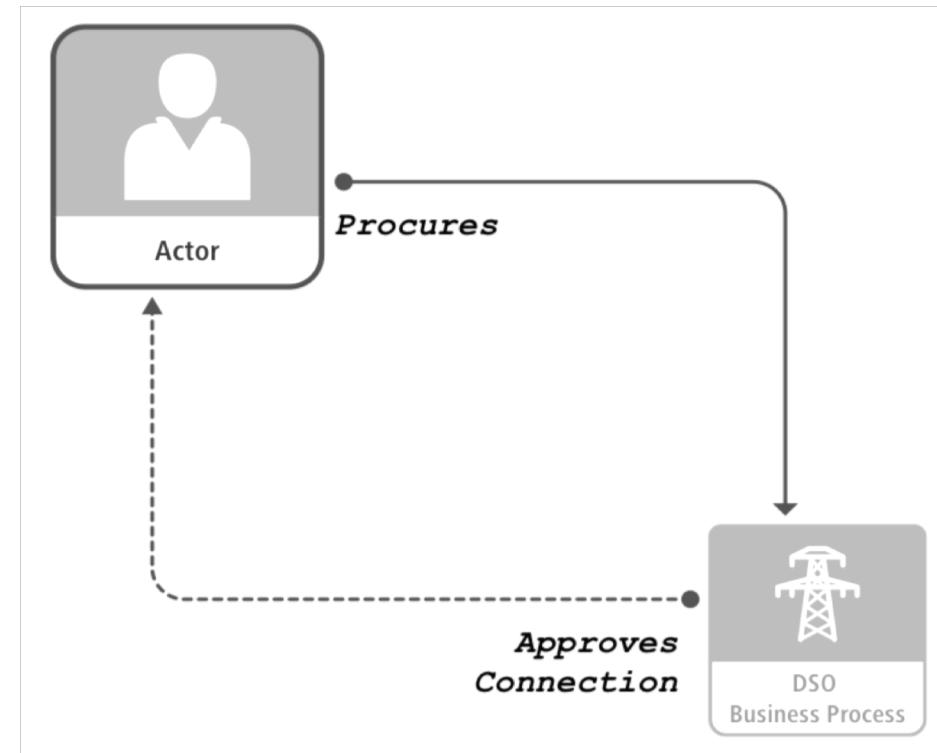
- A *trusted* Distribution Service and
- A *trusted* Meter Point Operation are being provided.

Only what matters for all, matters at all.

There are processes that Distribution.

Service and Meter Point Operators

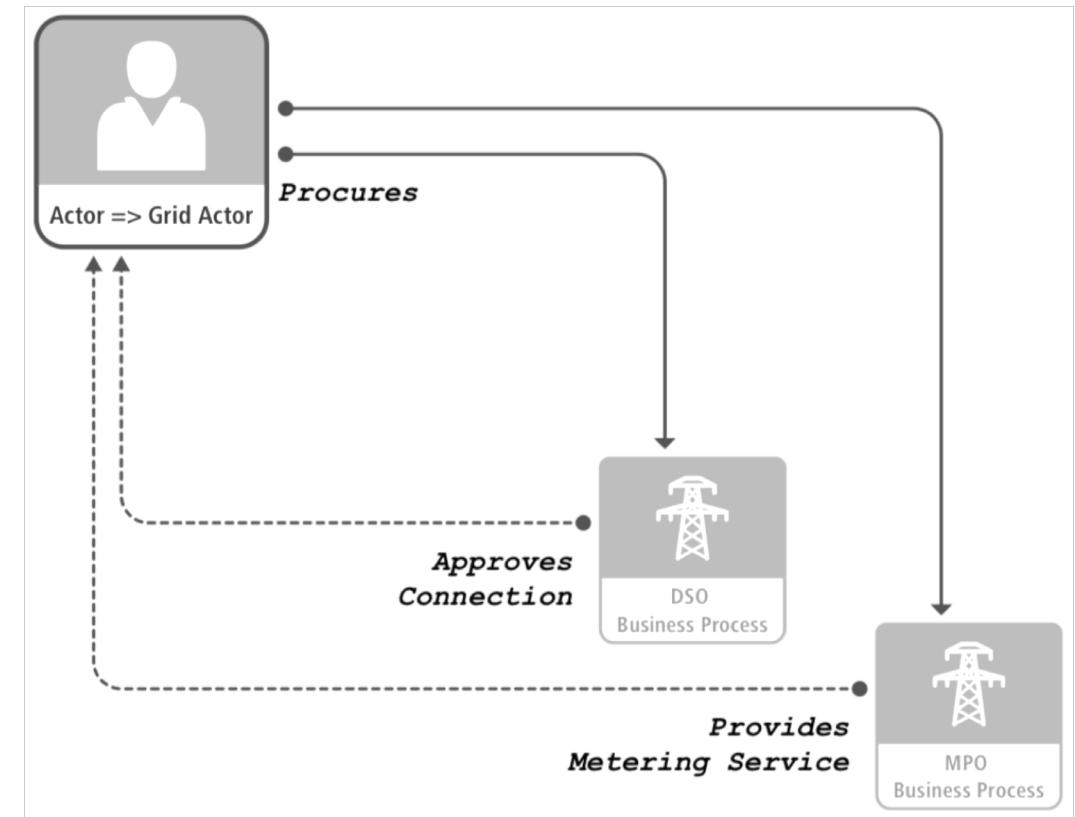
comply with.



Only what matters for all, matters at all.

There are processes that Distribution Service and
Meter Point Operators comply with.

But it is all bilateral: No one else actually cares
about this.

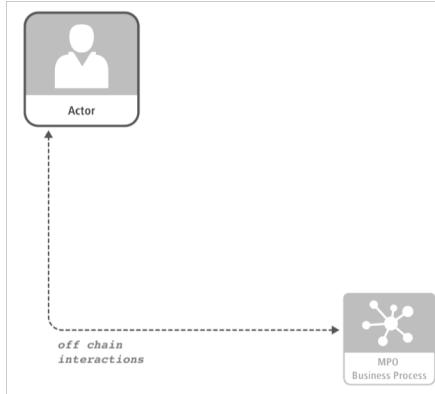


PROOF OF EXISTENCE

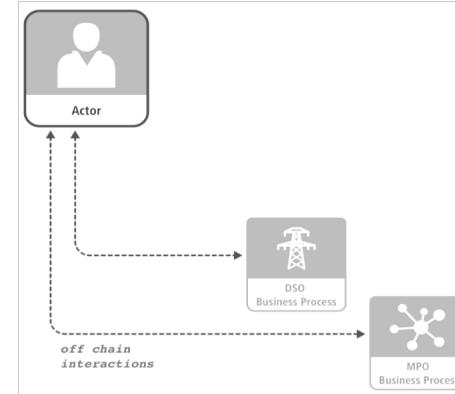
The one thing others do care about is that a valid agreement is in place, not all its details:

- It boils down to a simple proof of two signatures that can be verified by others.
- Nordic Energy utilises blockchain technology to establish and maintain such consensus by '*Proof of Existence*'.

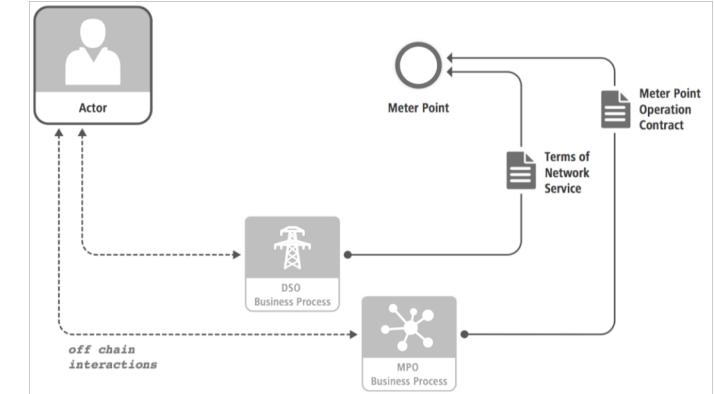
Forget bilateral processes.



