

STROMDAO

A consensus system for
energy markets

Thorsten Zoerner

**strompolizeilich
verboten**

Mythos Smart Meter

Letztverbraucher:

Transparenz und Effizienzsteigerung durch Visualisierung.

Stromanbieter:

Optimierung der Beschaffung auch Bedarfserkennung.

Netzbetreiber:

Höhere Betriebssicherheit durch Daten.

Als fernkommunizierende digitale Stromzähler ermöglichen sie direkte Übertragungen von Messwerten an Verbraucher, Netzbetreiber, Energielieferanten und Energiedienstleister. Der **Verbraucher** erhält eine präzise **Visualisierung** seines Verbrauchsverhaltens und sieht so jede "vergeudete" Kilowattstunde. Dies kann ihn zu **energiesparendem** Verhalten motivieren. Zum anderen ermöglichen intelligente Messsysteme die Umsetzung **variabler Tarife**, in denen der Verbraucher **wirtschaftliche Anreize** erhält, Strom dann zu nutzen, wenn er am günstigsten ist. Intelligente Messsysteme ermöglichen den **Netzbetreibern** zudem einen präzisen Blick in ihr Stromnetz, - so können über sie Erzeugungs- und Verbrauchsanlagen **angesteuert** werden.

Regulierung

MaStR

DigiWende

Strommarkt 2.0

Regelungen zur Adressierung

EDI@Energy Kommunikationsrichtlinie Verfahrensbeschreibung zur Abwicklung des Austauschs von EDIFACT-Dateien

Version:

Herausgabedatum:
Autor:

2.2
01.10.2012
BDEW

Konsens

MaStR

DigiWende

Strommarkt 2.0



"Um Ihnen *diskriminierungsfrei* eine Abrechnung und Bilanzierung in Anlehnung an die registrierende Lastgangmessung (RLM) anbieten zu können, *müssen* diese Punkte *branchenweit geklärt* werden. Entsprechende Arbeitsgruppen sind u. a. beim BDEW eingerichtet, welche sich mit diesem Thema beschäftigen."



Konsens:
Dezentral. Autonom.
Elektrisch.

21.3.2017, 21:07:37

Strom 5.6 KWh in 5.7 Stunden

Transaktion: #0xcf697d7423

Von: Netzanschluss GWR29

An: BLK StromDAO

Betrag: 1,39€



Eine Konsens-Maschine für Energietransaktionen

Eine Maschine geschaffen um Konsens zwischen Marktteilnehmern herzustellen und unwiderruflich aufrecht zu erhalten.

Mit Blockchain Technologie können Energietransaktionen jeglicher Art abgebildet und ausnahmslos nachvollzogen werden.

What is a grid connection?

1. Forget bilateral activities
2. 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?

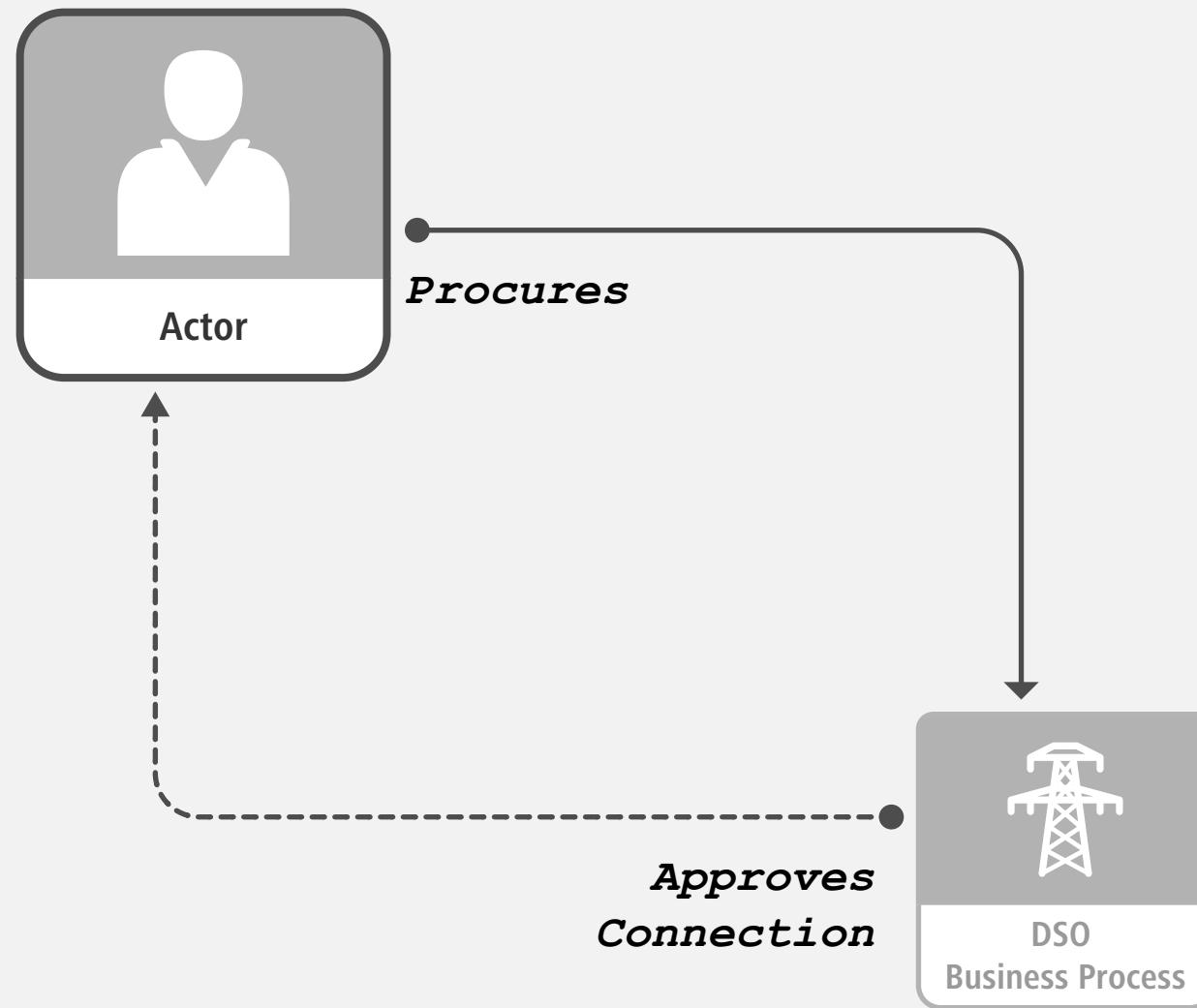
An entity qualifies as a *Grid Actor* only,
if there is *proof* that:

1. A *trusted* Distribution Service and
2. A *trusted* Meter Point Operation

are being provided.

Only what matters for all, matters at all.

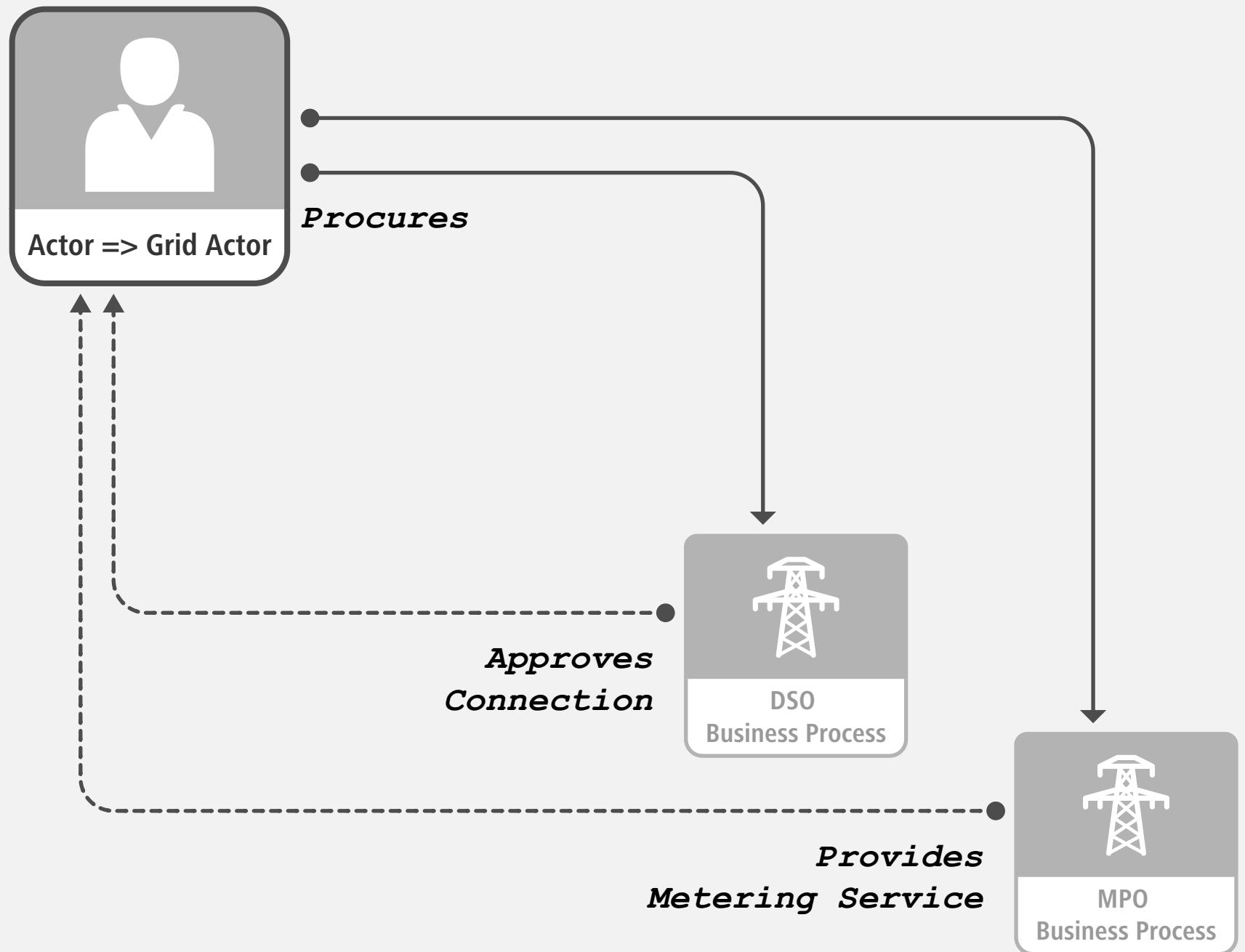
There are processes that Distribution Service and
Meter Point Operators comply with.



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.

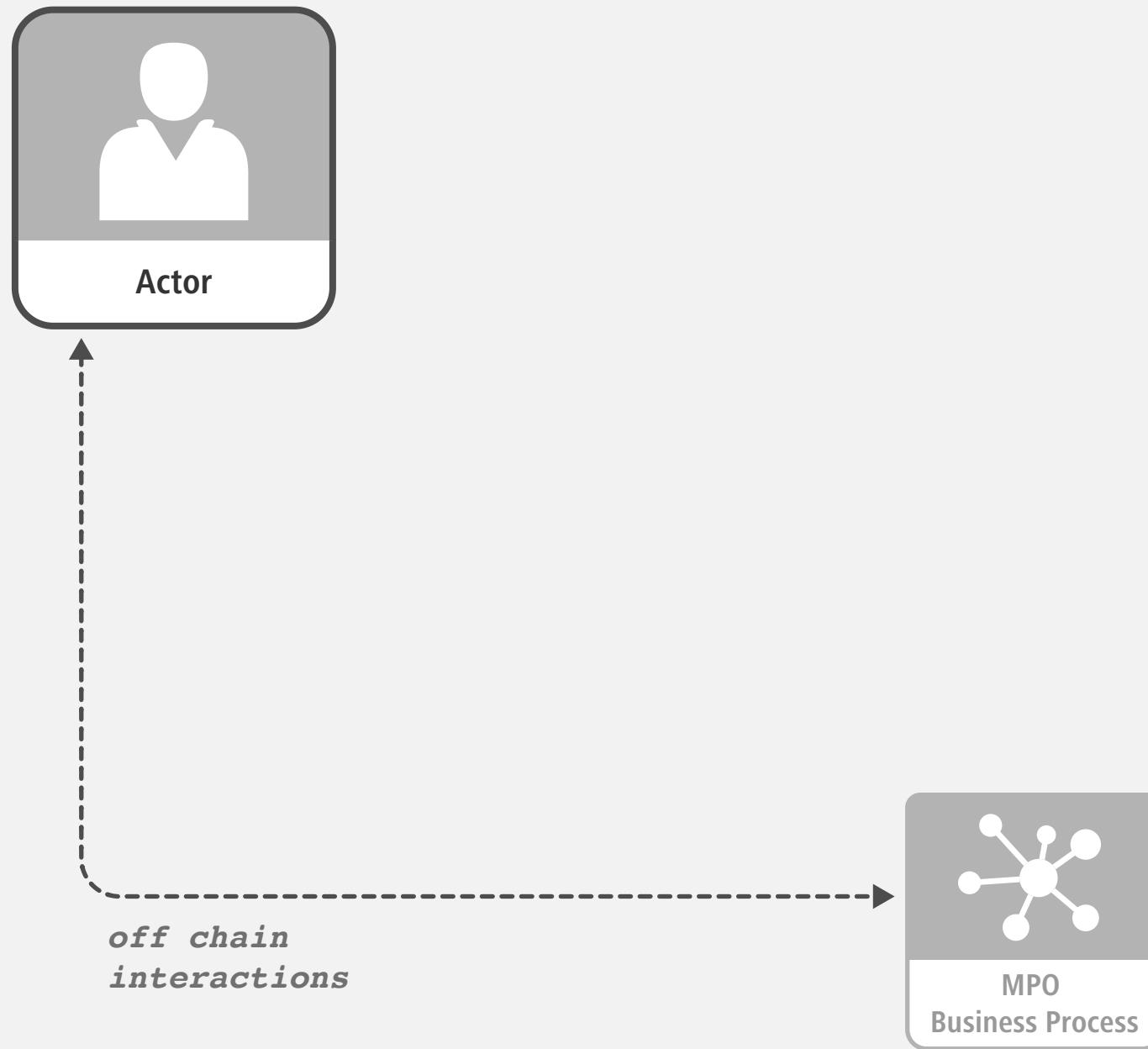


Proof of existence

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.

