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Energy Communities: Design & Business Models

The Future of Solar Energy in Cyprus: Energy Communities

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Background

- 2015 - EU expressed the vision of “*citizens taking ownership of the energy transition, benefitting from new technologies to reduce their bills, participating actively in the market, while vulnerable consumers are being protected*”.
- 2019 - Adoption of the EU Clean Energy Package with two definitions for Energy Communities:
 - “Renewable Energy Communities” (RECs), via the Renewable Energy Directive
 - “Citizen Energy Communities” (CECs), via the Electricity Market Directive
- CECs: new type of entity due to their membership structure, governance requirements and purpose (purpose being framed around provision of services/benefits for members or the local community – as opposed to profits)
- RECs: new type of entity that can be distinguished from other market players based on, inter alia, size and ownership structures.
- Energy communities as a legal entity can cover various parts of the value chain (incl. generation, distribution, supply, consumption, aggregation etc.).

Definitions

Differences between types:

- Geographic limitation (RECs members must be in the proximity of the RE project, whereas CECs have no geographic limitations)
- Sectoral coverage (CECs' activities are limited in the electricity sector, whereas RECs can be active in all sectors)
- Technologies used (RECs are limited to RE technologies, whereas CECs can develop and use all technologies)
- Membership (in both cases, the members can be regional authorities, natural persons and small enterprises, but in the case of RECs the private entities need to have a different primary activity).

*However, the term “**Energy Communities**” is often used to refer to CECs and RECs collectively*



Characteristics

- Often, energy communities are focusing on jointly investing in nearby RES projects, participating in the simple investment opportunity and respective returns.
- Also they can provide more complex solutions, such as self-consumption combined with storage, p2p-trade, balancing, where management of the distributed energy resources (even of the distribution grid and trading), becomes increasingly important.
- Value propositions related to energy communities may be very diversified and include:
 - Local energy supply
 - Sustainable energy supply
 - (Partial) energy autonomy
 - Technology preference for distributed energy sources (over centralized or large-scale RES installations)
 - Independence from national energy policy and large incumbents
 - Active participation of citizens in the shaping of the energy context

Characteristics

- In Europe, there are about 3,500 so-called renewable energy cooperatives - a type of energy communities, found mostly in North-Western Europe
- Community energy projects exist in diverse forms across Europe. Energy generation is the most popular.
- Energy communities are very diverse regarding organizational models and legal forms. The most common type are energy cooperatives, established since the introduction of renewables support schemes.
- Additional types: Limited partnerships, development trusts, and foundations
- Bottom-up energy-related projects driven towards local needs, characterized by strong citizen participation, local ownership, decision-making with a single vote per actor and sharing of collective benefits



Energy business models

Business models:

1. Customer-side business models

2. Third-party-side business models

3. Generic energy community business models



1. Customer-side business models

- Based on the direct purchase of energy technologies by end-users, who aim to become prosumers/prosumagers or take advantage of DSM programs
- Approaches: ‘all sold to the grid’ or ‘self-consumption with surplus sold to the grid’
- High up-front costs and long-term payback periods
- Different ‘key activities’ of the two customer-side BM streams: local energy generation, self-consumption and selling vs changing consumption patterns
- Different ‘cost structure’ and ‘revenues streams’: in prosumerism BM, assets purchase, installation, reparation and maintenance, and grid interconnection costs are included. In customer-owned DSM BM, costs are smaller as the required DSM enabling devices are usually cheap and customers expect to be financially compensated by savings



2. Third-party-side business models

- Fully financed by third-party companies, typically utilities, which maintain control and ownership (assume the related costs and risks)
- Value proposition: the creation of valuable energy services and remuneration streams
- Assets installed either on customers' roofs and backyards, or in the vicinity if there is lack of space
- Aim to consume renewable electricity – DSO must be involved as partner and may also deliver DSM-based services
- Goal for companies: aggregate customers' demand flexibility and sell it to a system operator
- Also, provide EE services: energy audits, provision of space heating, lighting, etc.