**Forget bilateral processes.
Don't worry about entity
relations.**



**Instead, think about stateless self enforcing
agreements...**

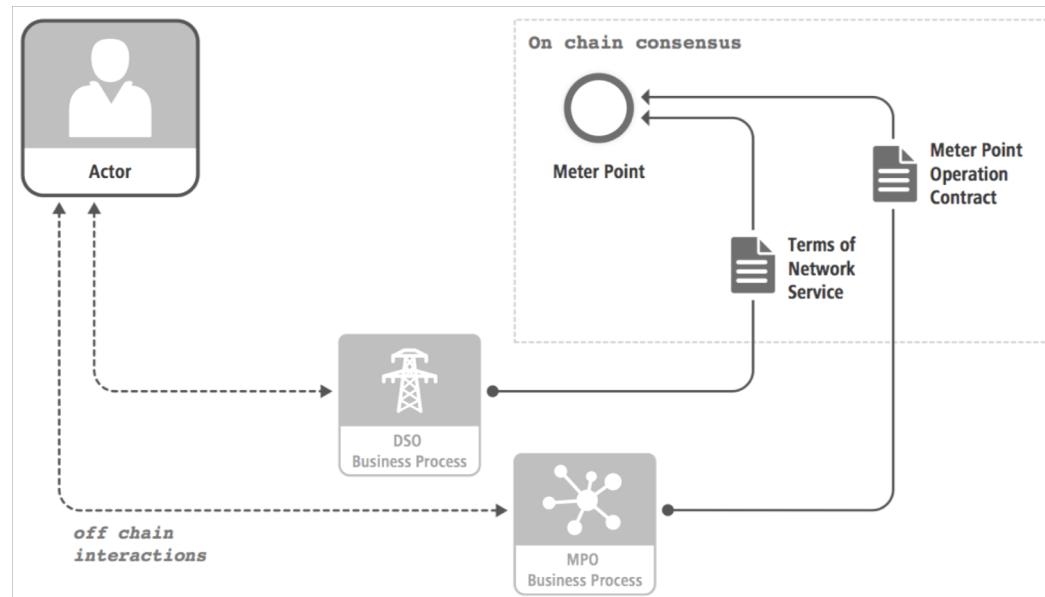


PROOF OF EXISTENCE

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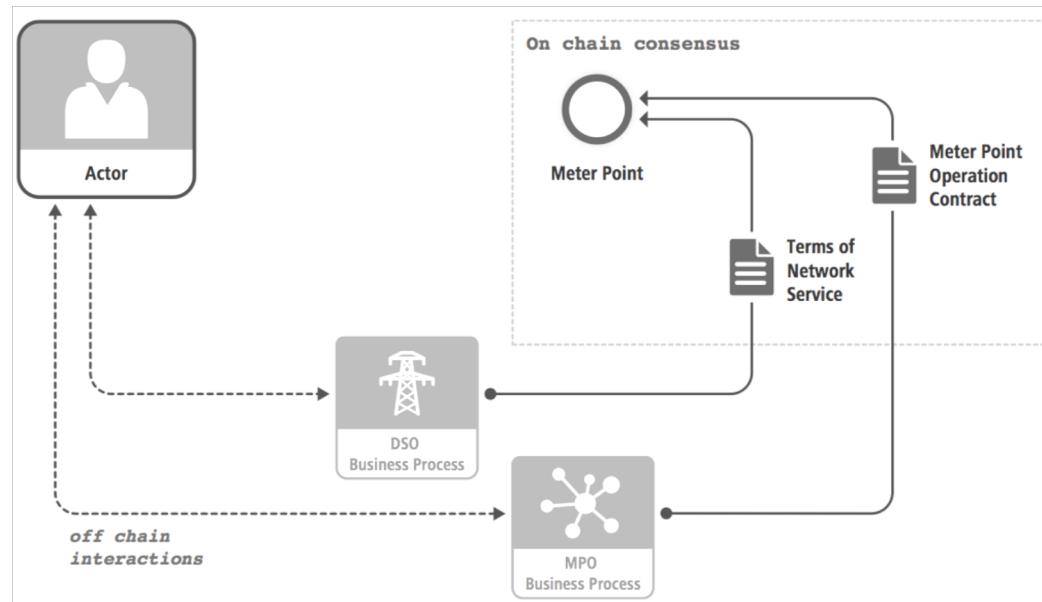


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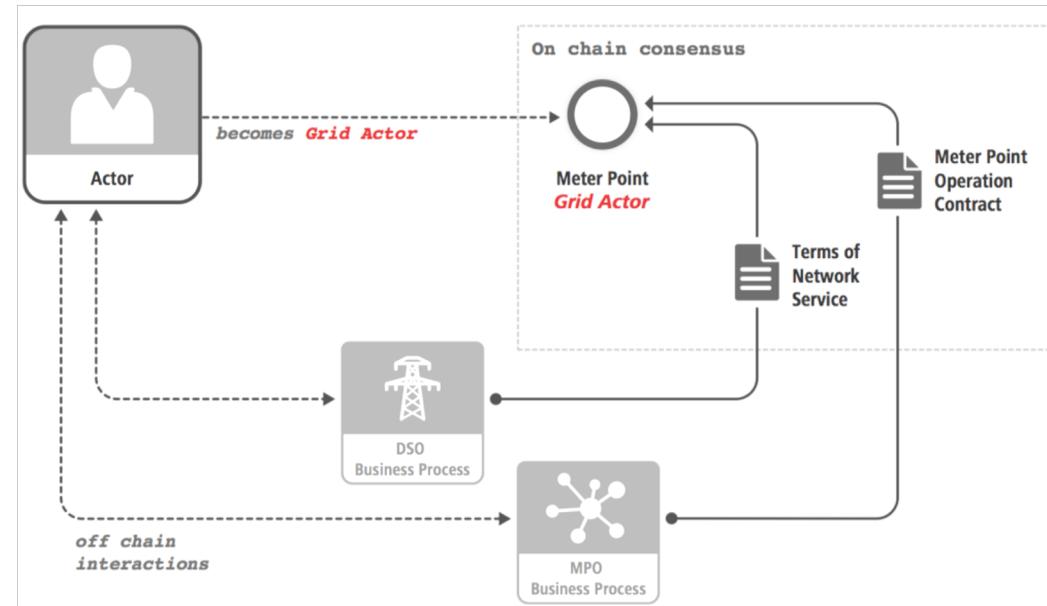
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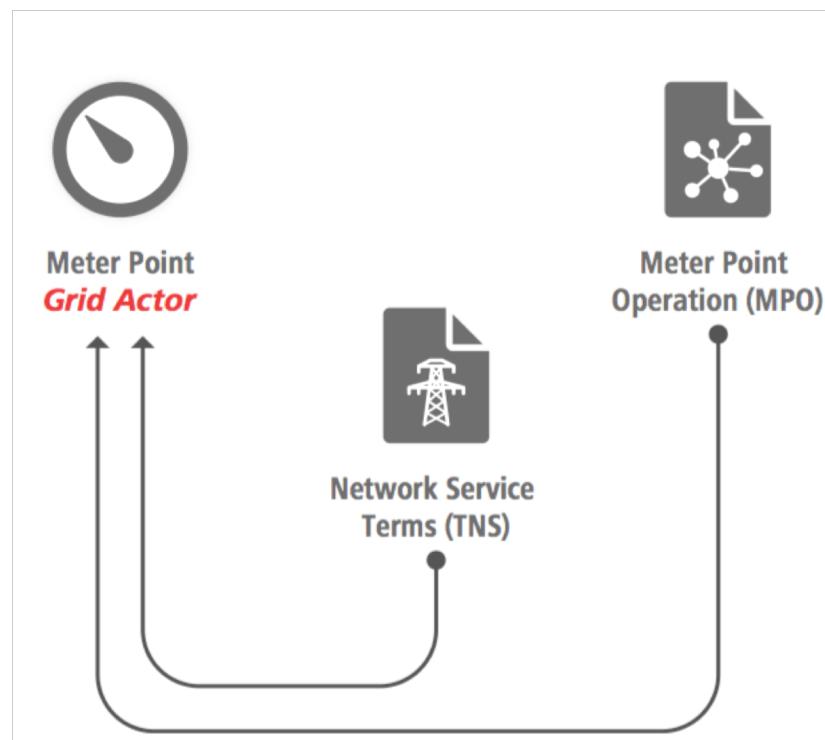
Proof of existence is sufficient.



GRIDBORNE

ON CHAIN CONSENSUS

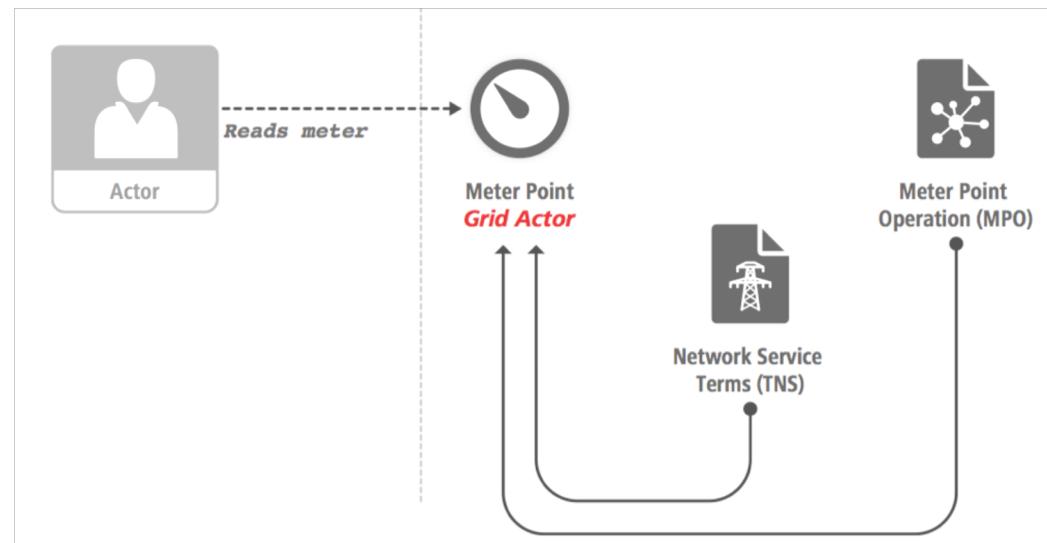
An actor is *gridborne* when a valid TNS and MPO contract is in place.



GRIDBORNE

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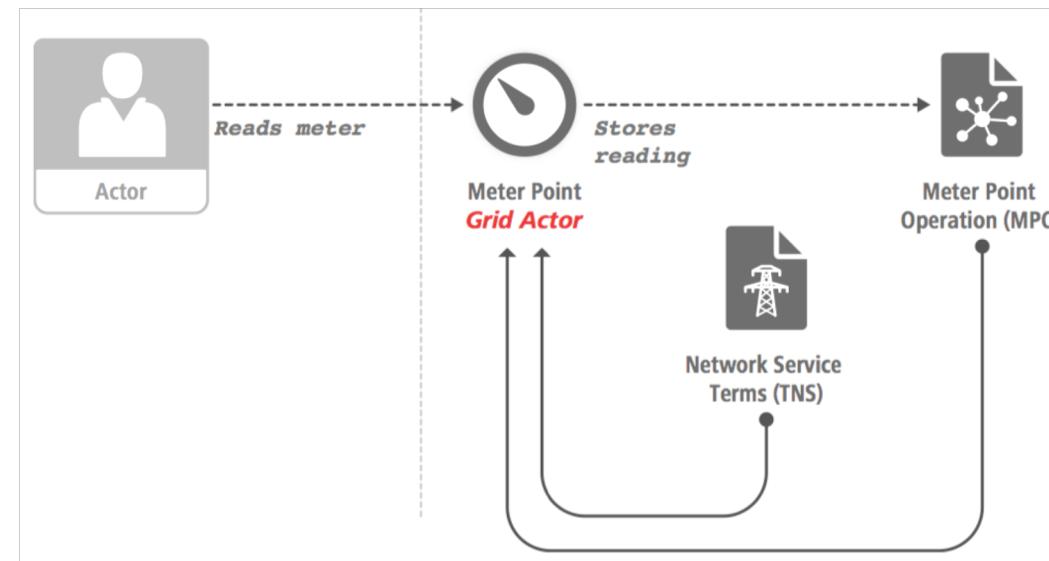


GRIDBORNE

ON CHAIN CONSENSUS

An actor is *gridborne* when a valid TNS and MPO contract is in place.

The MPO contract is now
authorised to underwrite power
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reading provided.