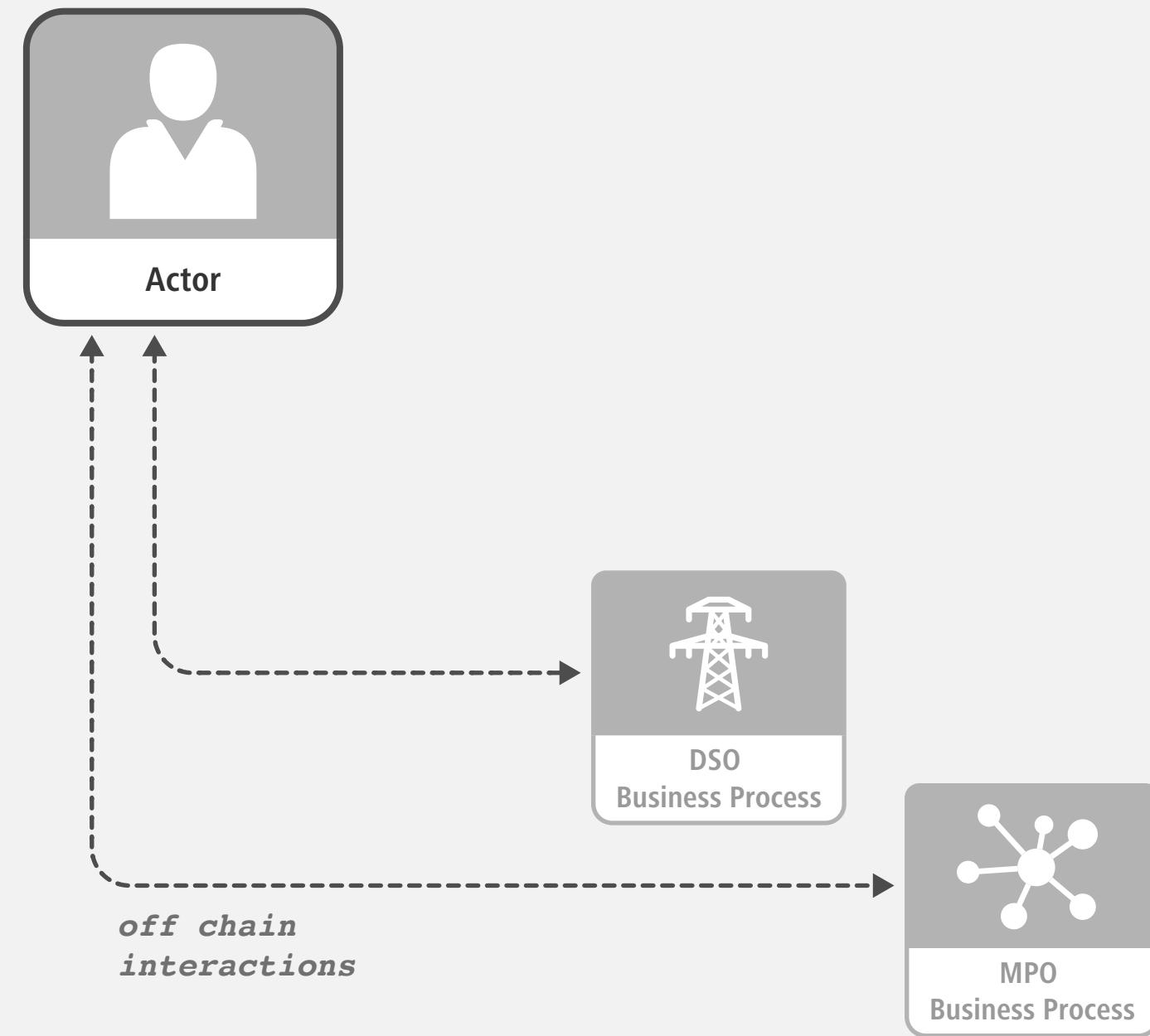
StromDAO utilises blockchain technology to establish and maintain such consensus by '*Proof of Existence*'.

Forget bilateral processes.

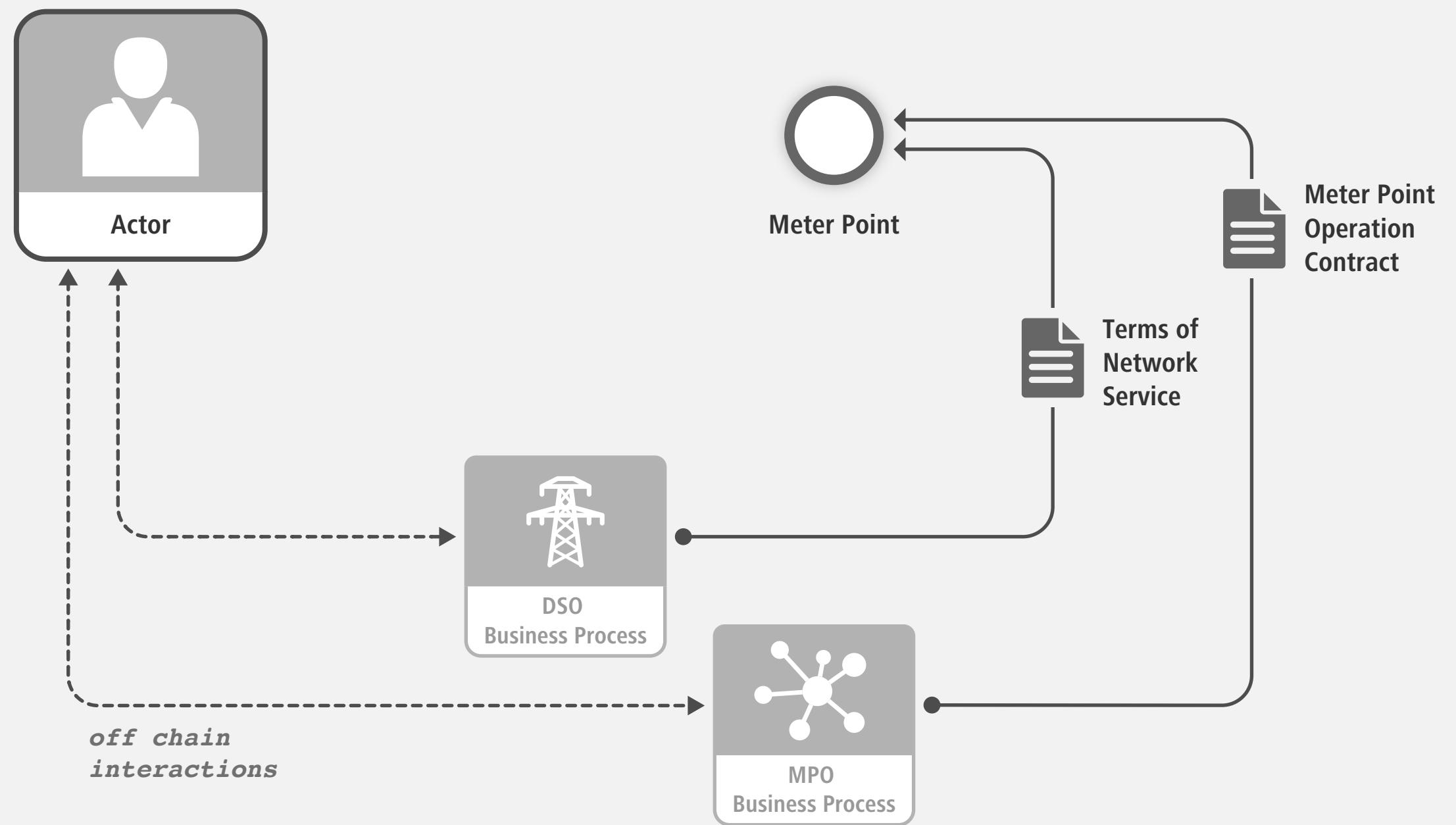


Forget bilateral processes.

Don't worry about entity relations.

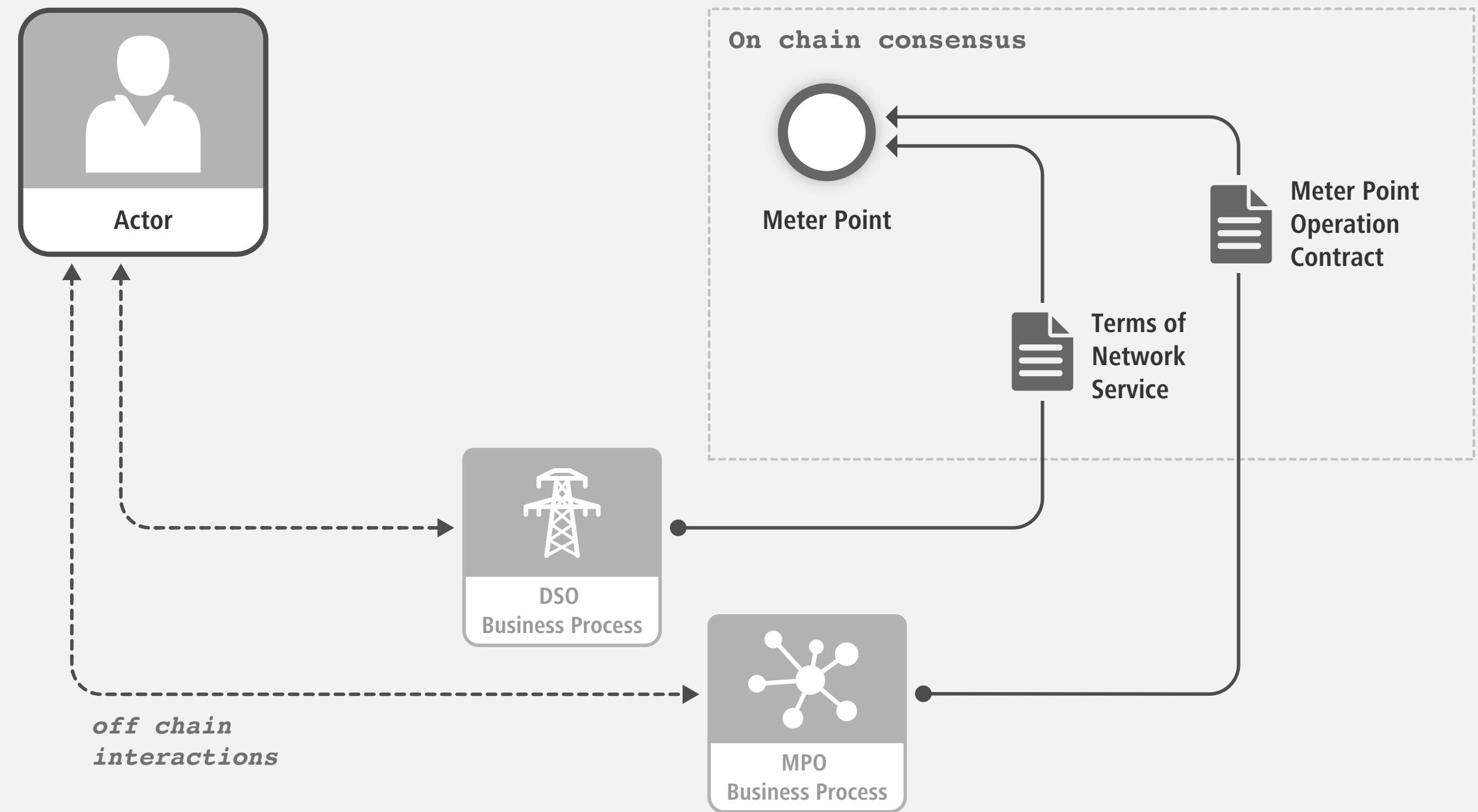


Instead, think about stateless
self enforcing agreements...



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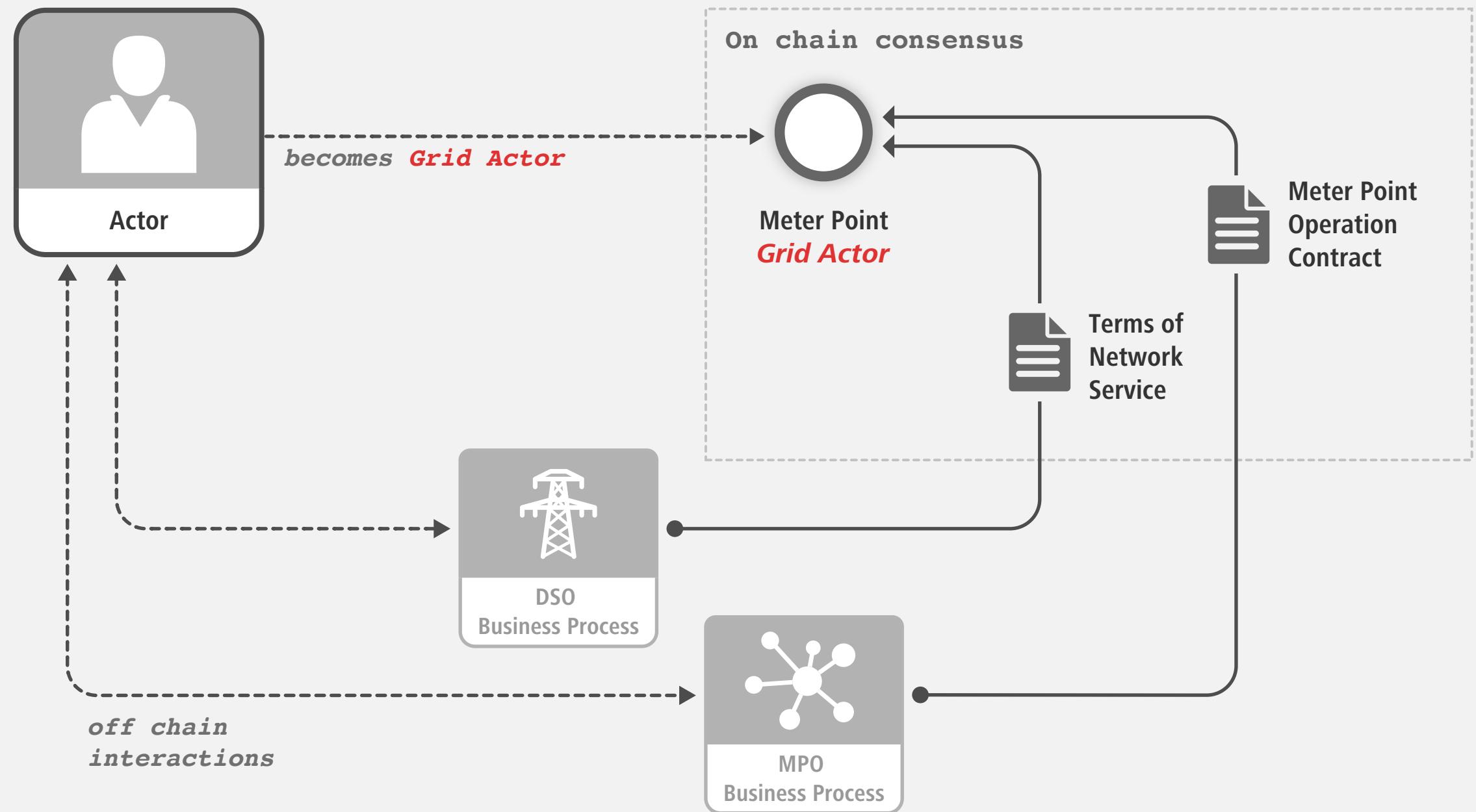
...what matters is verifiable proof that mutual agreement has been established, not what it details.



Instead, think about self enforcing agreements...

...what matters is verifiable proof that mutual agreement has been established, not what it details.