3. Generic energy community business models

- Community members must be financially involved and the ***whole BM must be created by, for, and with them***. Members should be considered in the overall arrangement design, implementation and operation, influencing how the ECBM value is generated and the risks and costs are shared
- Key activities: local generation, supply, storage, consumption, trading, aggregation, e-mobility, and energy related services, as well as system administration
- Key resources: the members, the available area for implementing generation and storage facilities, the financing resources to implement and manage the project, and technical know-how, which can be outsourced (and considered in the 'cost structure').
- Most energy communities have been primarily involved in local generation and self-consumption but can also become local DSO

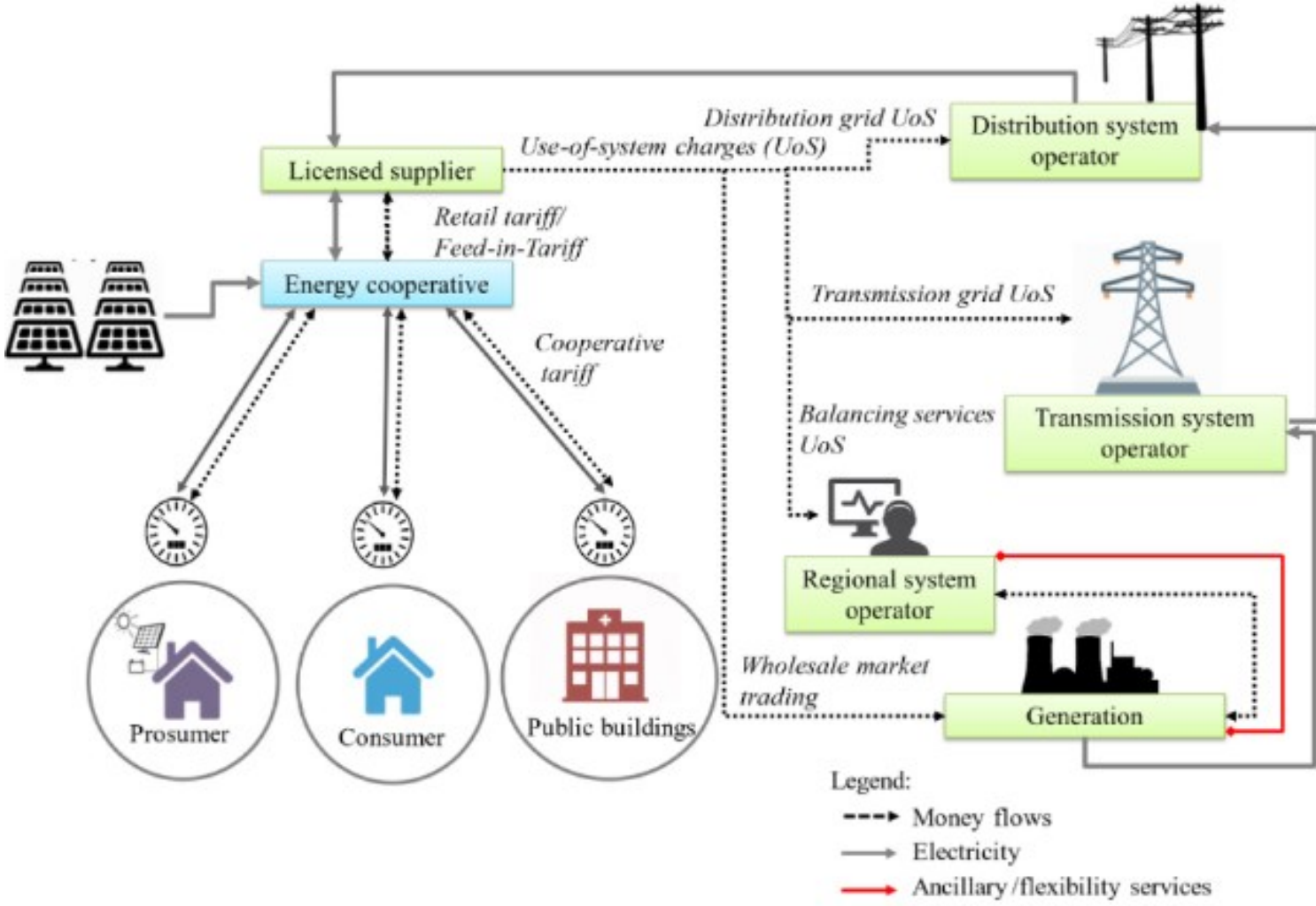


Archetypes

Energy community business models archetypes

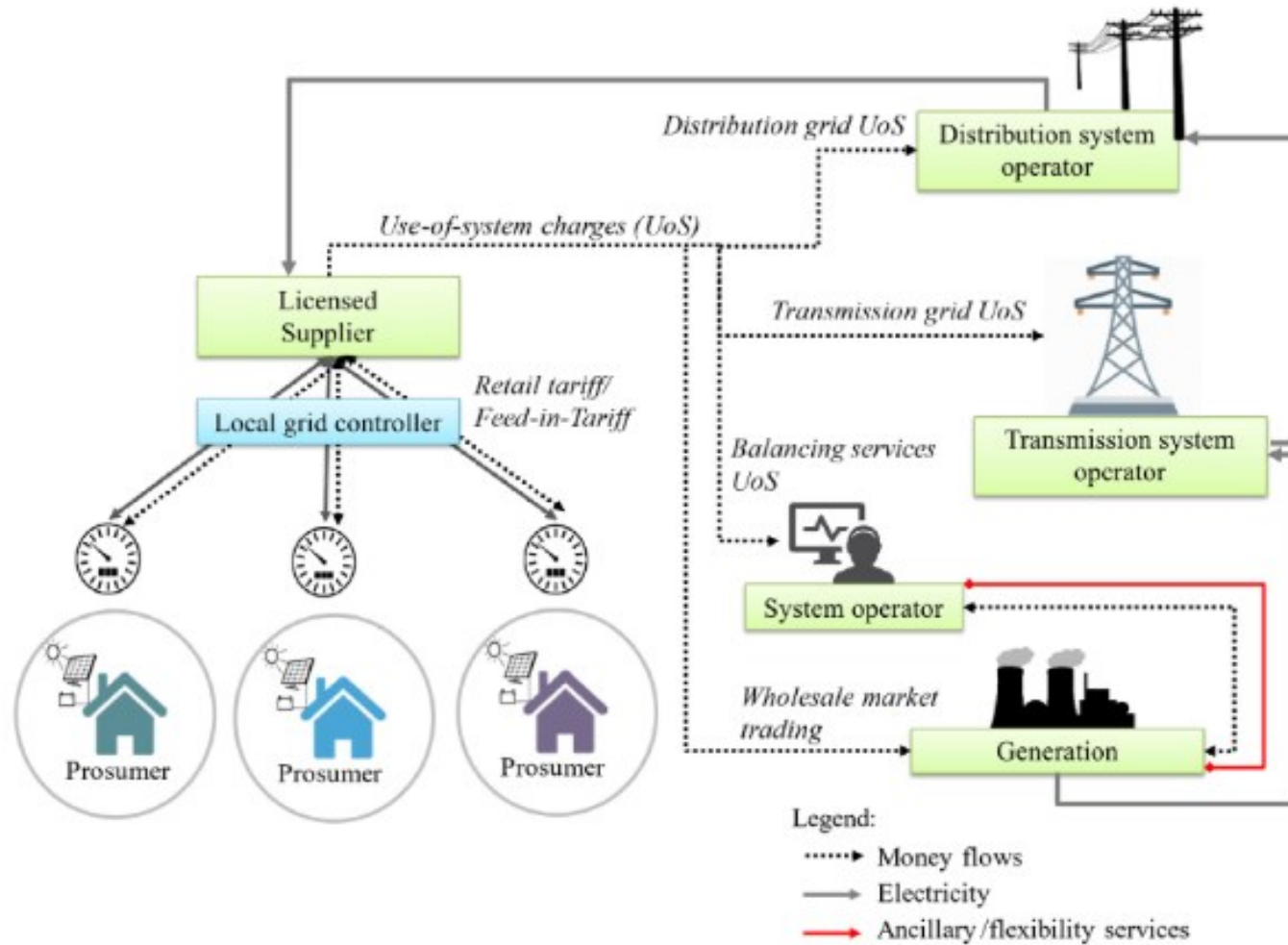
1. Energy Cooperatives
 2. Community prosumerism
 3. Local energy markets
 4. Community collective generation
 5. Third-party-sponsored communities
 6. Community flexibility aggregation
 7. Community ESCO (Energy Service Companies)
 8. E-mobility cooperatives
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1. Energy Cooperatives