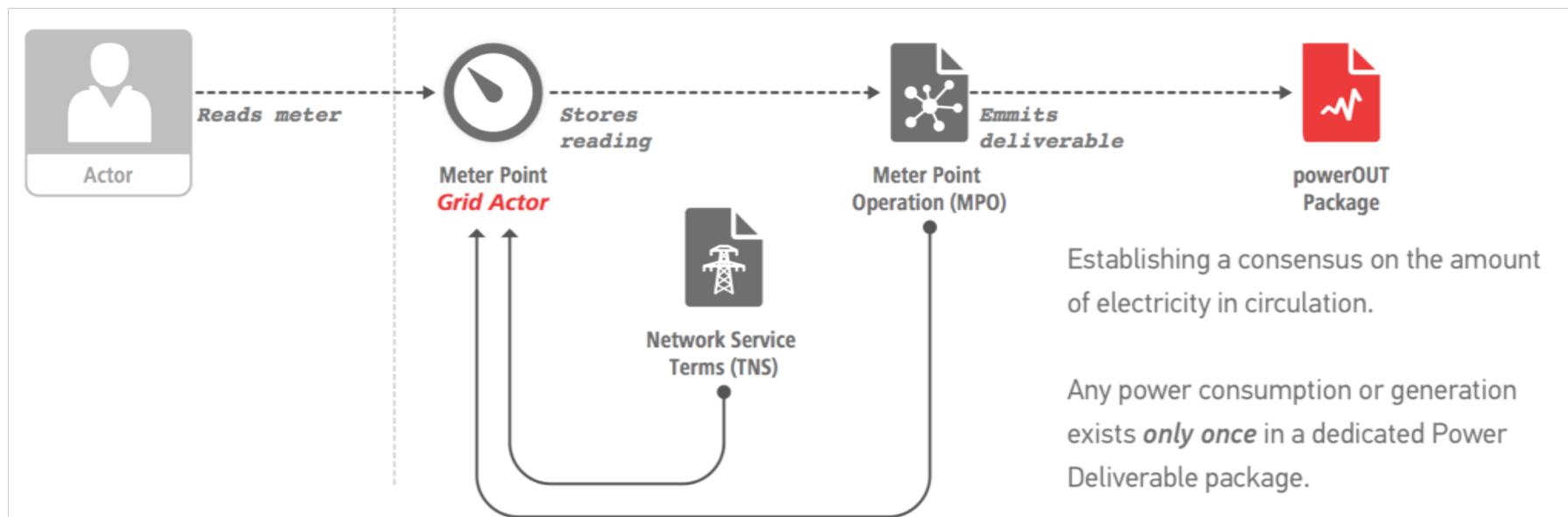


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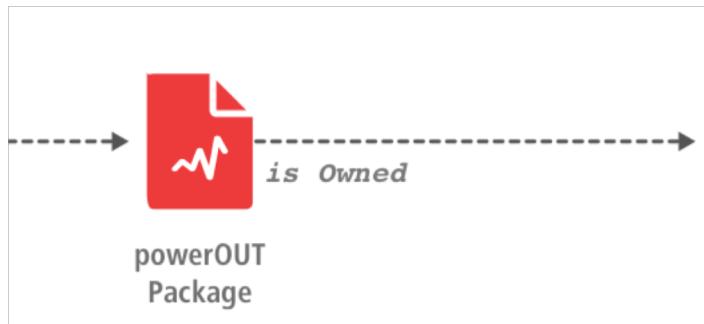
The MPO contract is now *authorised to underwrite* power deliverables with any meter reading provided.



OWNERSHIP

ON CHAIN CONSENSUS

The notion of ownership is an important concept in blockchain terminology.



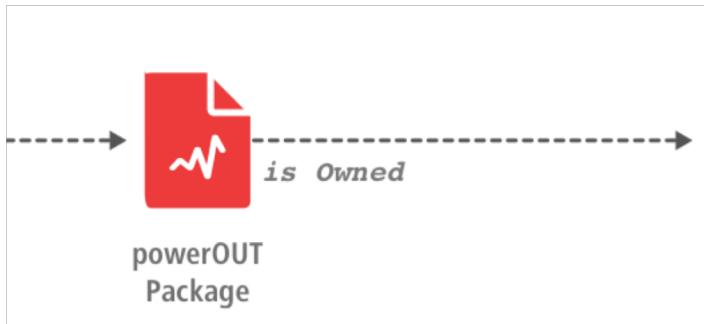
```
contract Delivery is owned {  
    address public owner;  
    address public dso;  
    uint256 public role;  
    uint256 public startTime;  
    uint256 public endTime;  
    uint256 public power;  
    address public resolution;  
    ...  
}
```

OWNERSHIP

ON CHAIN CONSENSUS

The notion of ownership is an important concept in blockchain terminology.

It is being utilised to correlate individual Actors
with Power Deliverable packages.

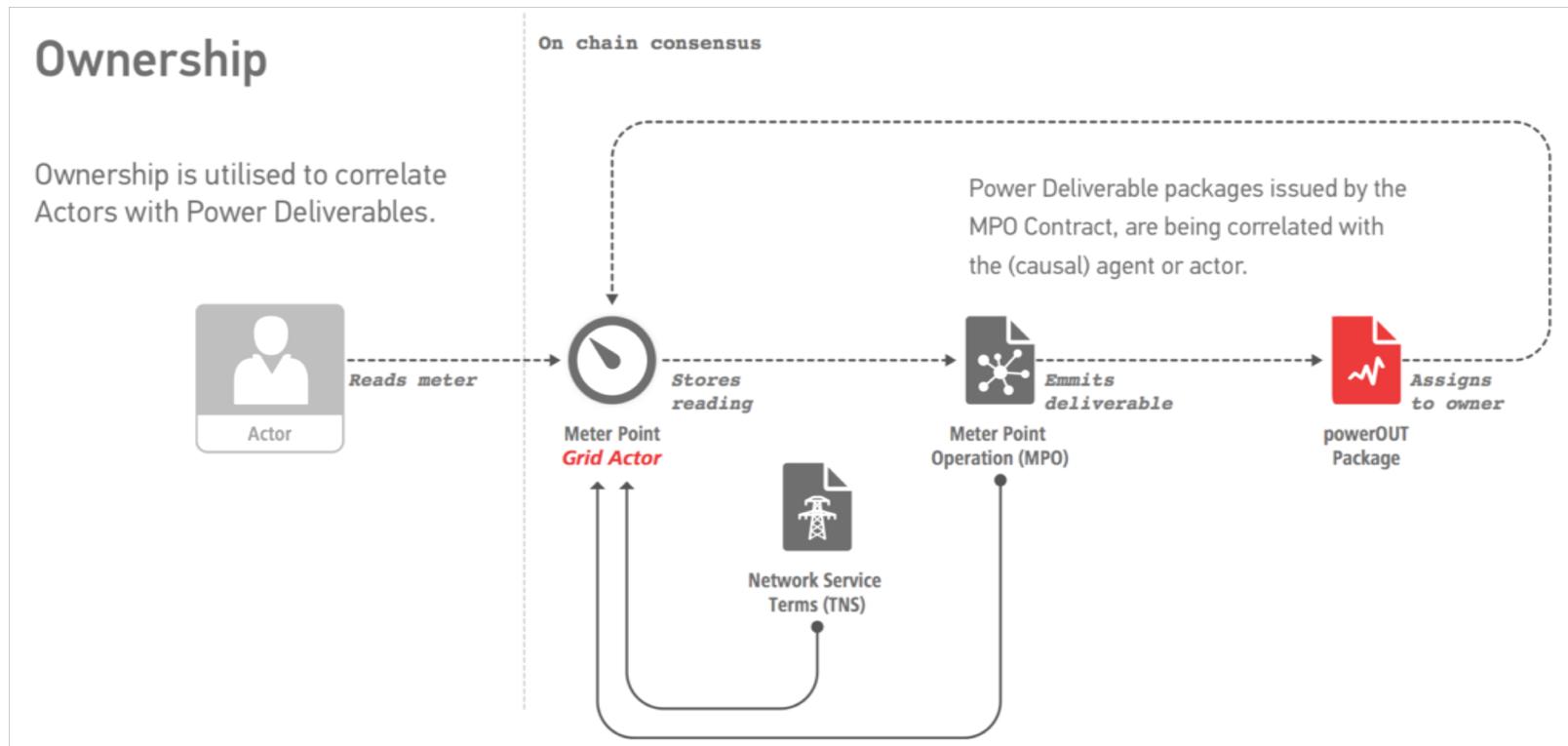


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```

OWNERSHIP

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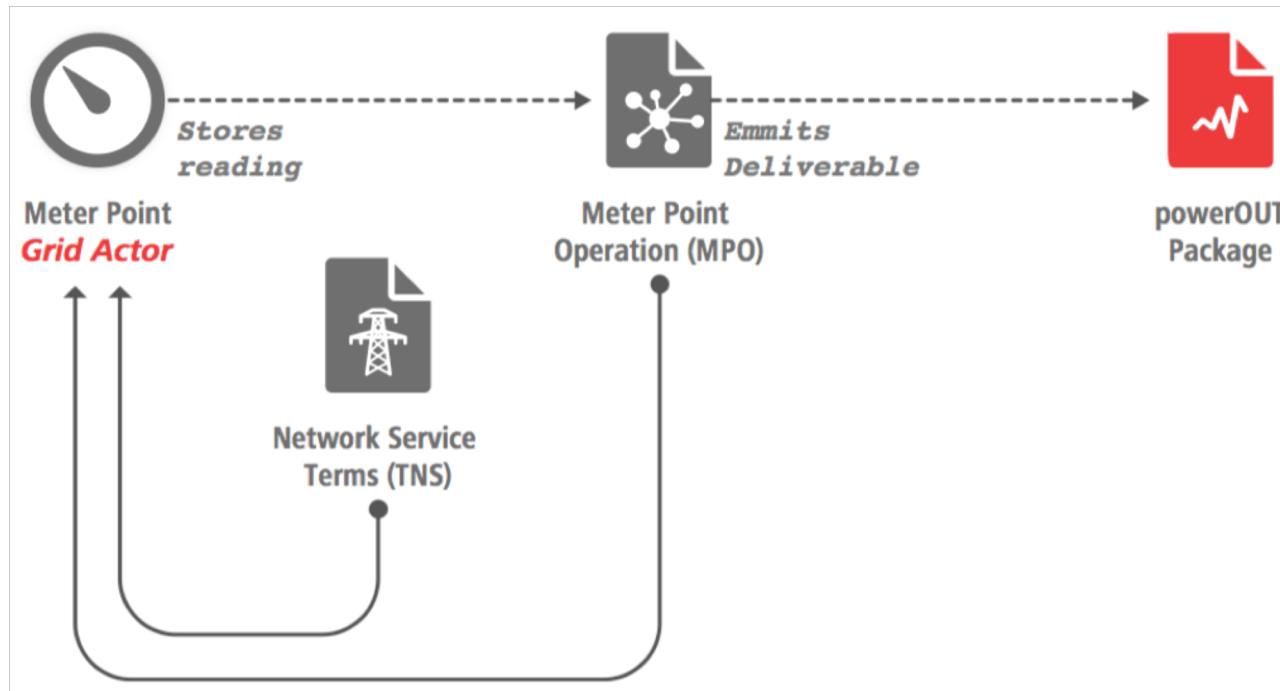


What if the actor doesn't want to care about it?