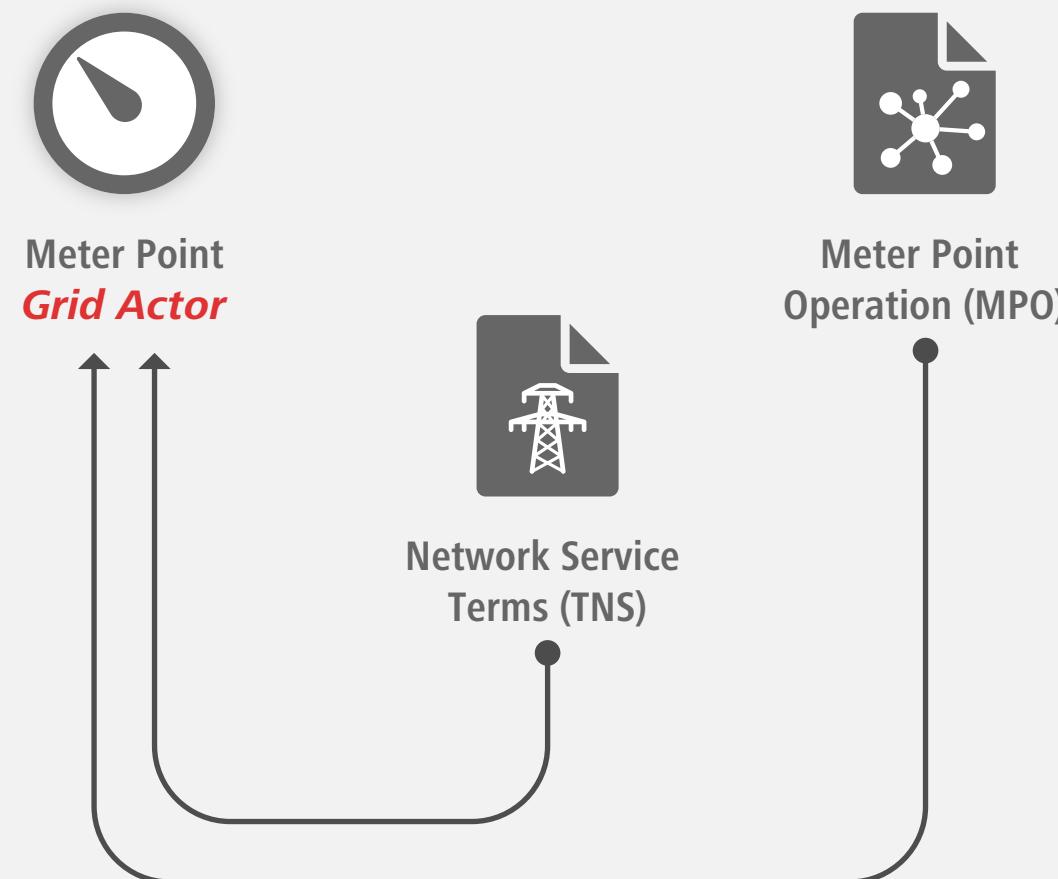
Proof of existence is sufficient.



Gridborne

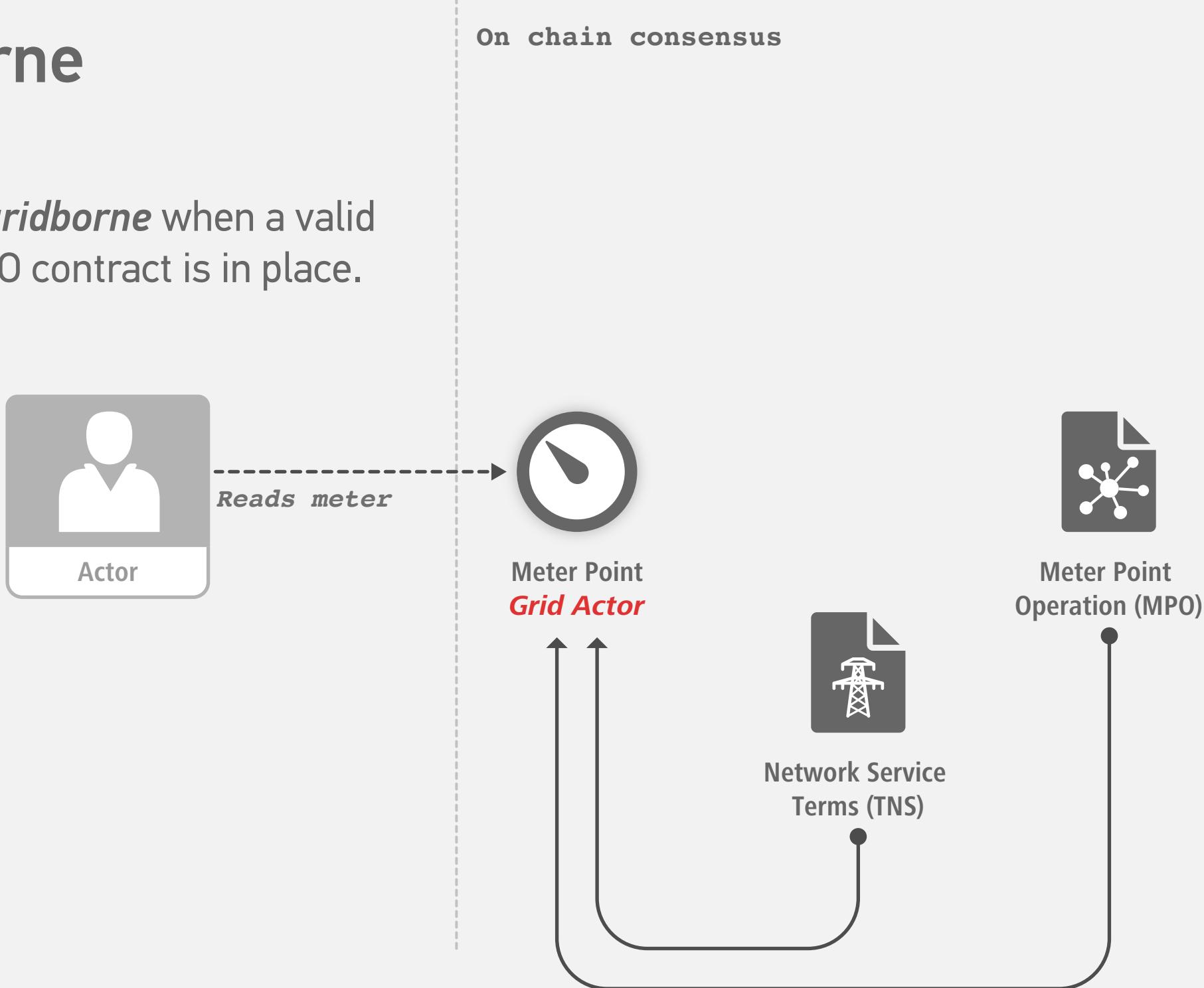
An actor is *gridborne* when a valid TNS and MPO contract is in place.

On chain consensus



Gridborne

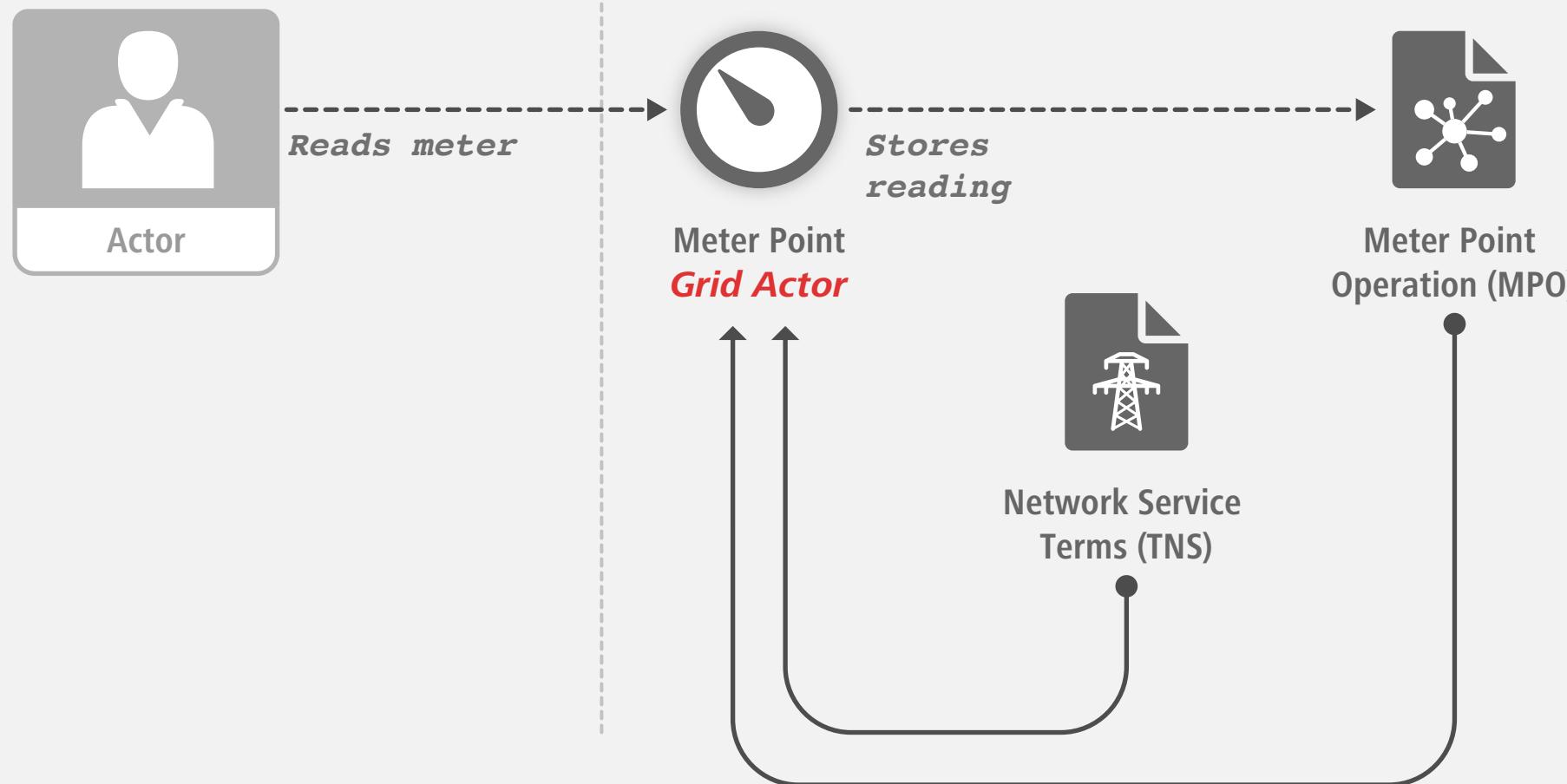
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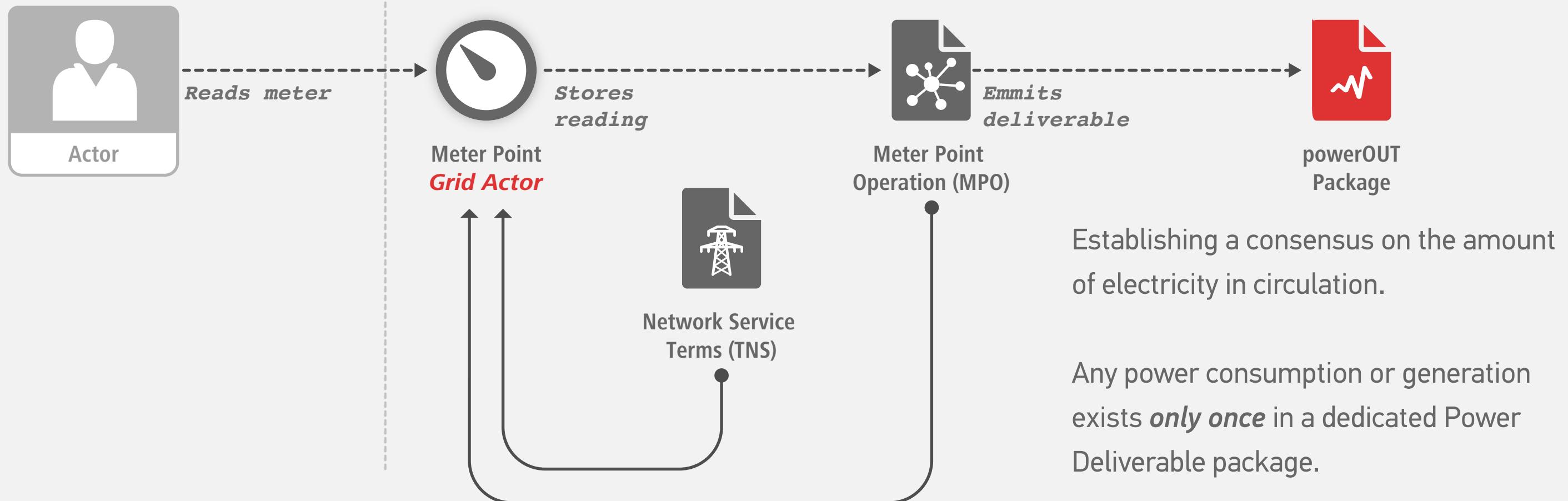


The MPO contract is now *authorised to underwrite* power deliverables with any meter reading provided.

Gridborne

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

On chain consensus



Ownership

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



is Owned

powerOUT
Package

```
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

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

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



powerOUT
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Ownership

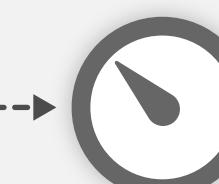
Ownership is utilised to correlate Actors with Power Deliverables.



Reads meter

Actor

On chain consensus

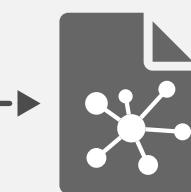


Meter Point
Grid Actor

Stores reading



Network Service
Terms (TNS)



Meter Point
Operation (MPO)

Emmits deliverable



powerOUT
Package

Assigns to owner



Assigns to owner

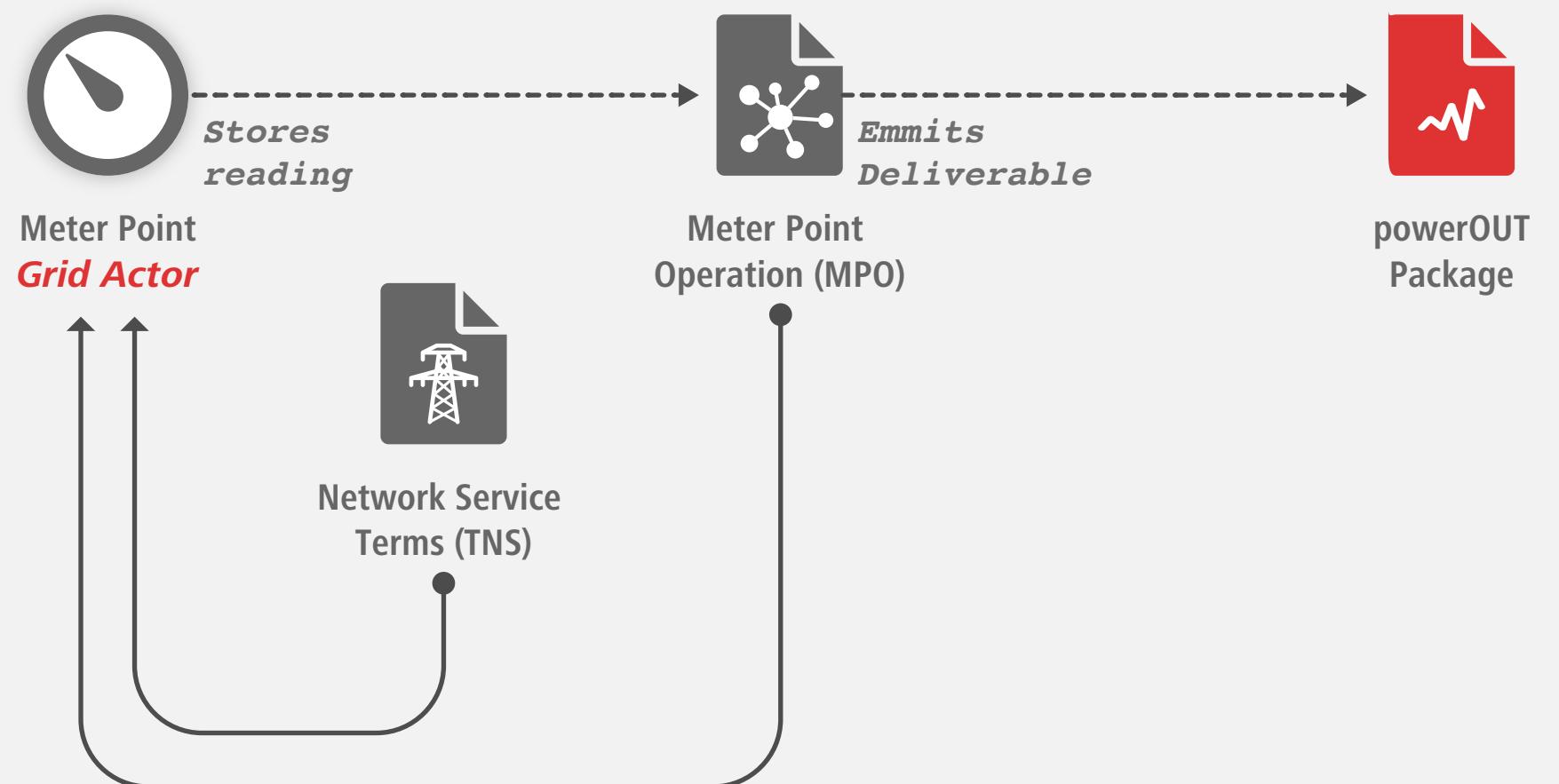


Assigns to owner

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

Delegating ownership

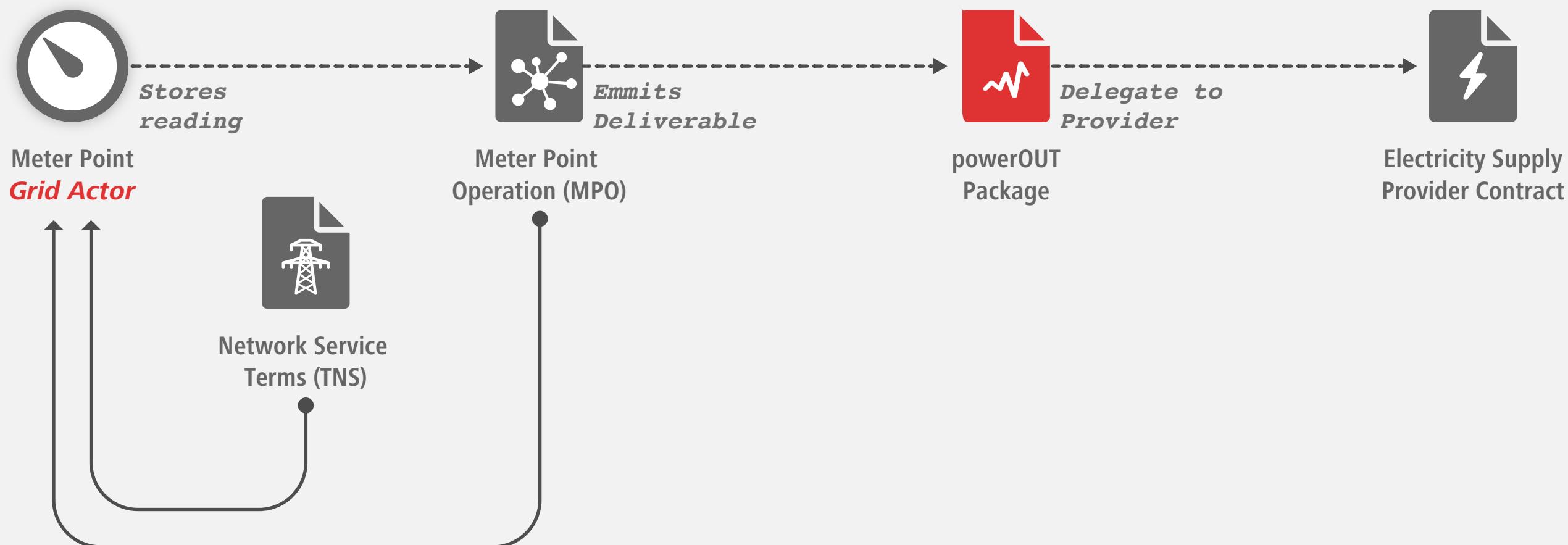
Power Deliverable packages may be delegated to a *third party* for aggregation and clearing.



Delegating ownership

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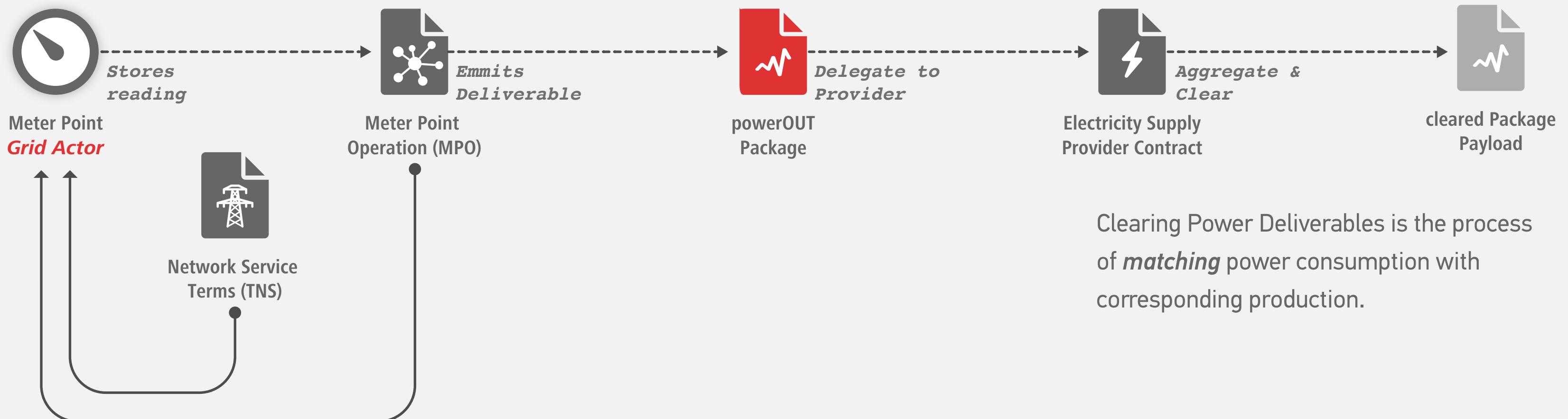
Packages can be delegated to an appropriate Electricity Supply Provider Contract.



Delegating ownership

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

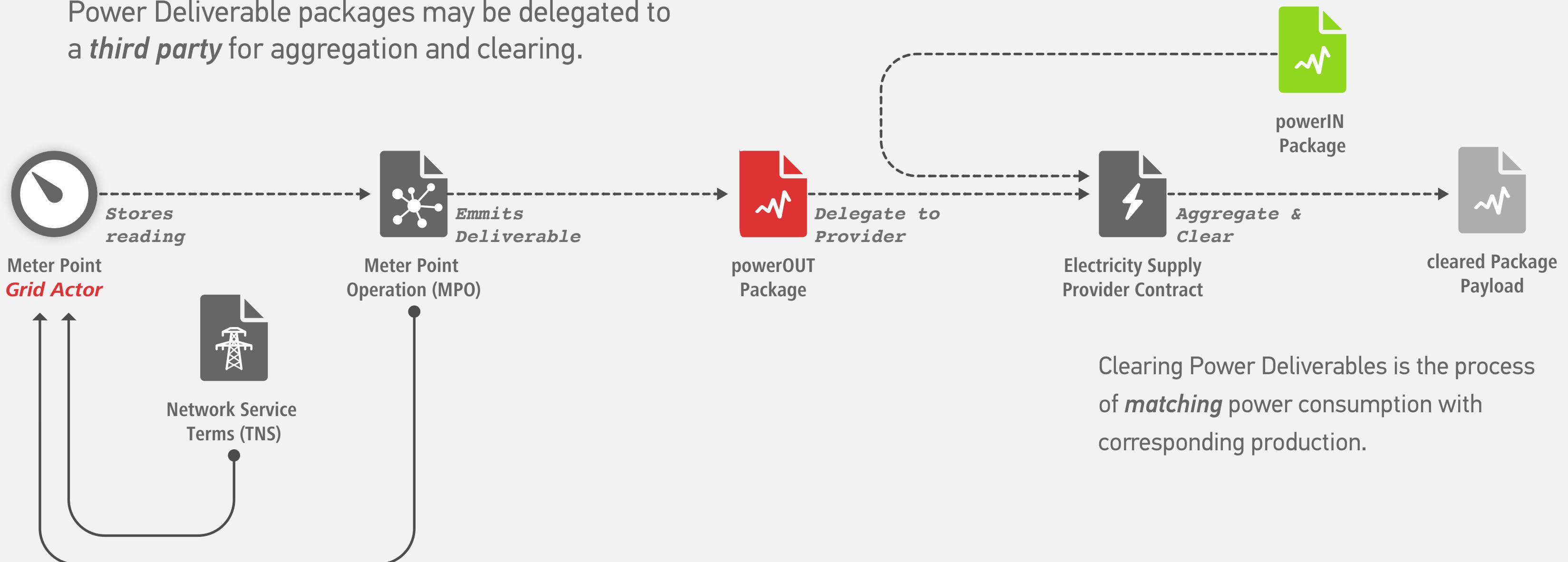


Clearing Power Deliverables is the process of *matching* power consumption with corresponding production.

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

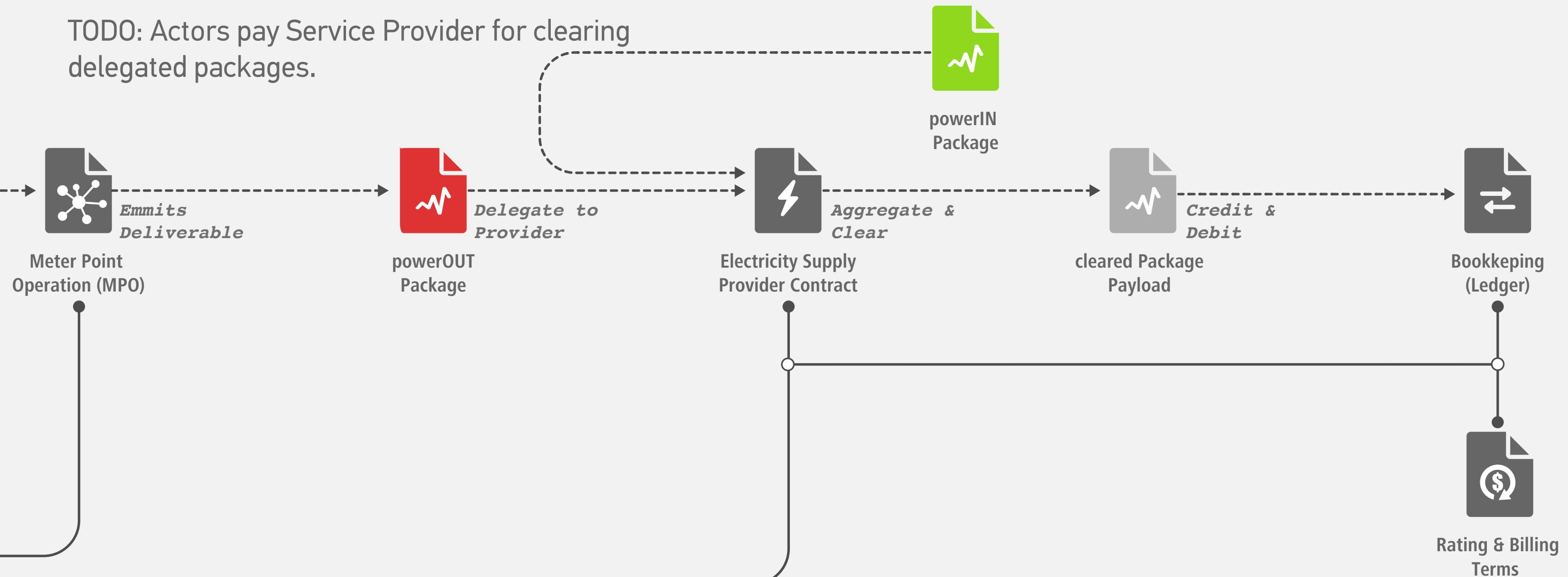
1. Create a new actor
2. Make sure MPO contract is singed
3. Ensure DSO contract is signed
4. Push some meter readings into the blockchain
5. Verify that Power Deliverables were created