DELEGATING OWNERSHIP

WHAT IF THE ACTOR DOESN'T WANT TO CARE ABOUT IT?

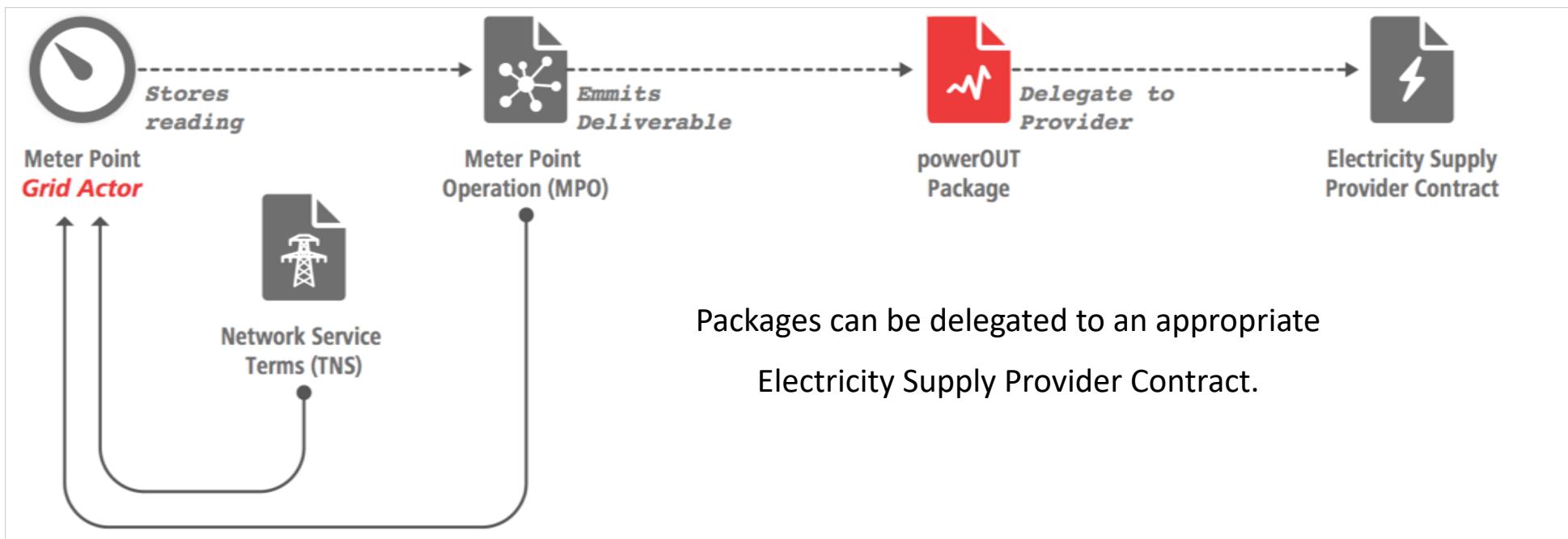
Power Deliverable packages may be delegated to a *third party* for aggregation and clearing.



DELEGATING OWNERSHIP

ON CHAIN CONSENSUS

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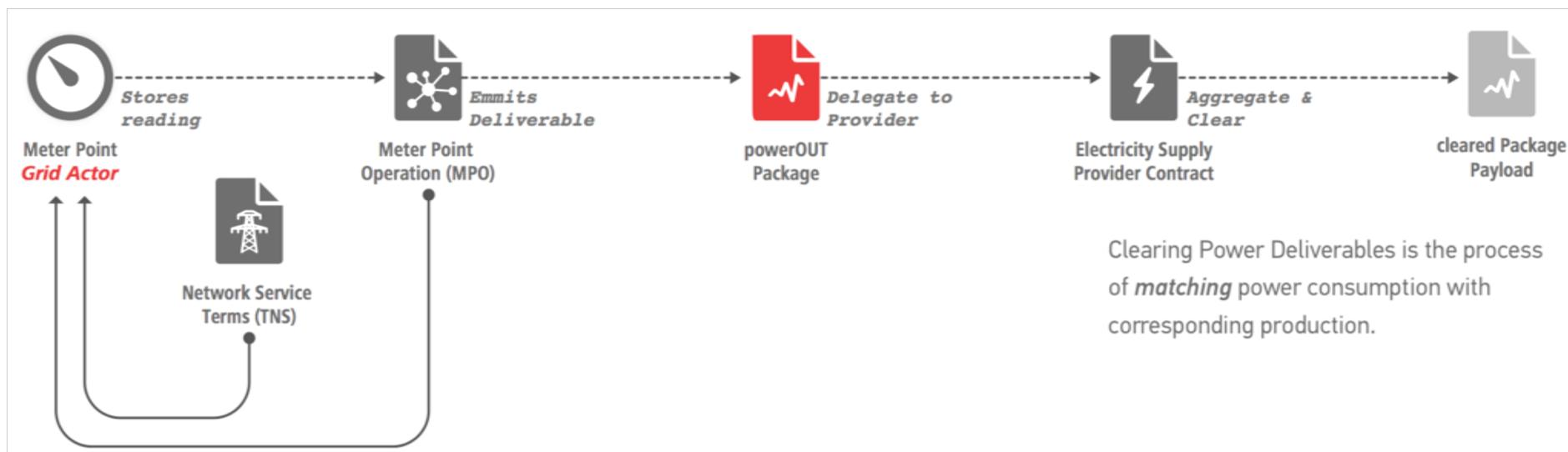


DELEGATING OWNERSHIP

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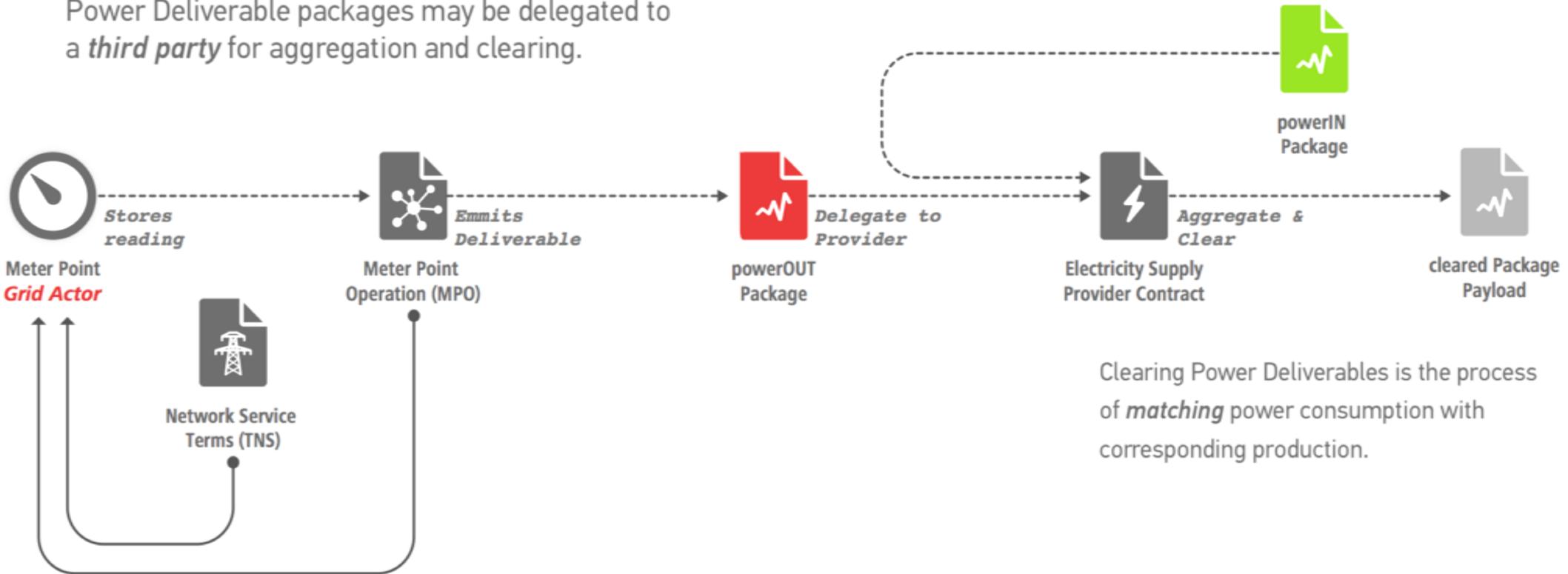
Packages can be delegated to an appropriate Electricity Supply Provider Contract.



Delegating ownership

The responsibility of sourcing appropriate sets of *corresponding* Deliverables is delegated to the Provider Contract.

Power Deliverable packages may be delegated to a *third party* for aggregation and clearing.