```
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
```

Back up

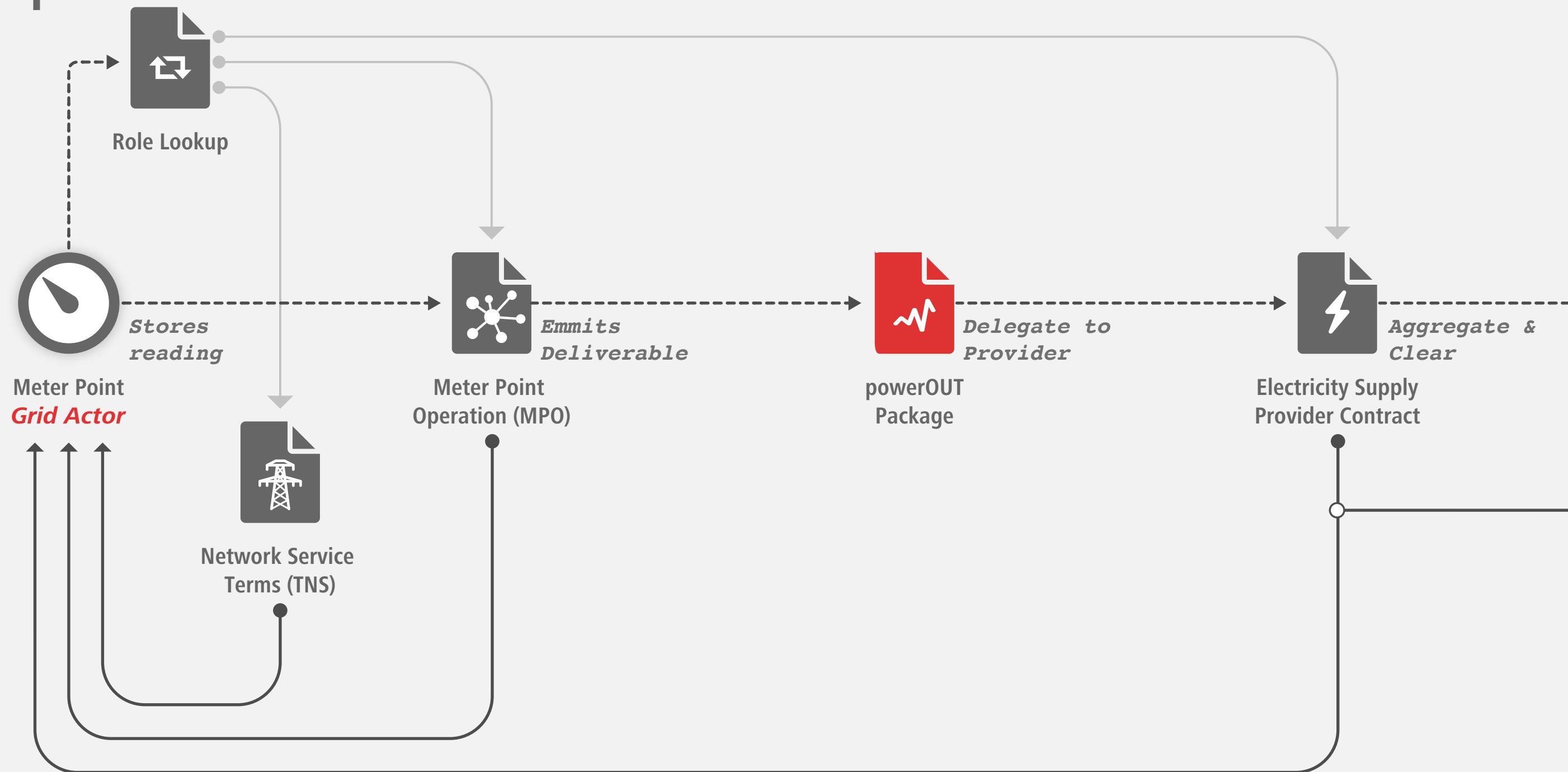
Invoicing

TODO: Actors pay Service Provider for clearing delegated packages.



Role lookup

TODO:





C



Secure https://app.stro...



D.



Apps



DevDocs/CSS



Baseliner - keyes.ie



Unicode® character...



git/github guide



Other Bookmarks

thon@sunrid...

8

Stromkonto: Mieter X

- Soll (Abbuchungen)

3.348,57 €

GrünStrom

35,0 K

» **Ableitung**

Entnahme

Letzte Ableitung

+ Haben (Einzahlungen)

3.355,02 €

GrauStrom

46,4 K

=Saldo (Kontostand)

6,45 €

Nachhaltigkeit

43%

StromDAO

HYBRIDSTROM

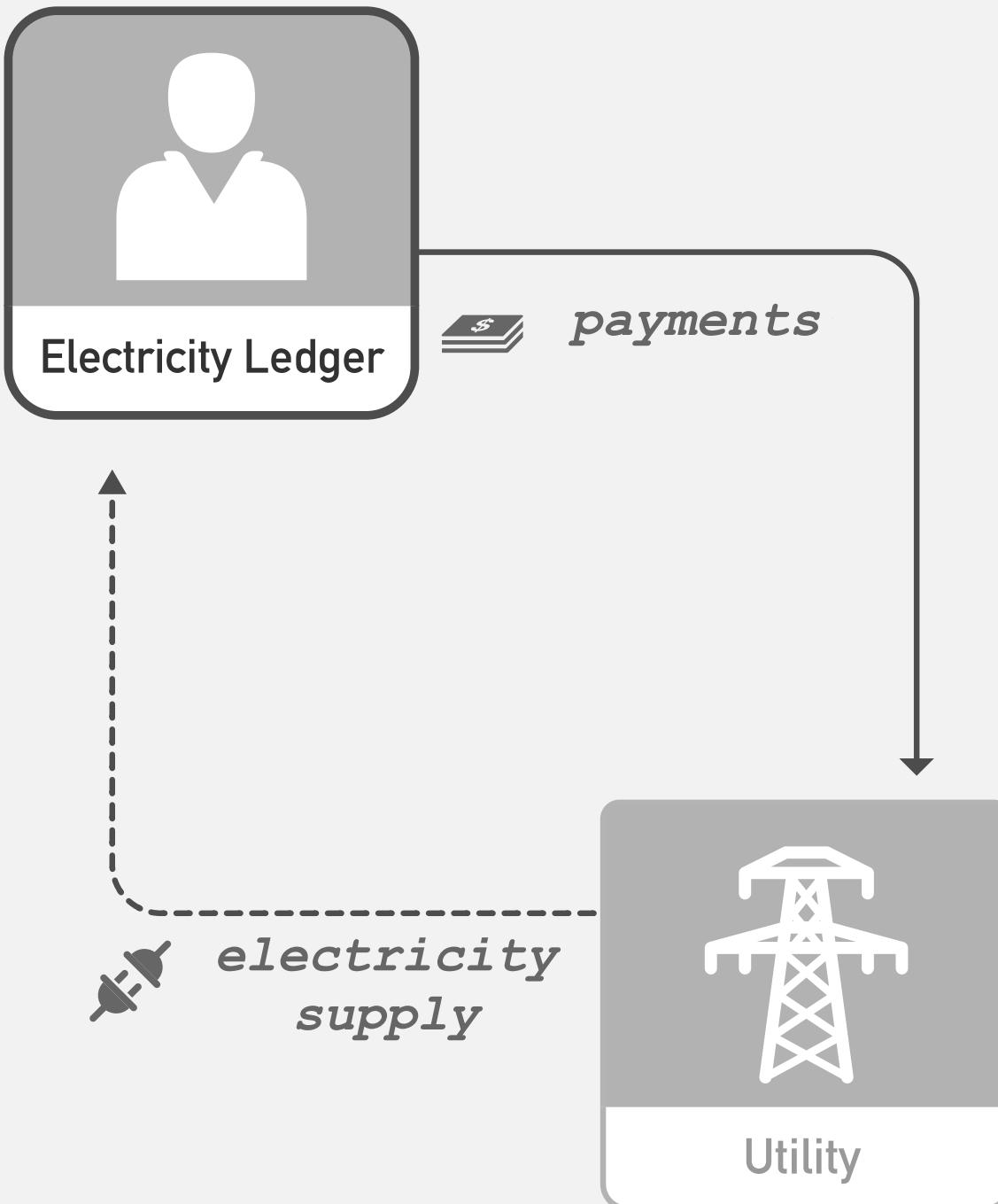
Virtueller Eigenverbrauch via Stromnetz

Auf einem hybriden Strommarkt investieren Endanwender langfristig in erneuerbare Erzeugungskapazitäten.

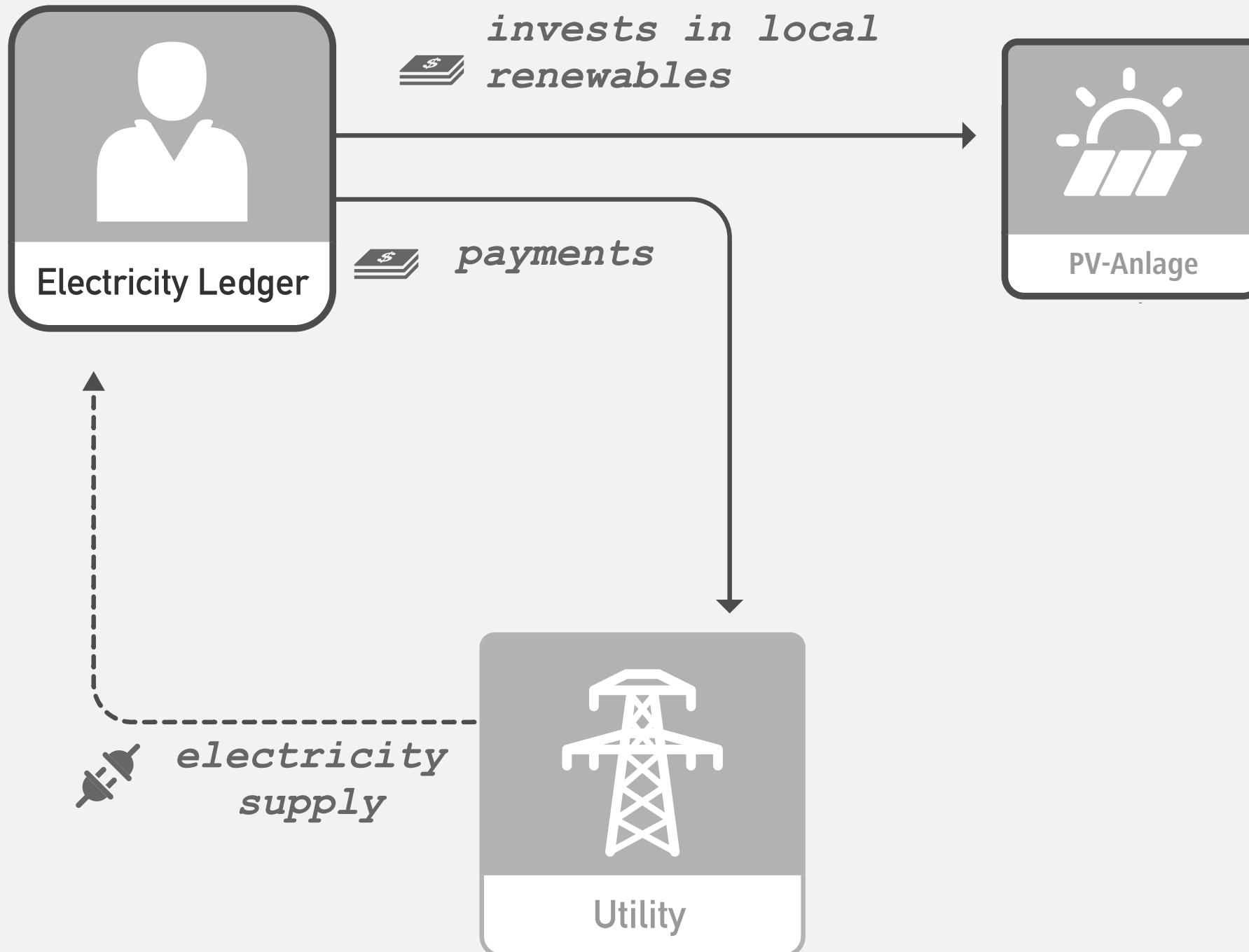
Gleichzeitig ist der Kauf und Verkauf von Ausgleichsenergie über den traditionellen Spotmarkt möglich.

Hierbei entstehen völlig neuartige Anwendungsmodelle, z. B. Eigenversorgung aus virtuellen Kobikraftwerken.

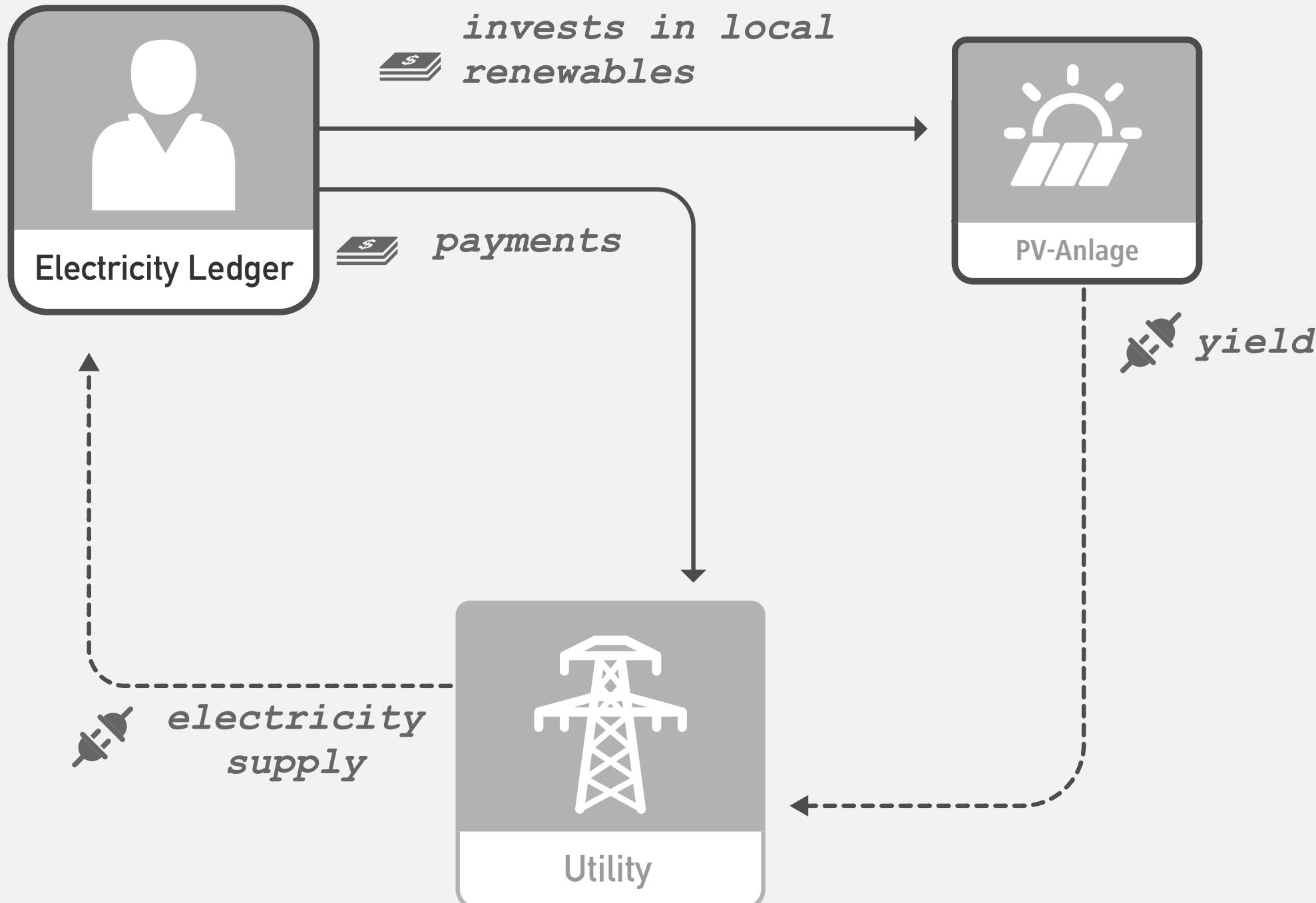
Hybridstrom



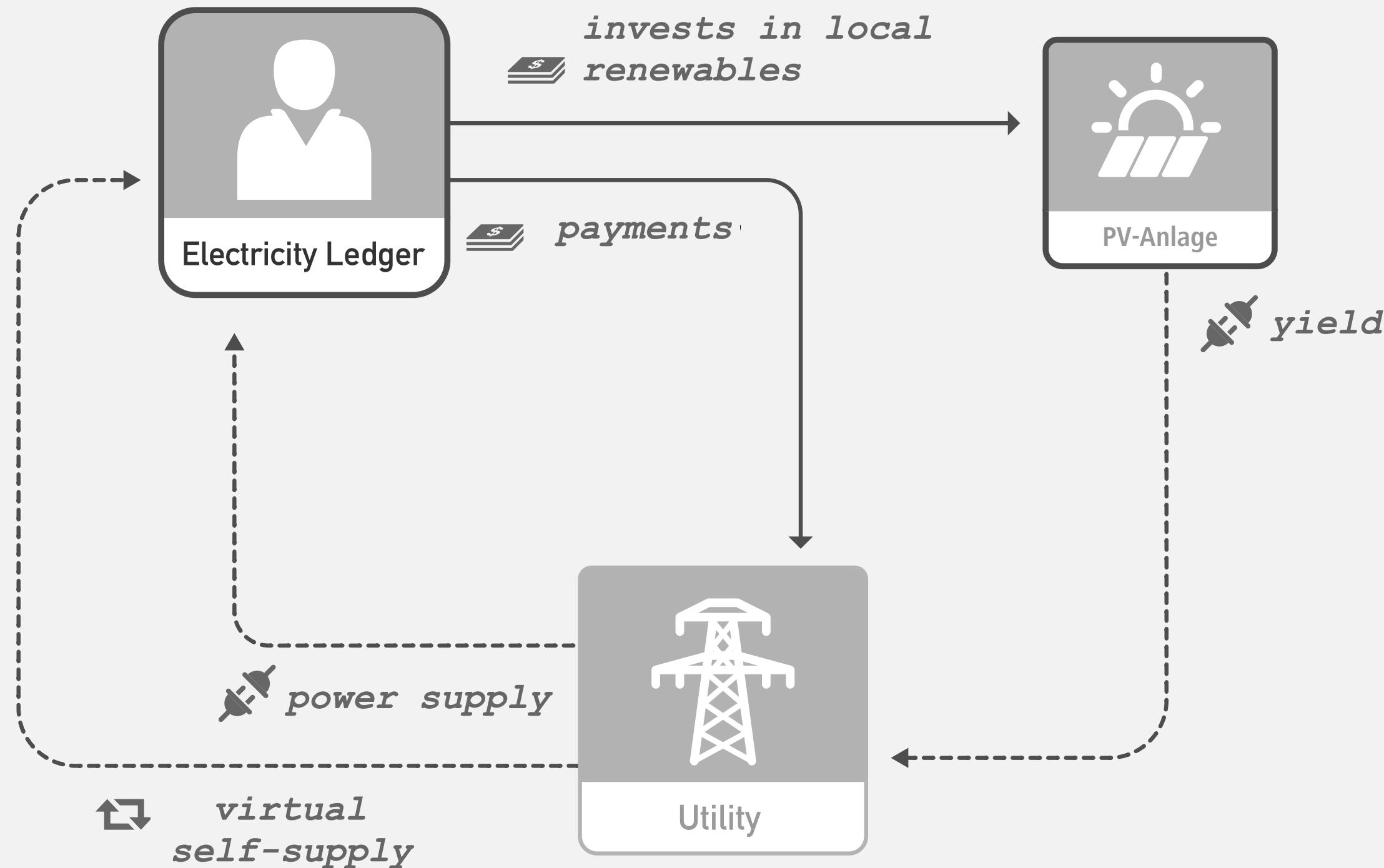
Hybridstrom



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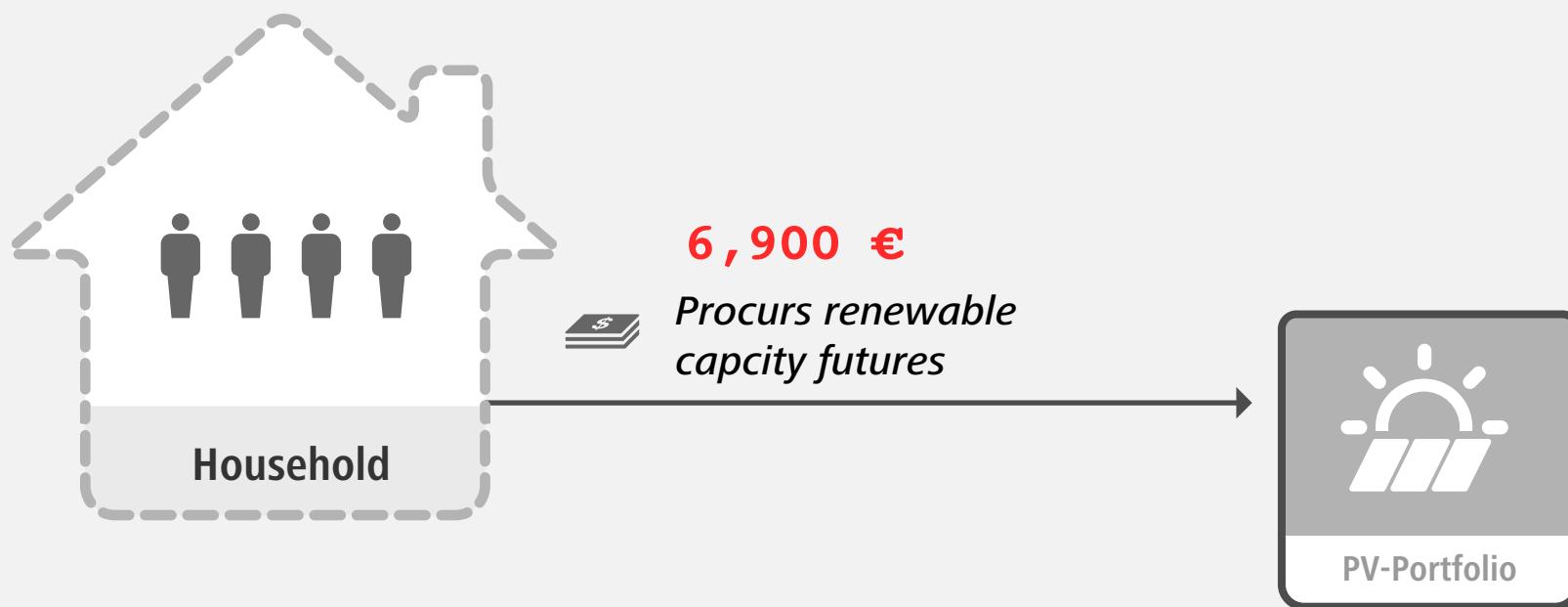
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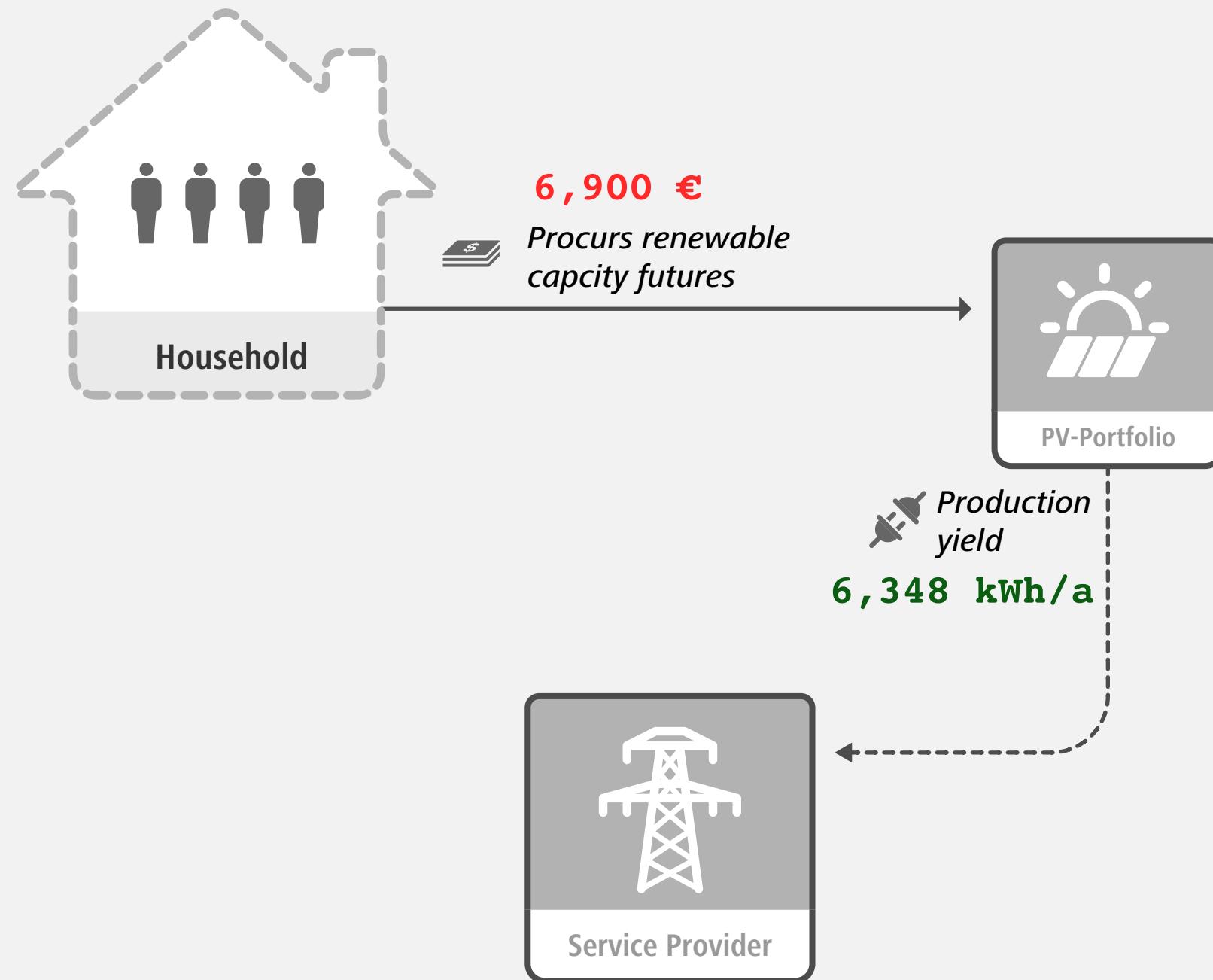
Hybrid economics

Im hybriden Strommarkt ist Photovoltaik bereits heute fast vollständig wettbewerbsfähig, ohne EEG Vergütung.

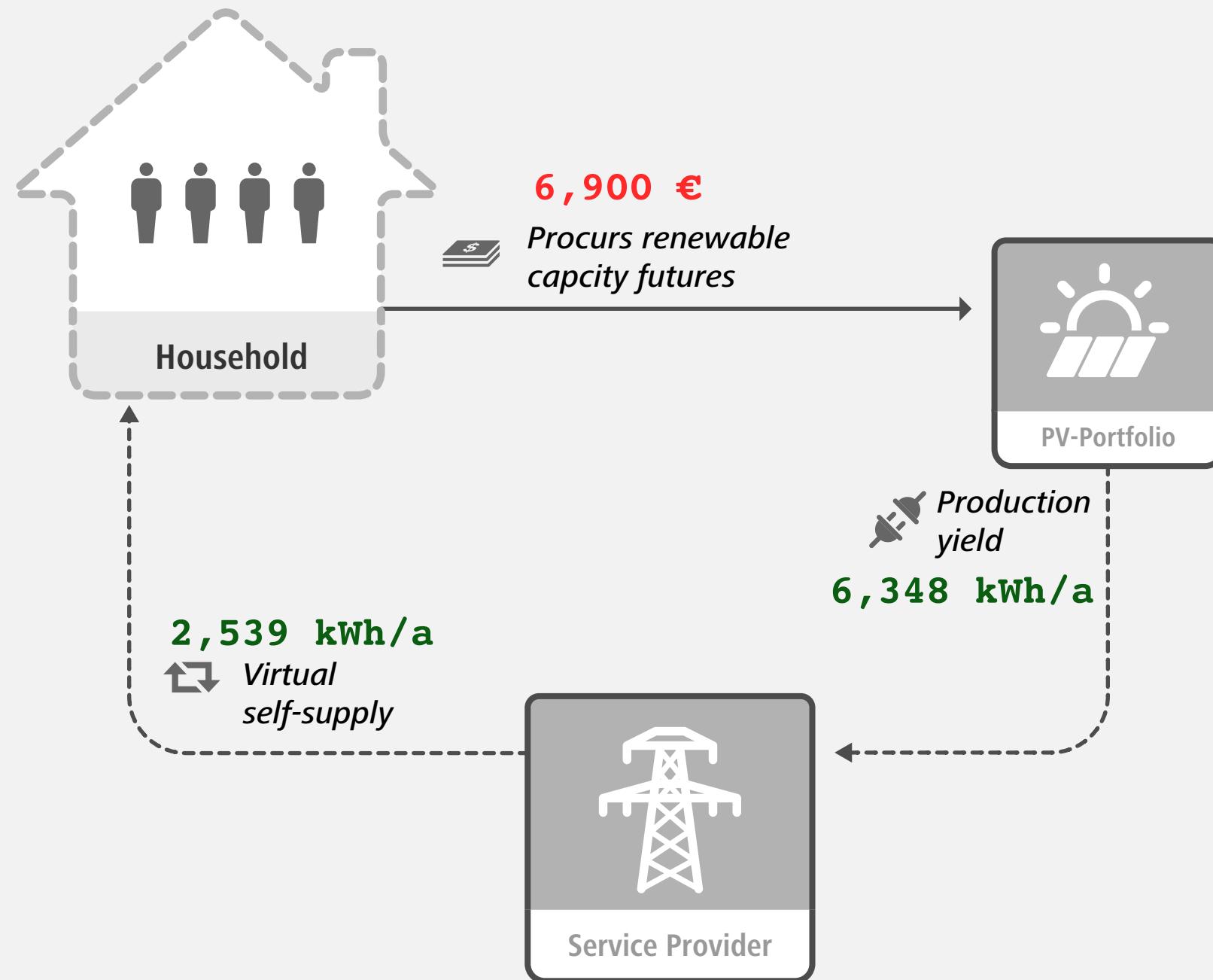
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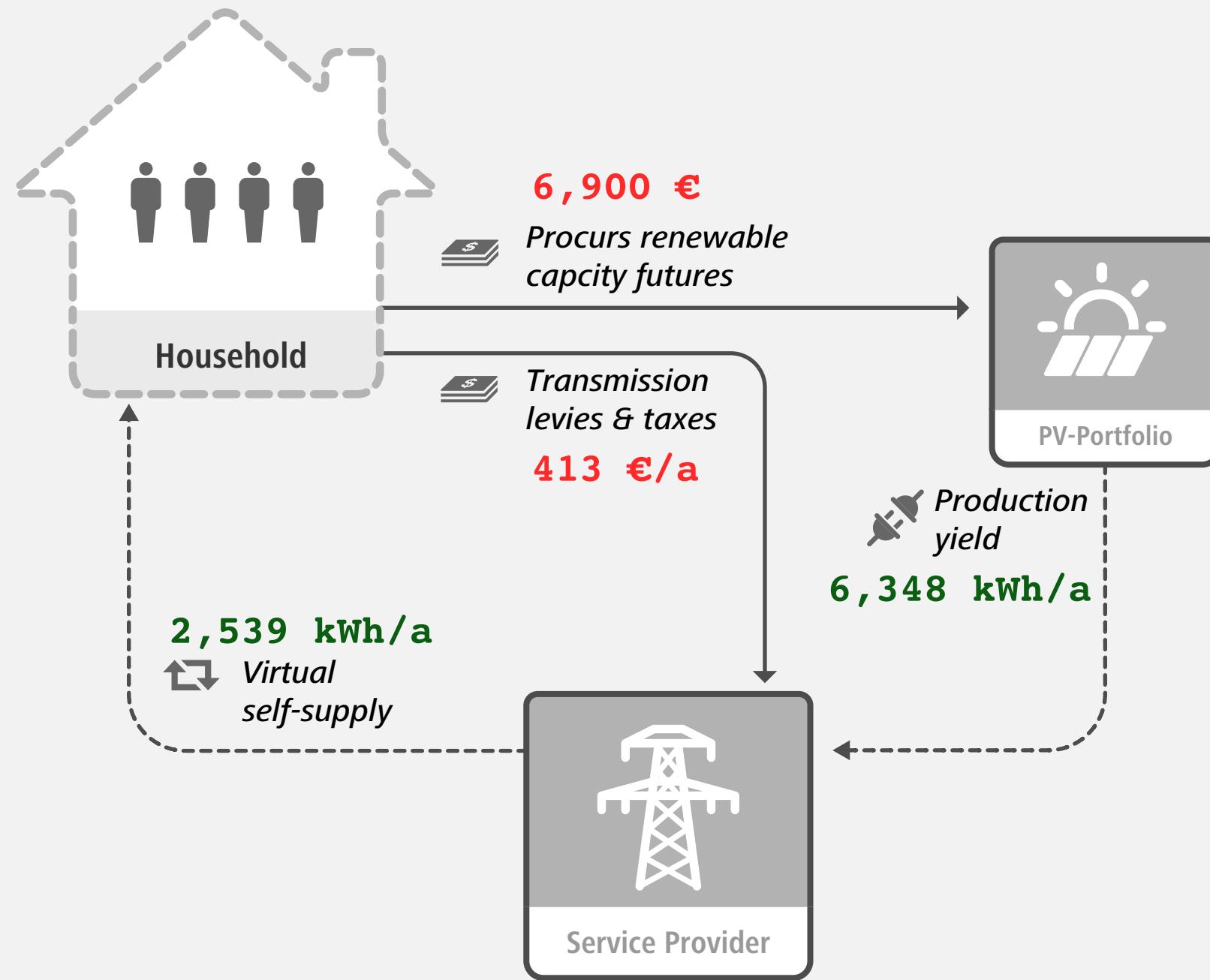
Hybrid Economics



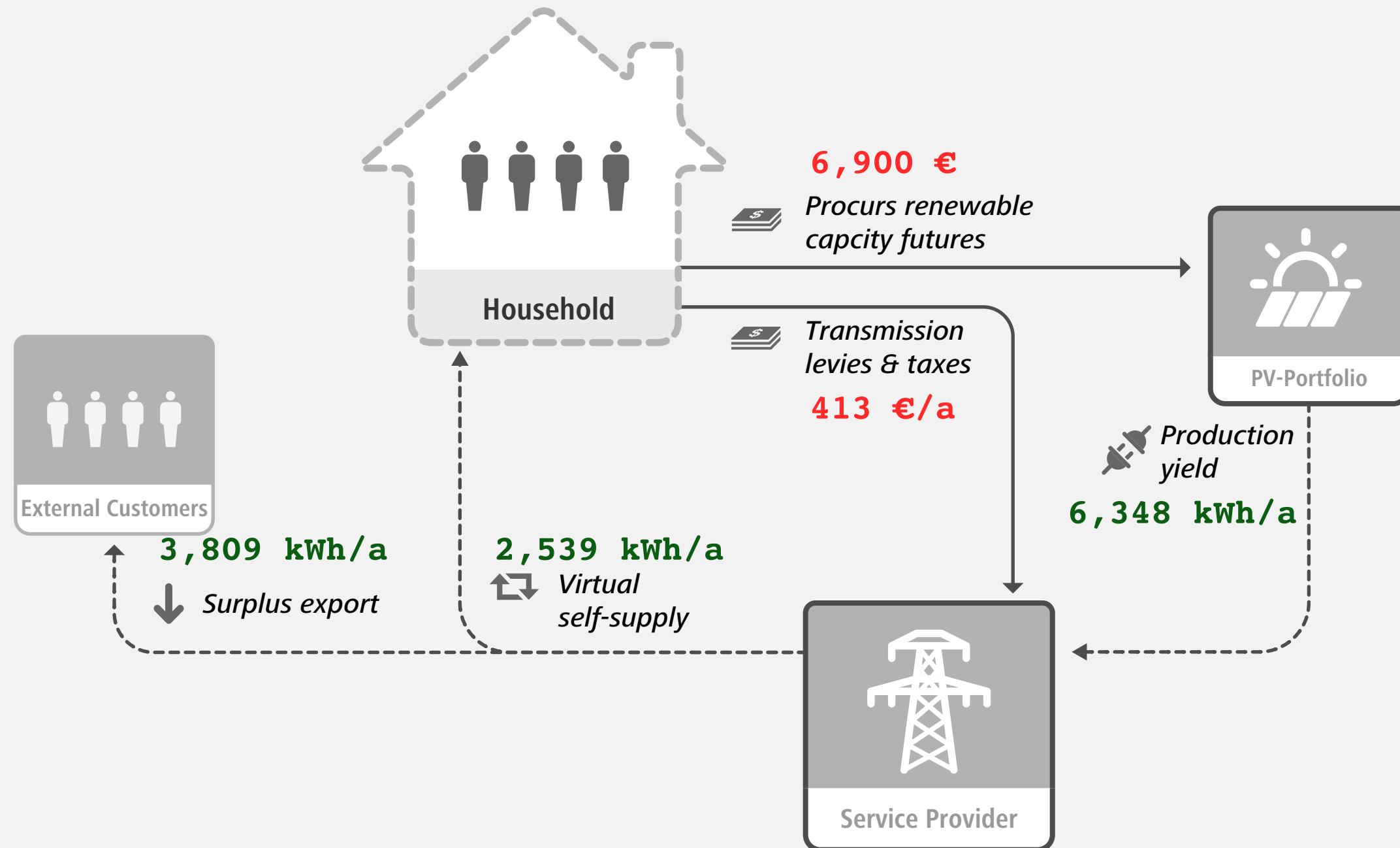
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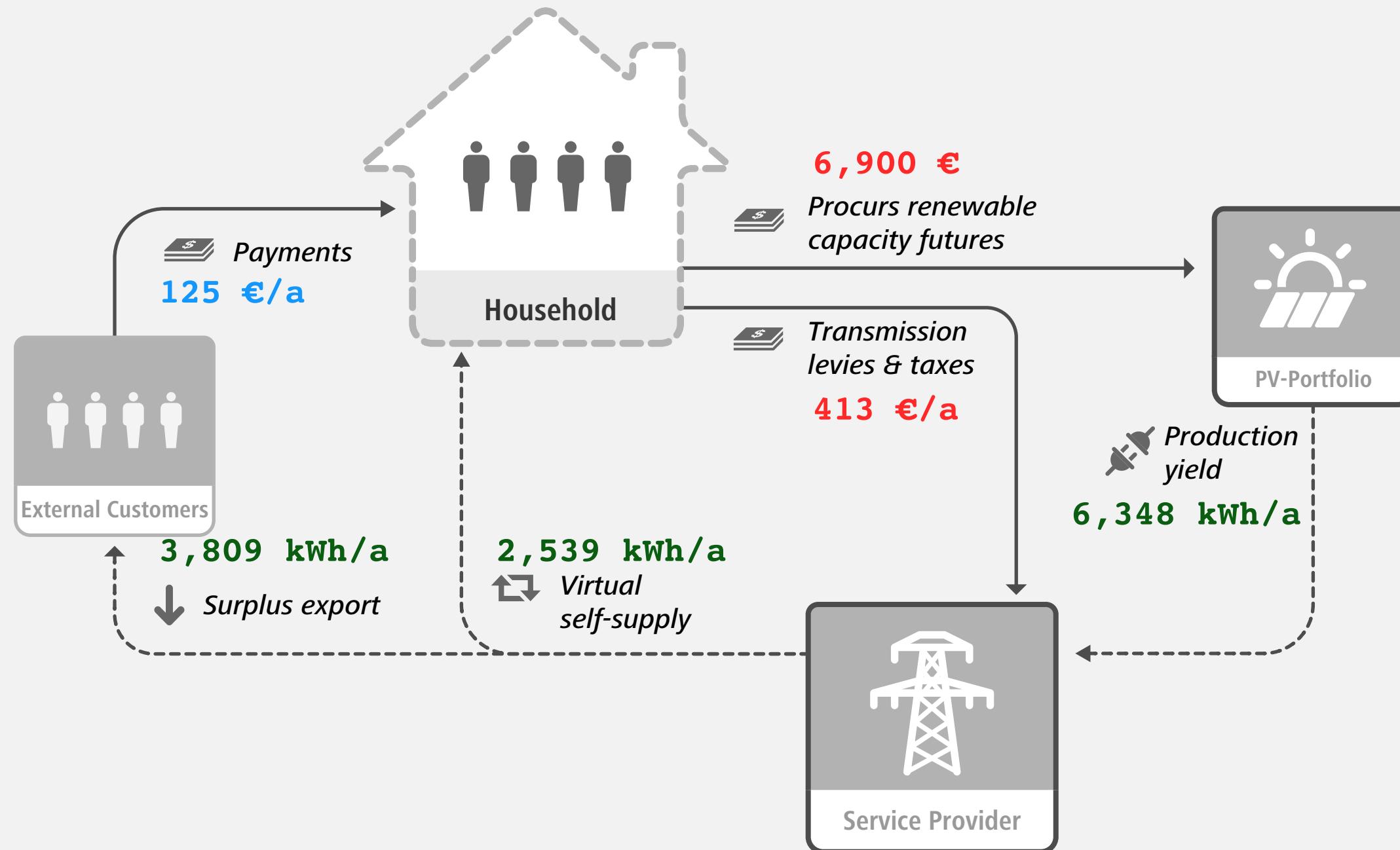