LET'S GO AND HAVE A LOOK

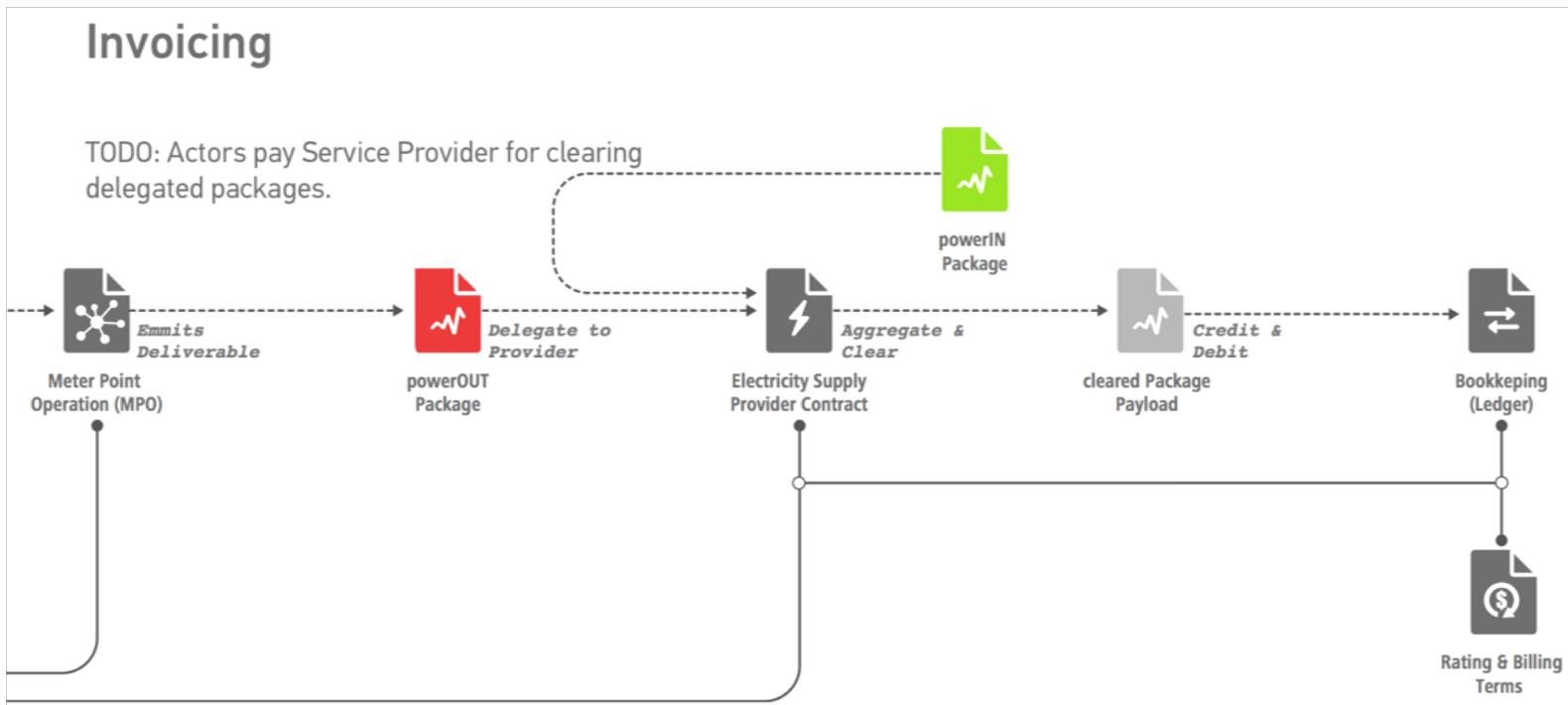
Start the Business-Object demo

- Create a new actor
- Make sure MPO contract is singed
- Ensure DSO contract is signed
- Push some meter readings into the blockchain
- Verify that Power Deliverables were created

```
1 $ git clone https://github.com/energychain/BusinessObject-Demo.git
2 $ cd BusinessObject-Demo
3 $ npm install
4 $ npm start
5
6 Server running at: http://localhost:8000
```

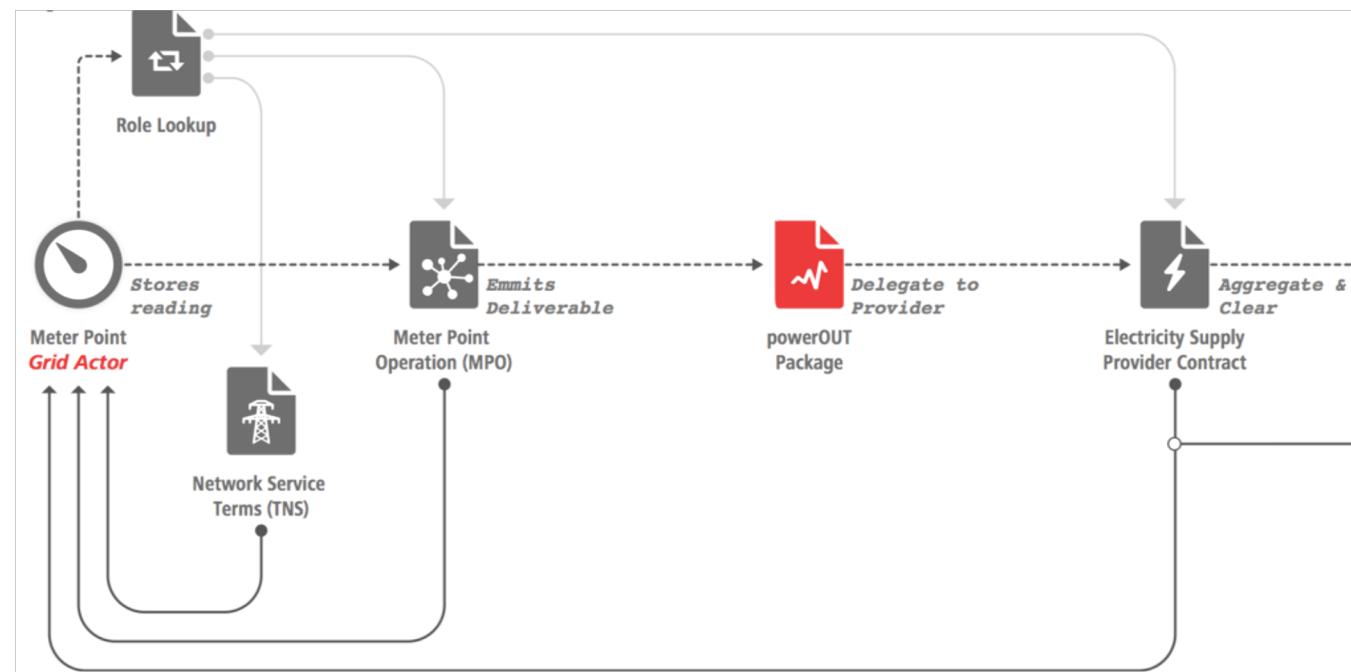
INVOICING

Actors pay Service Provider for clearing delegated packages.