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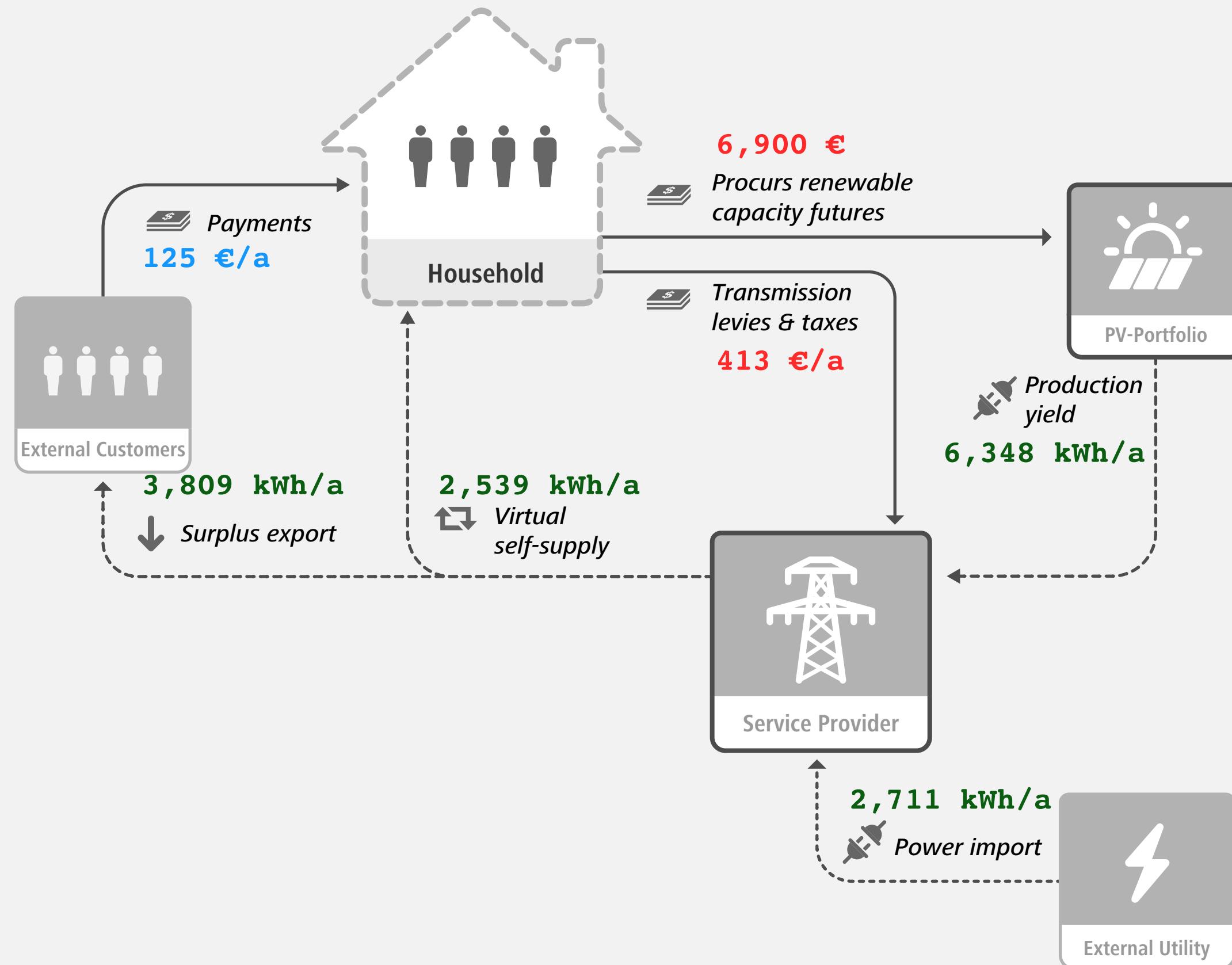
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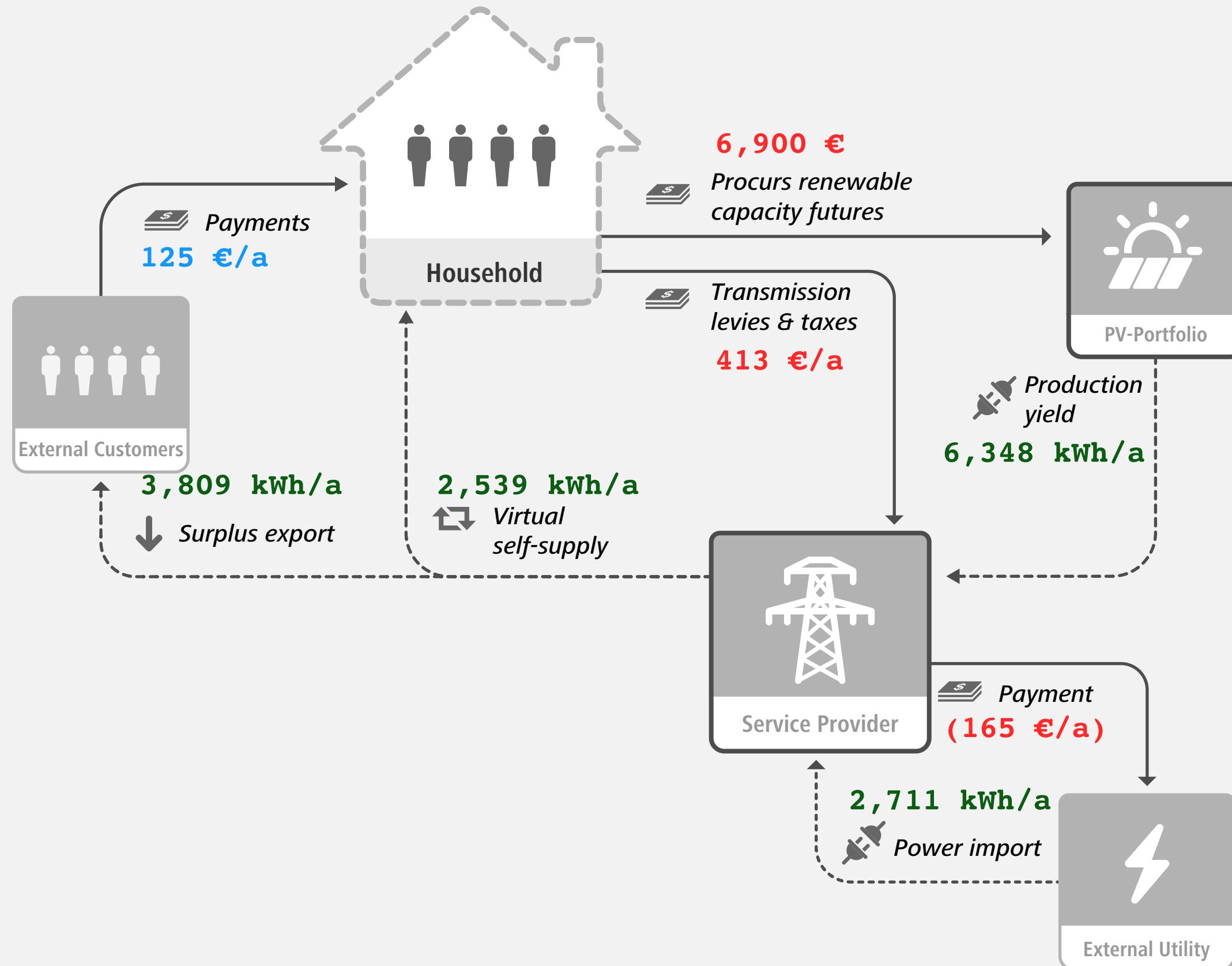
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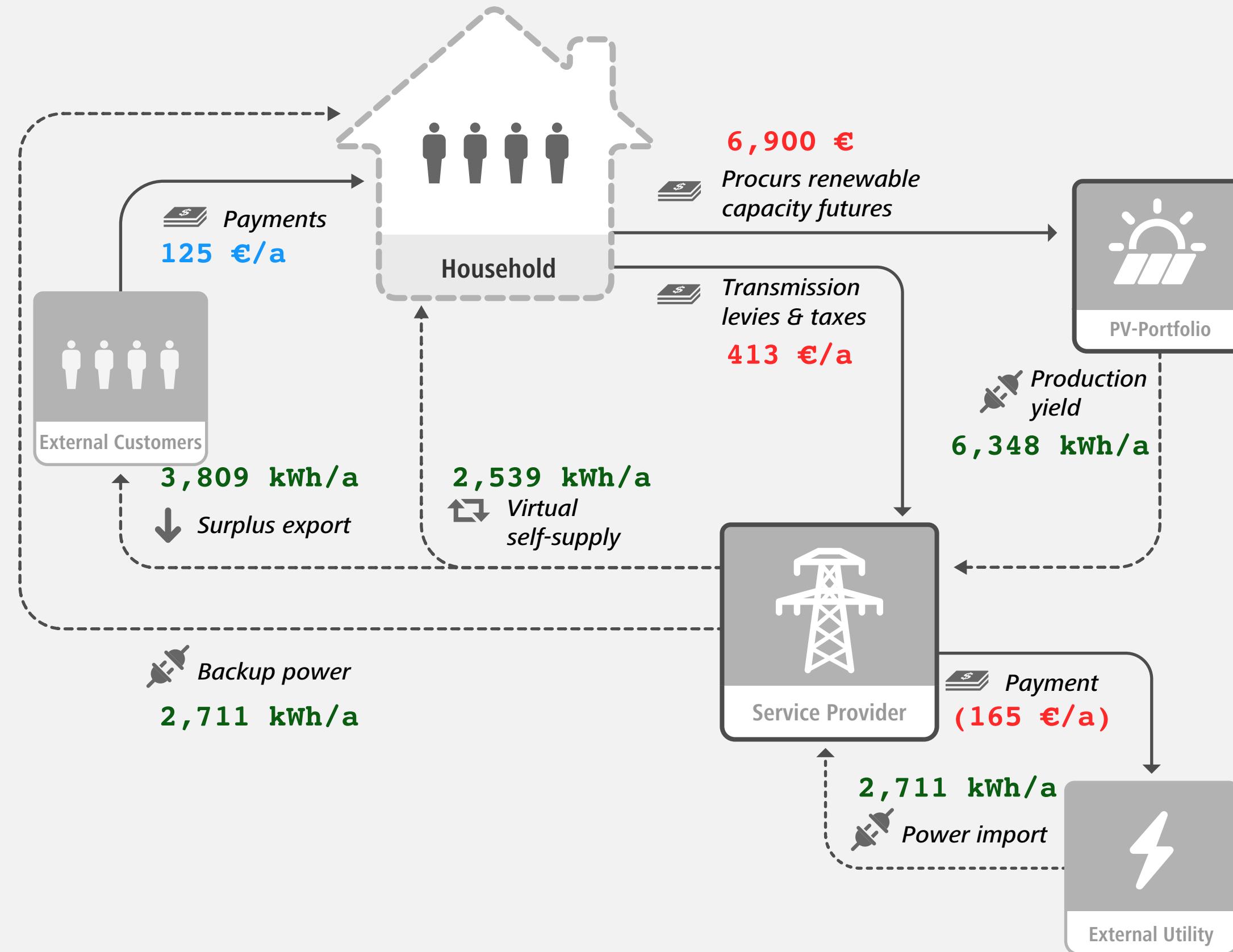
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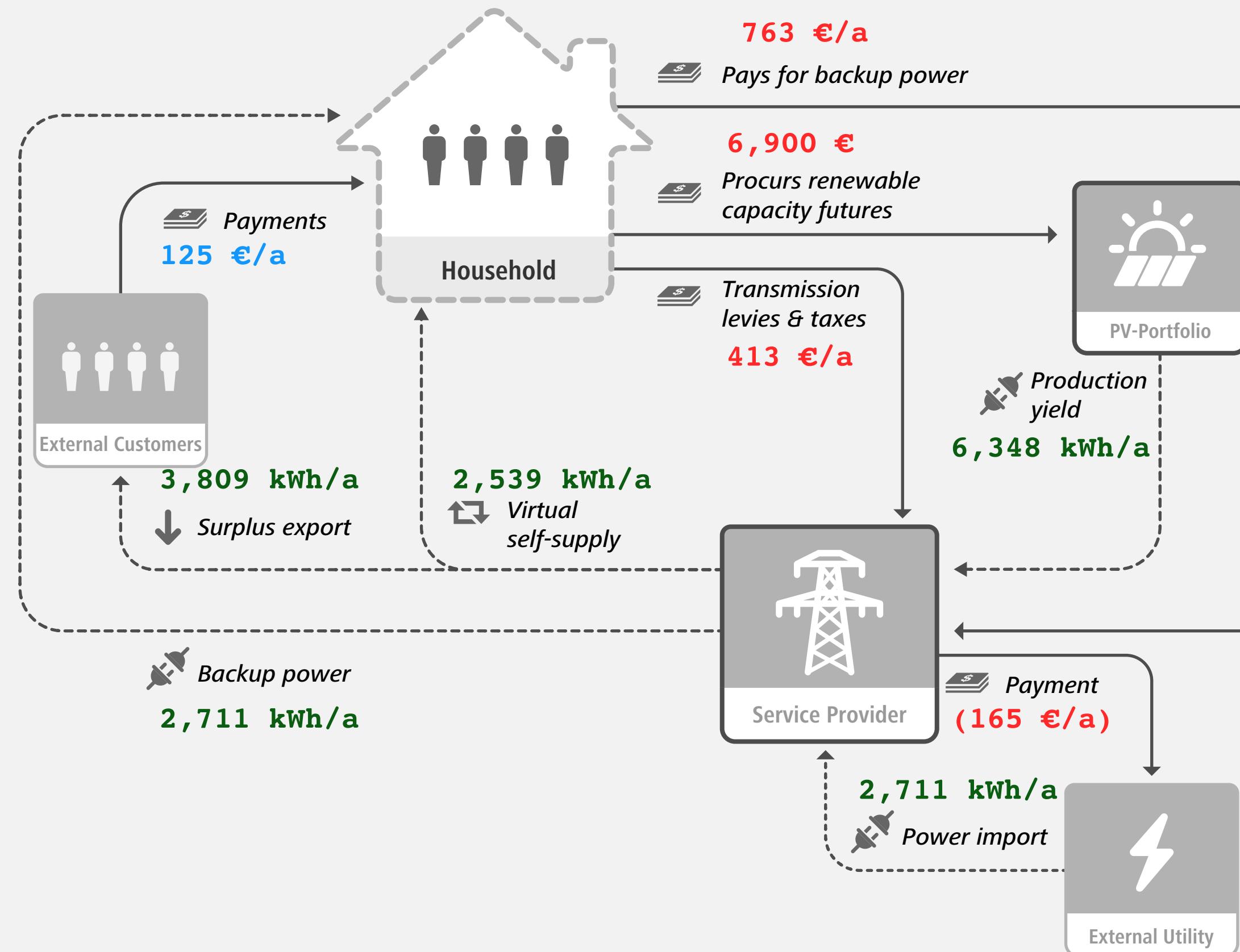
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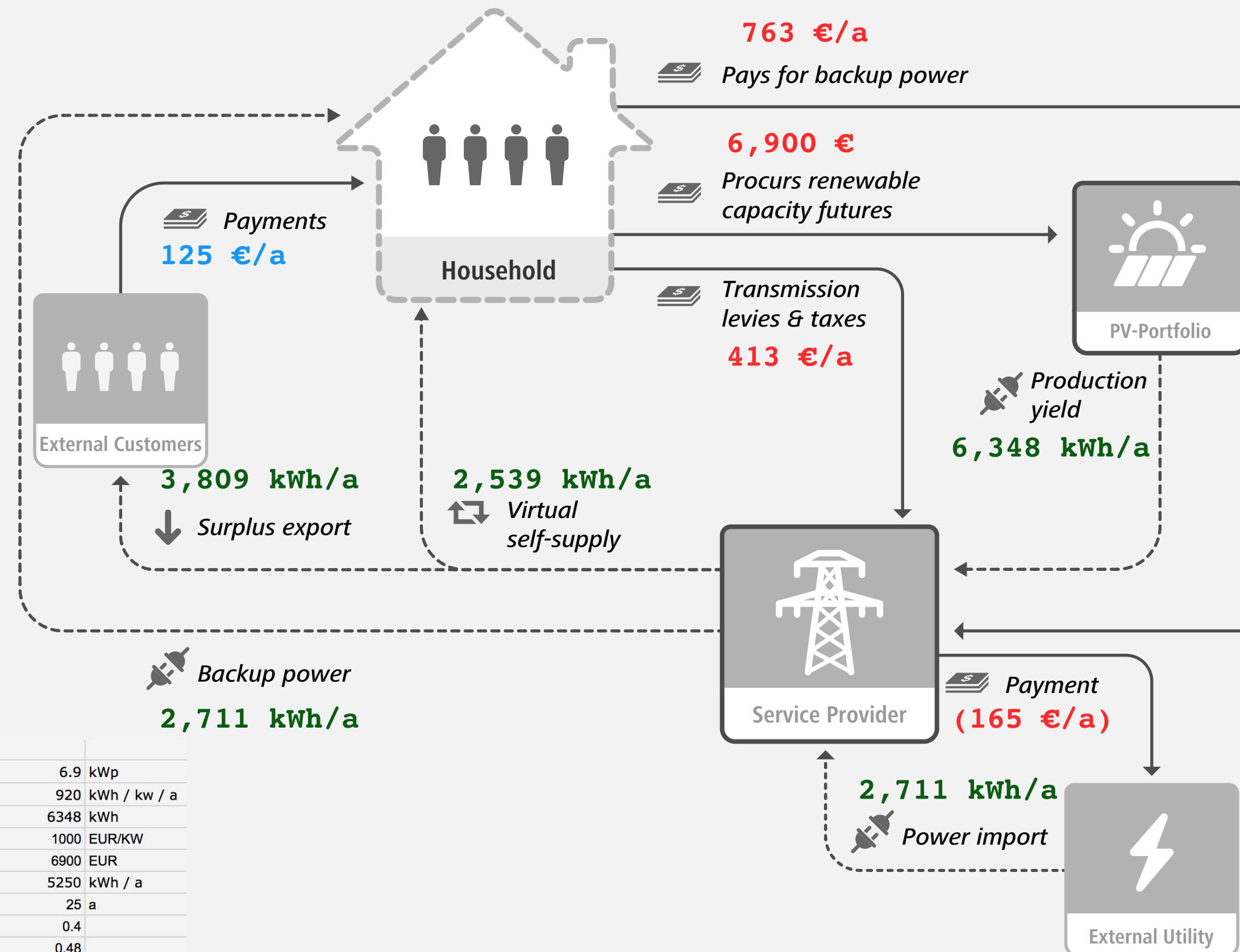
Hybrid Economics



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	

The background image shows a massive jet engine under construction or repair. Large yellow overhead cranes labeled "CMU = 4000 daN" are visible, along with various industrial equipment and structural elements of the factory. The engine itself has a prominent blue and white color scheme.

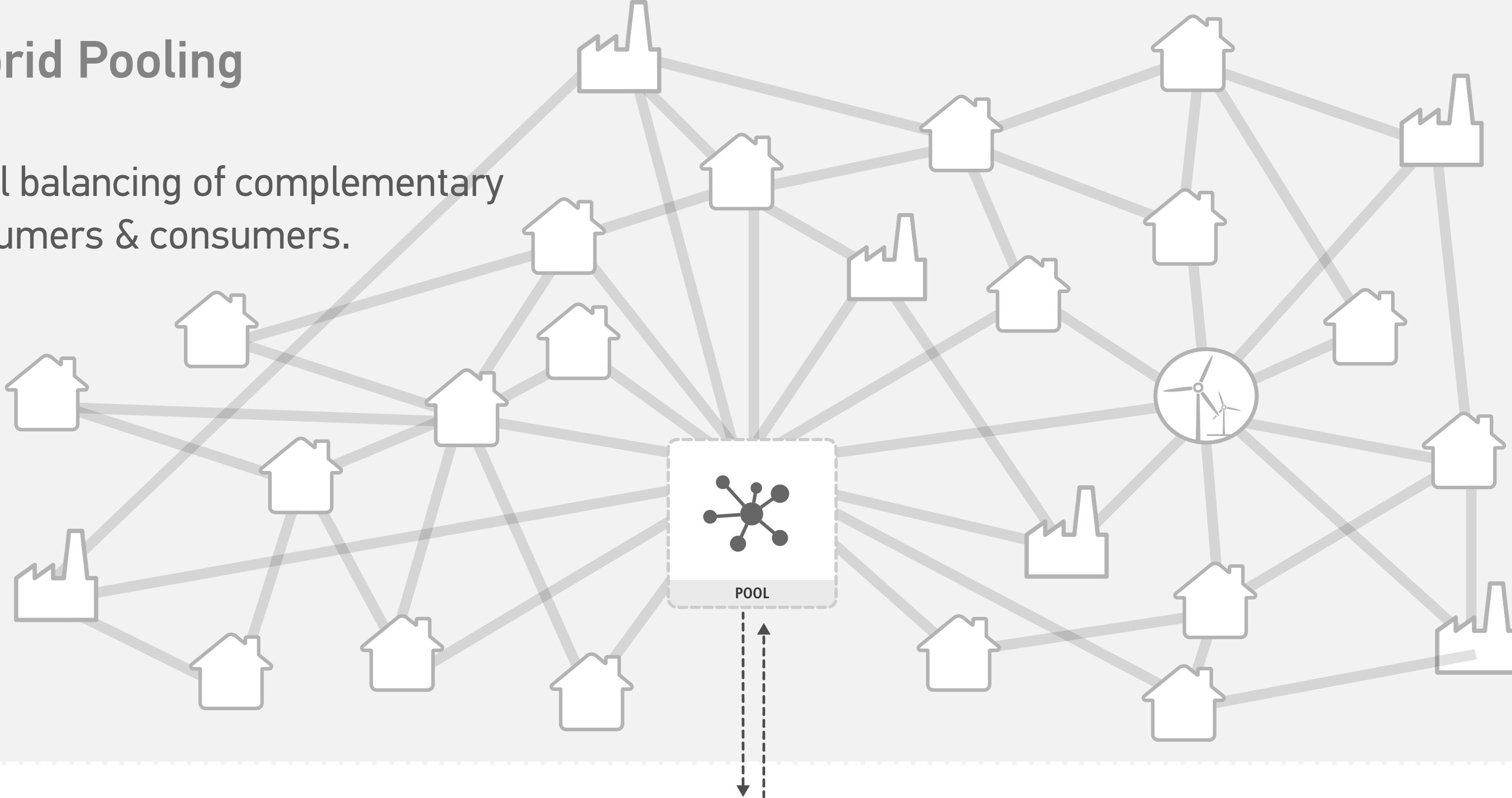
Capex is das neue Opex: Hybrid storm für die Industrie.

Industrielle Prozesse, die von grüner Energie befeuert werden.
Langfristige Preisstabilität. Operative Kosten, die sich in
Kapitalinvestitionen verwandeln.

Hybride Energiemärkte können auch in Gewerbe und
Industriekontext etliche Vorteile entfalten.

Hybrid Pooling

Local balancing of complementary prosumers & consumers.



↔ Import / Export von Energie
- z. B. über die Strombörse

An aerial photograph of a city at night, showing a dense network of streets and buildings illuminated by artificial lights. The city has a distinct grid-like urban planning pattern. A prominent feature is a large, brightly lit area in the center, possibly a central business district or a major stadium. The surrounding residential and commercial areas are also densely packed with lights.

Ein neues Ökosystem.

STROMDAO

Wir bauen die digitale Energie-
infrastruktur der Zukunft.

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