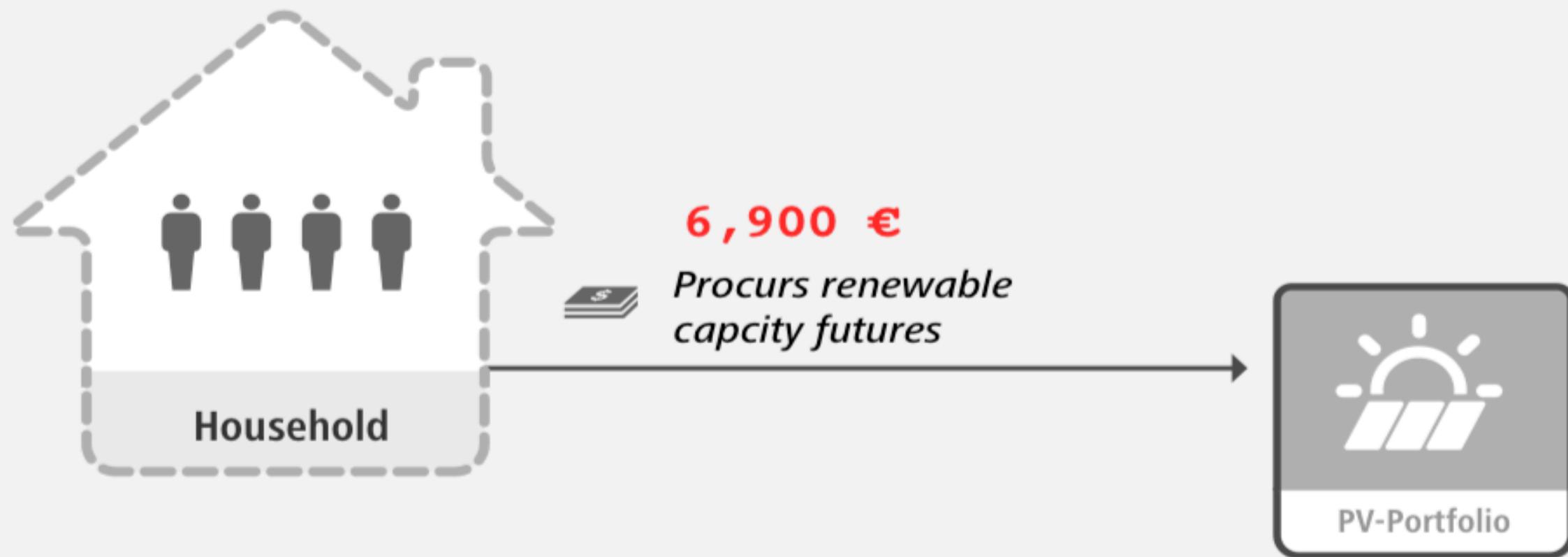


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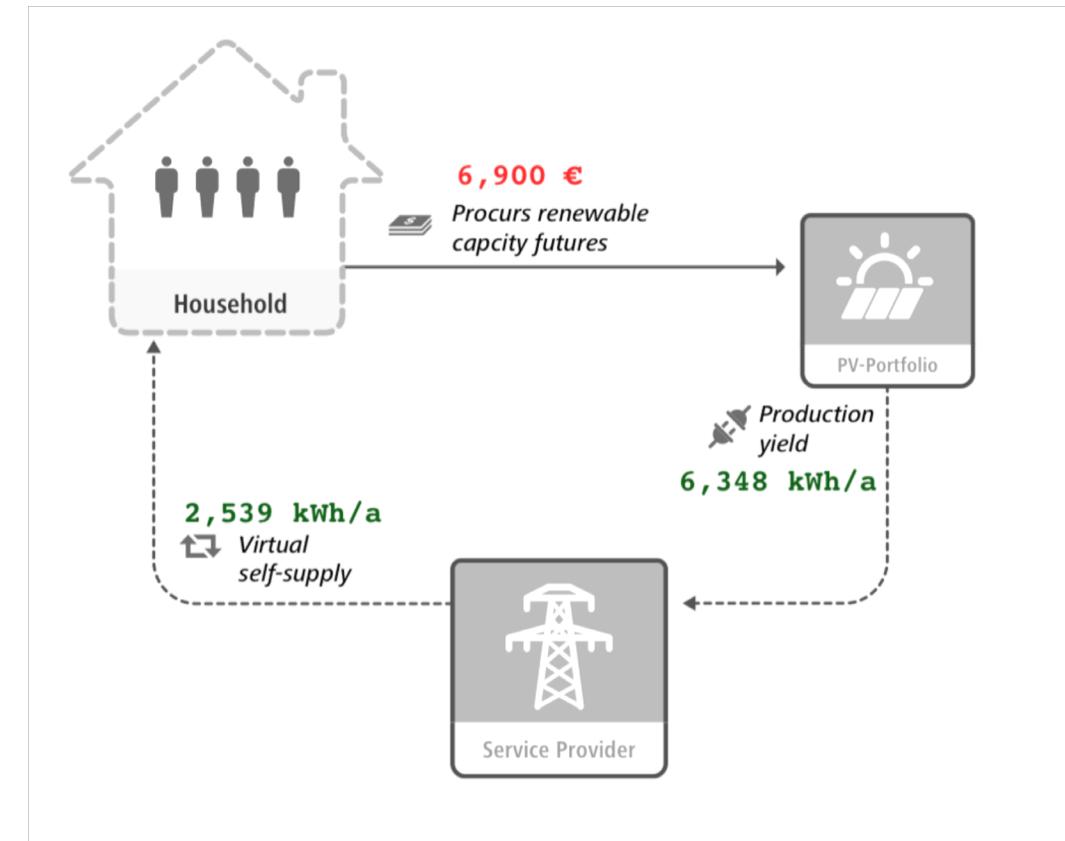
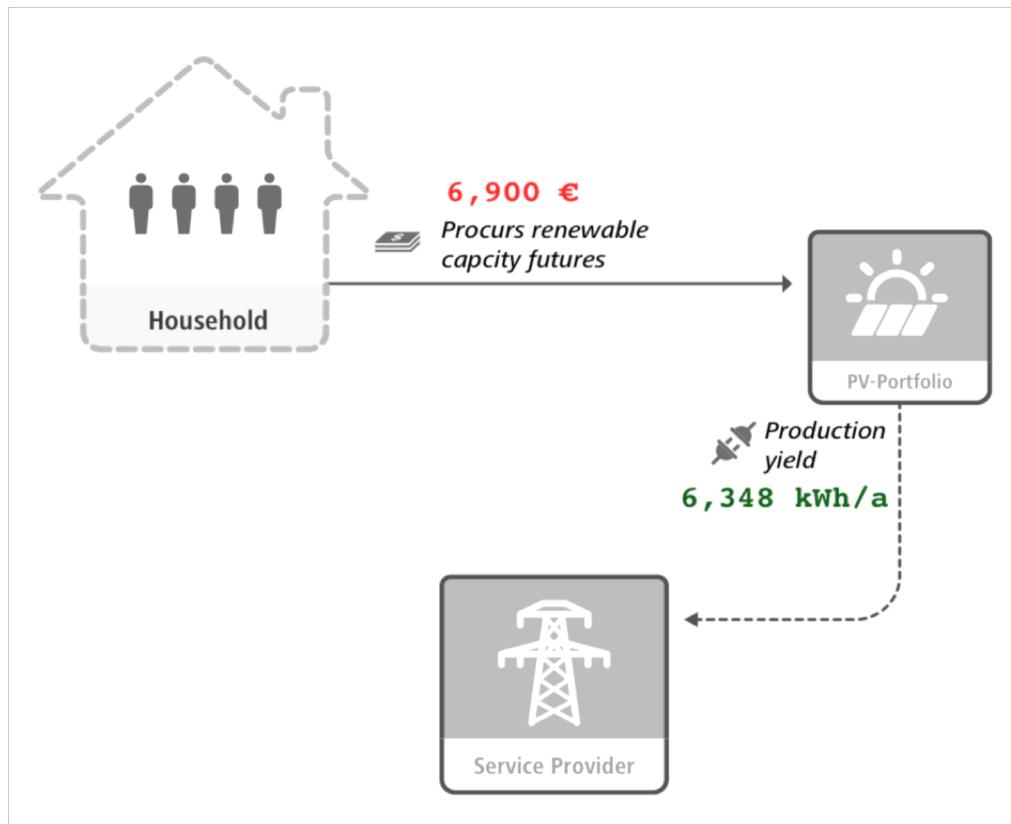
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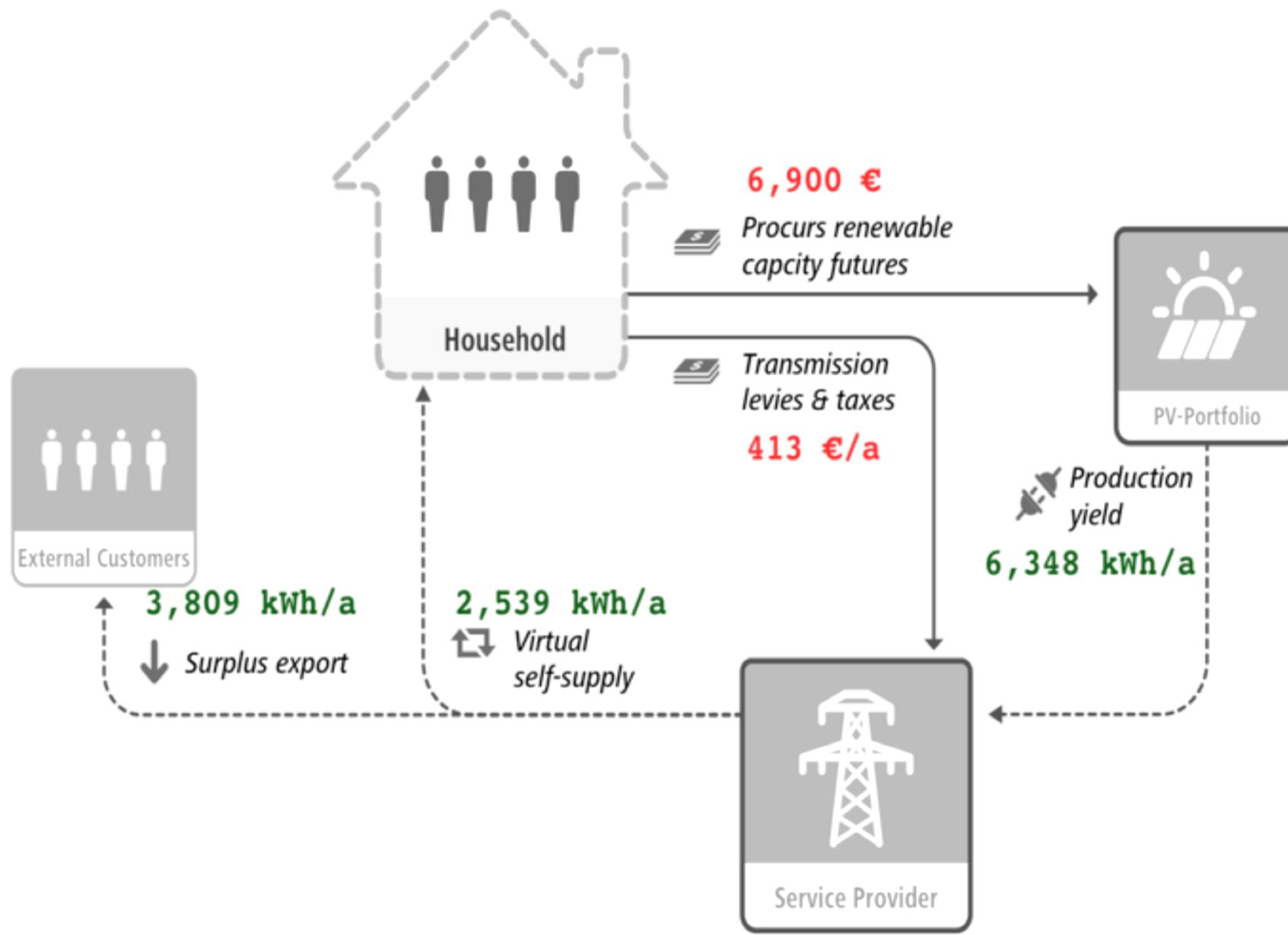
HYBRID ECONOMY



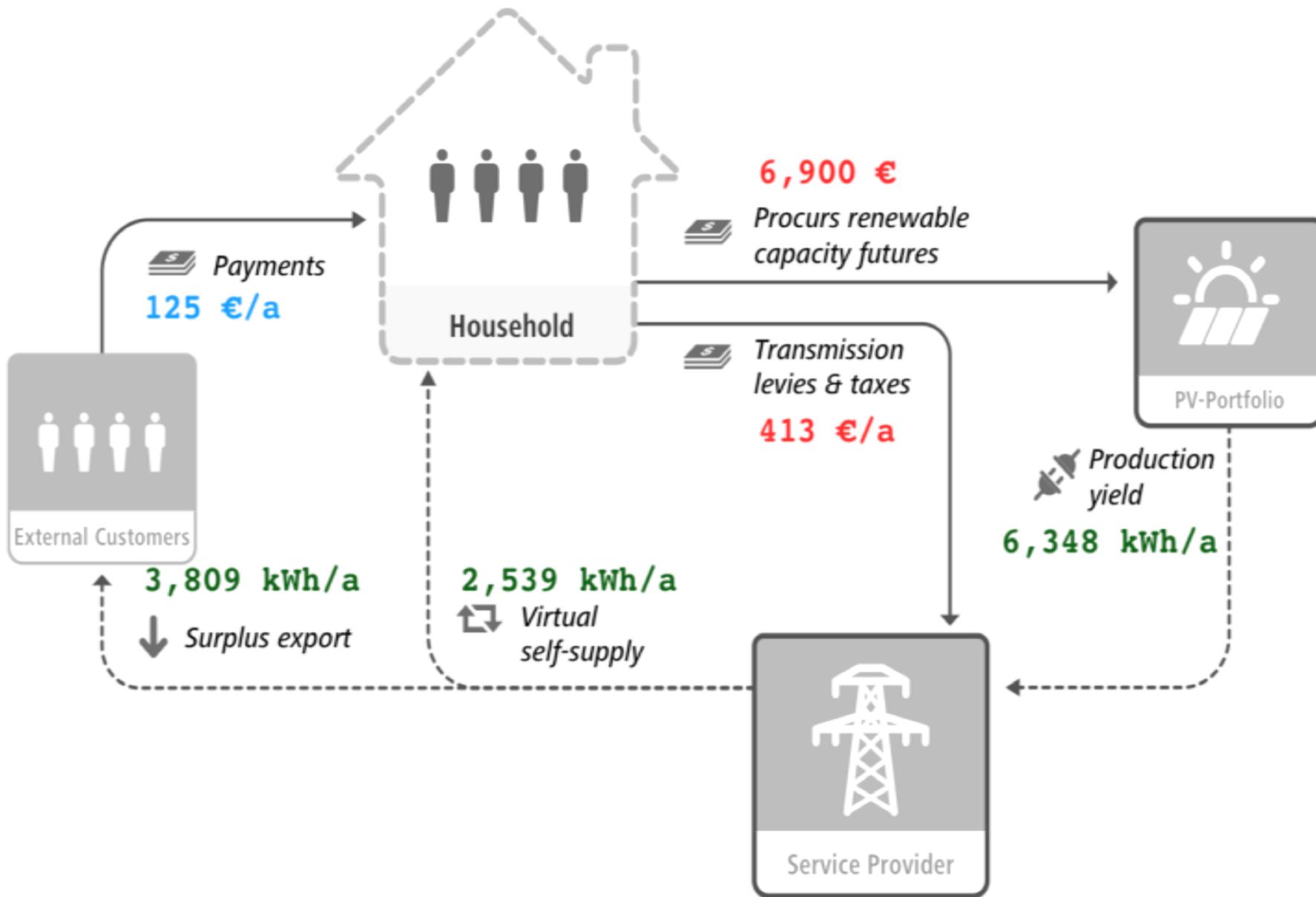
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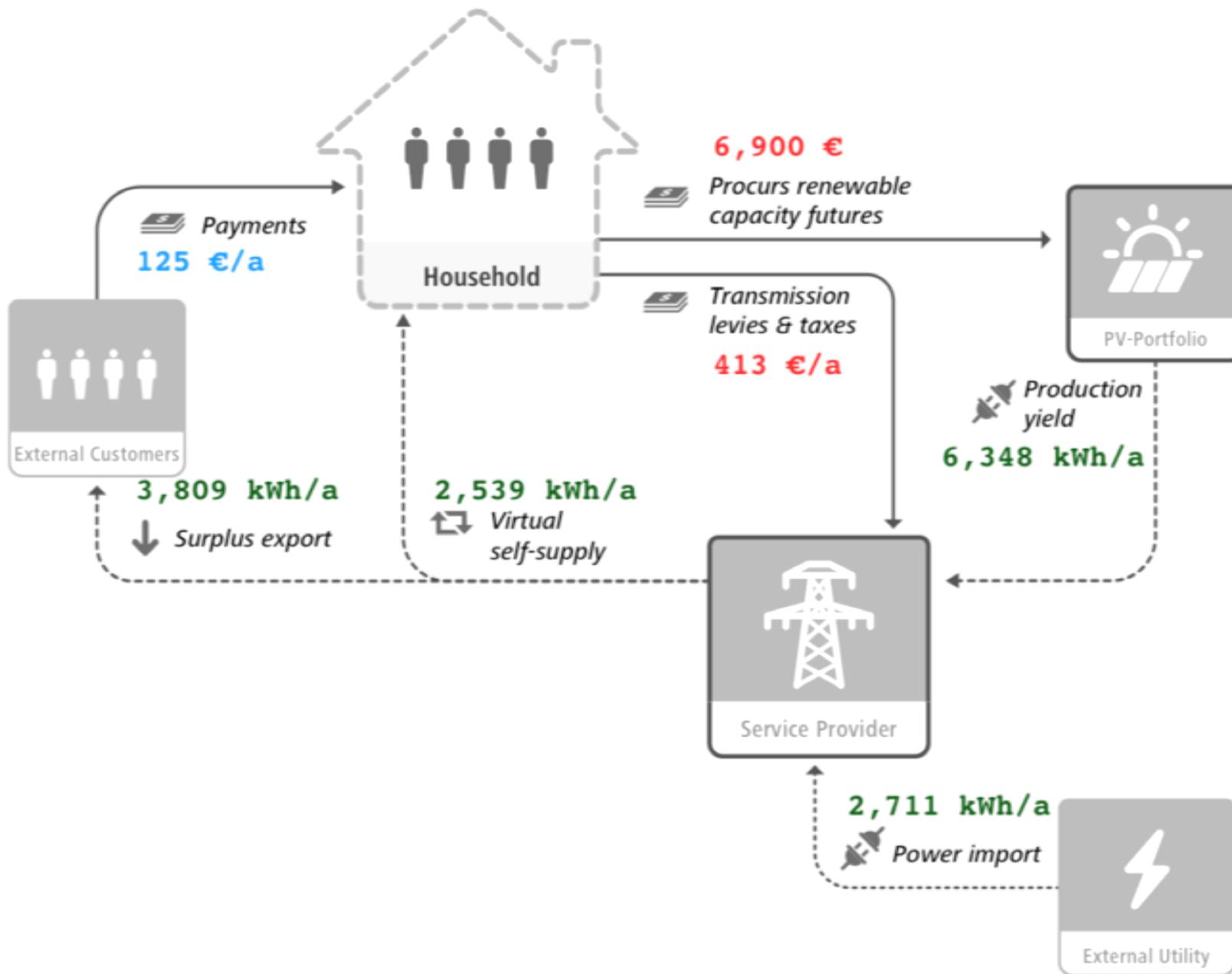
Hybrid Economics



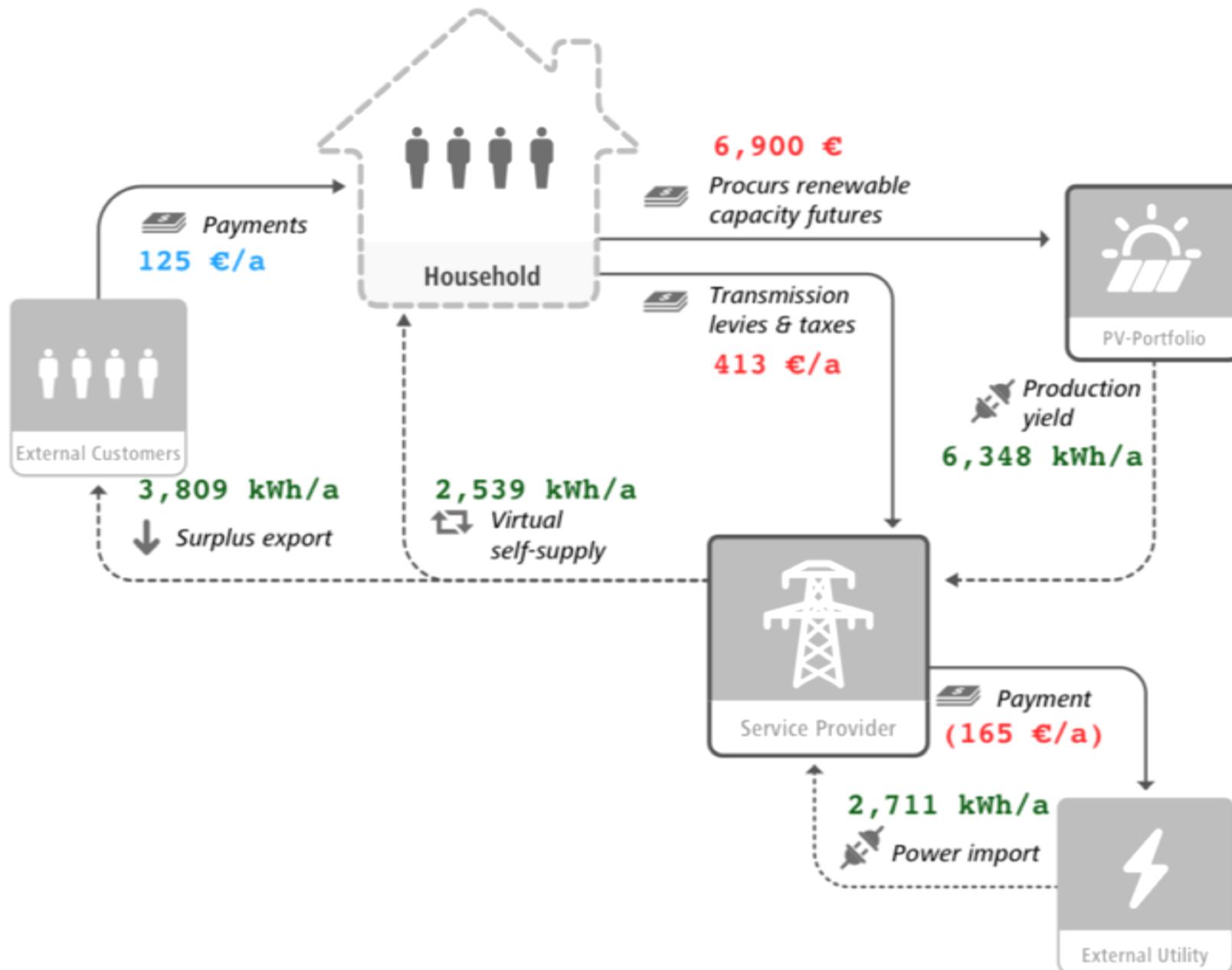
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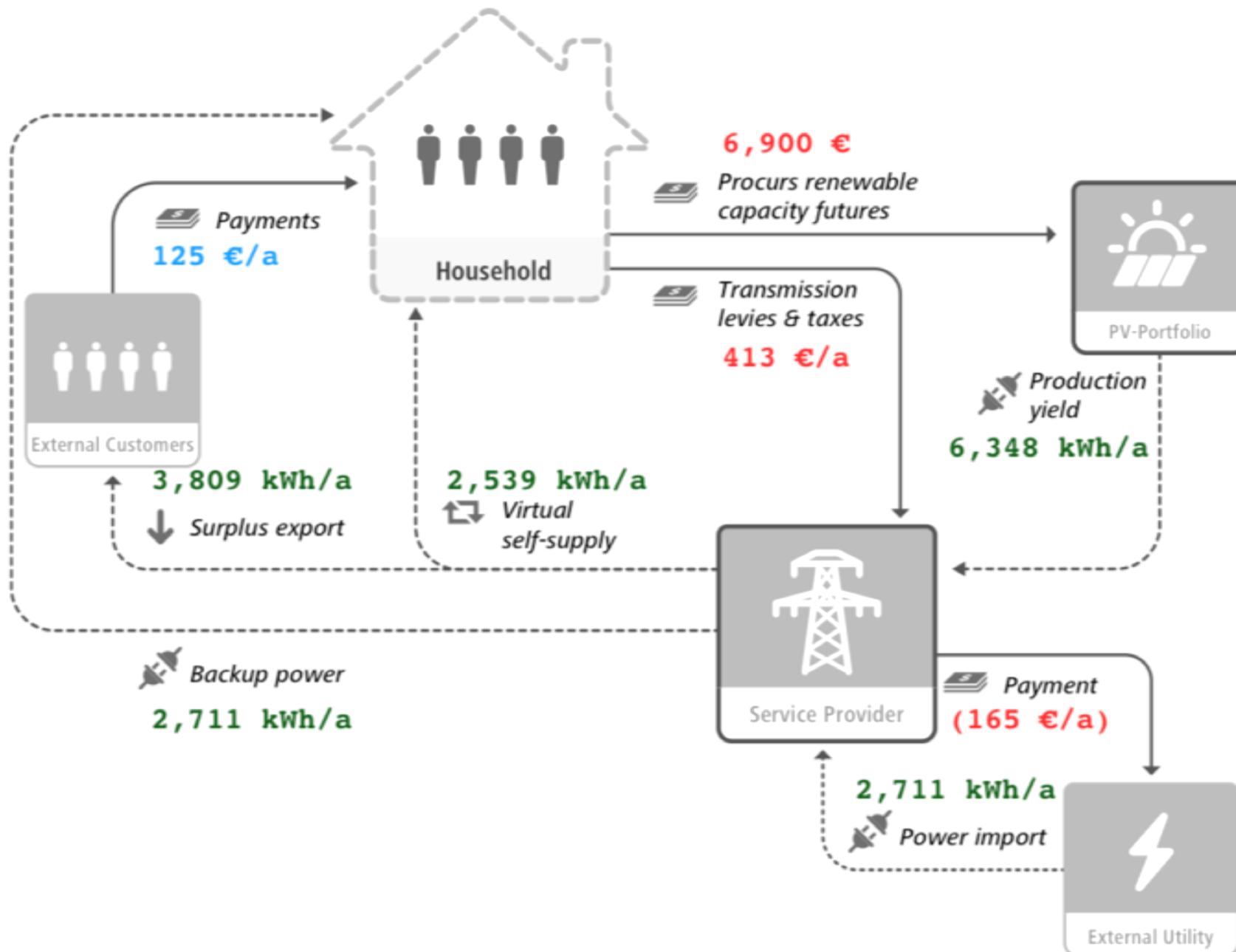
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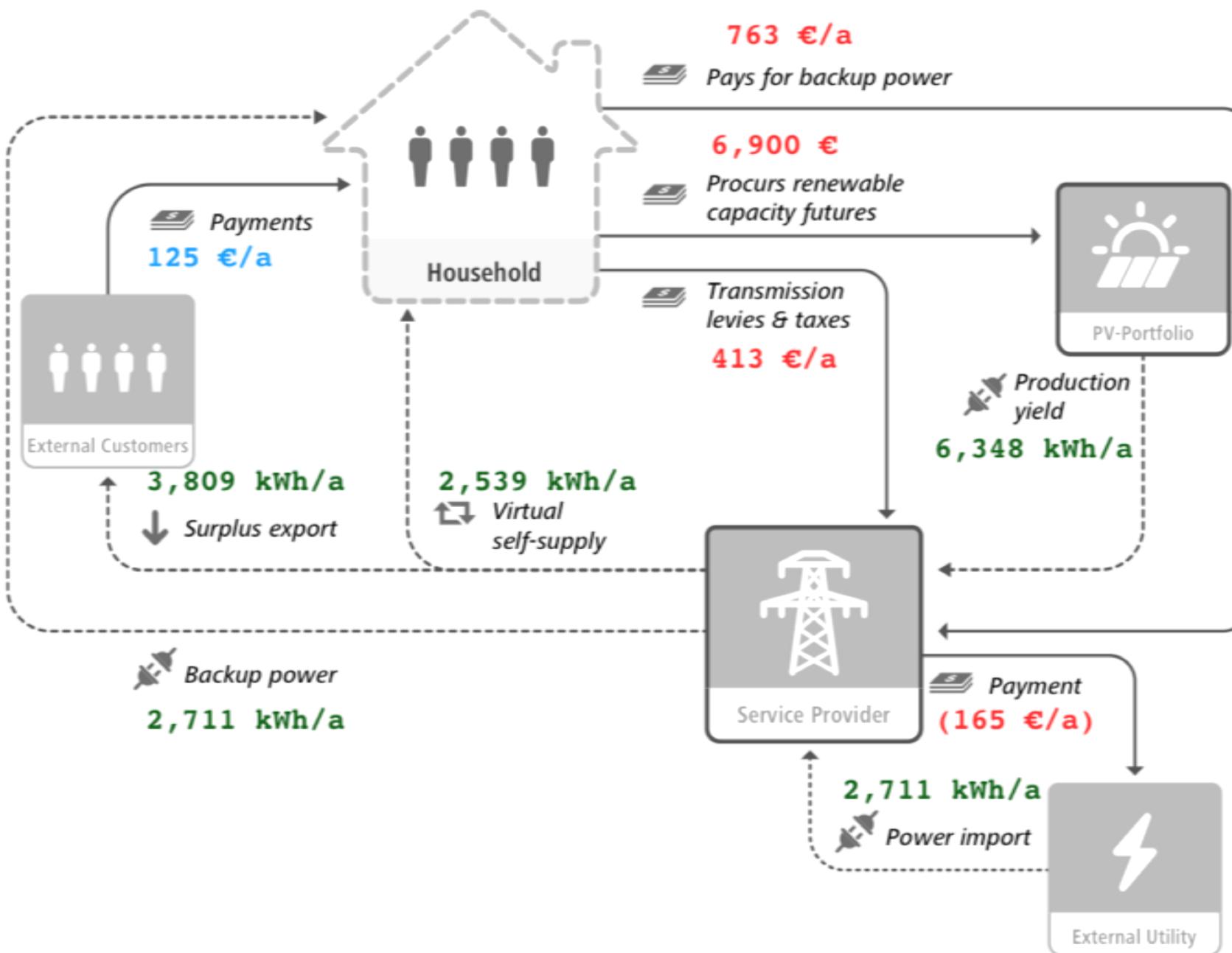
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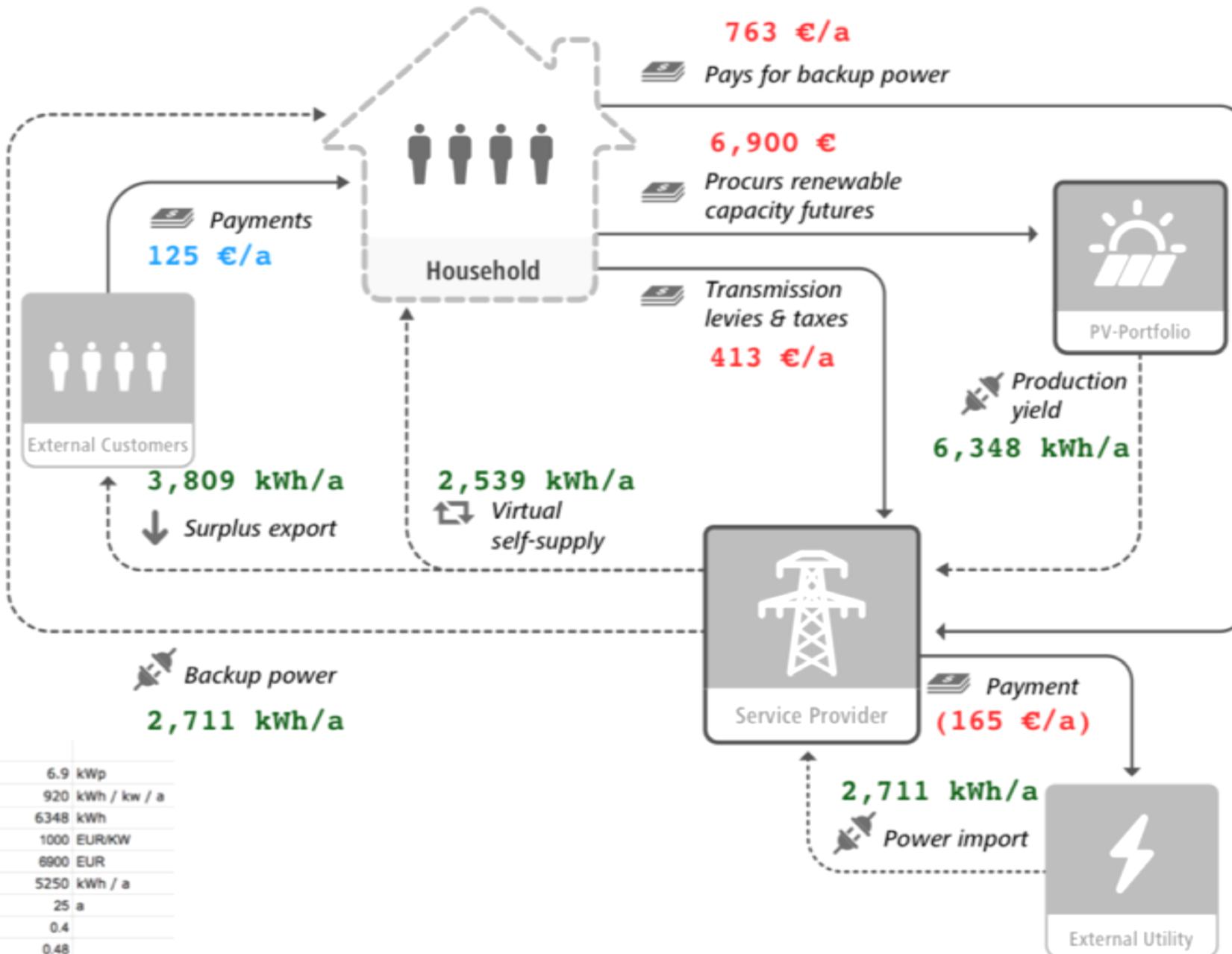
Hybrid Economics



Hybrid Economics



Hybrid Economics



Hybrid Economics

Solar is competitive today.

HyPower Saldo		vs	Standard Power Saldo	
Cost consumption	1175 EUR / a		Cost consumption	1360 EUR / a
Cost Invest PV	276 EUR / a		Cost Invest PV	0 EUR / a
Income export	-125 EUR / a		Einnahmen Export	0 EUR / a
Total	1326 EUR / a			1360 EUR / a
Savings	34 EUR / a			
Savings total	854 EUR over 25 yrs			

PV Assumptions	
PV-Anlage	6.9 kWp
PV-Yield	920 kWh / kw / a
	6348 kWh
PV price per unit	1000 EUR/kW
PV cost lifetime cost	6900 EUR
Power consumption annual	5250 kWh / a
Laufzeit	25 a
HyS self consumption ratio	0.4
HyS Autarkiegrad	0.48

Hybrid Pooling

Local balancing of complementary prosumers & consumers.