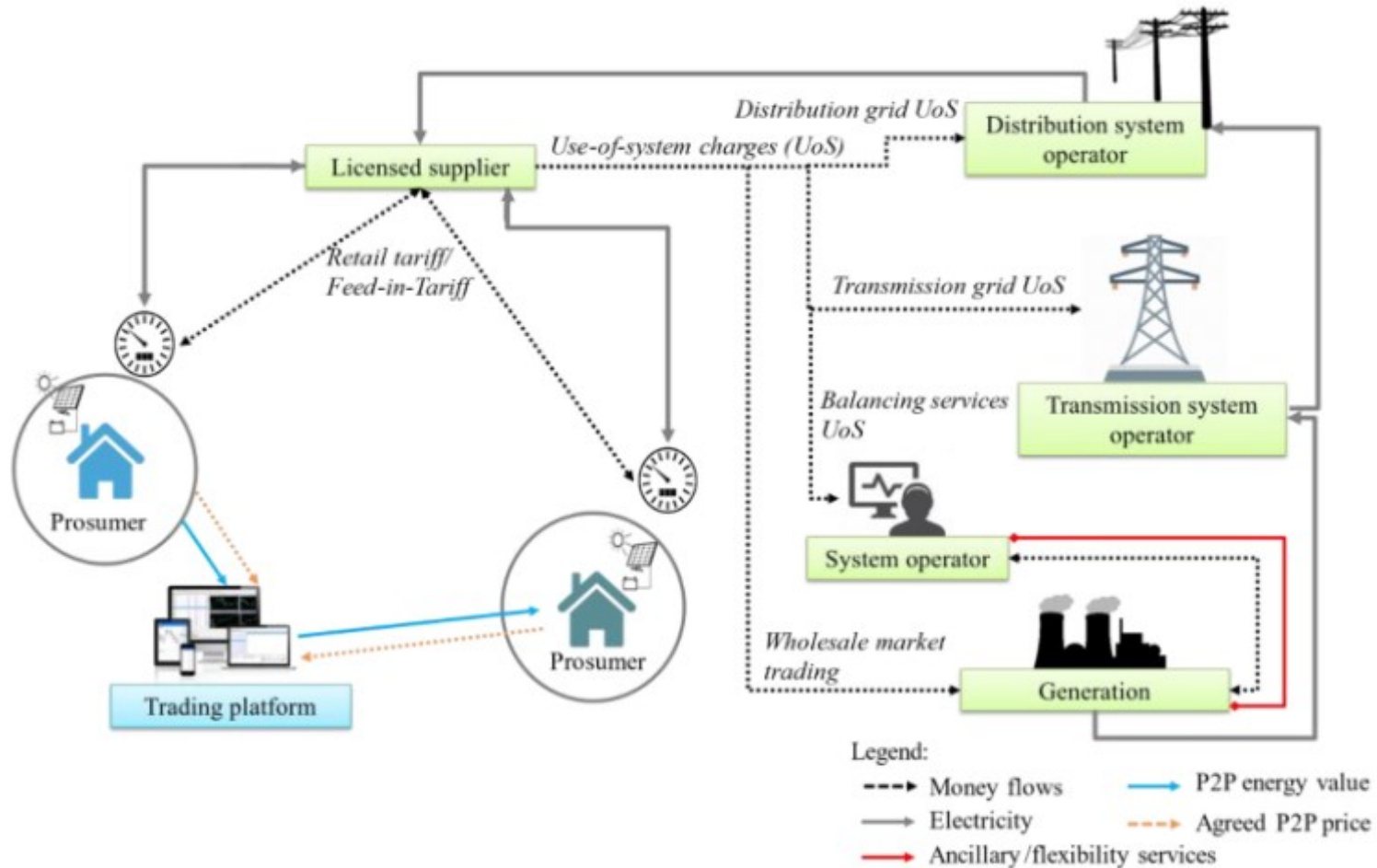
(F.G. Reis et al., 2021)

2. Community prosumerism



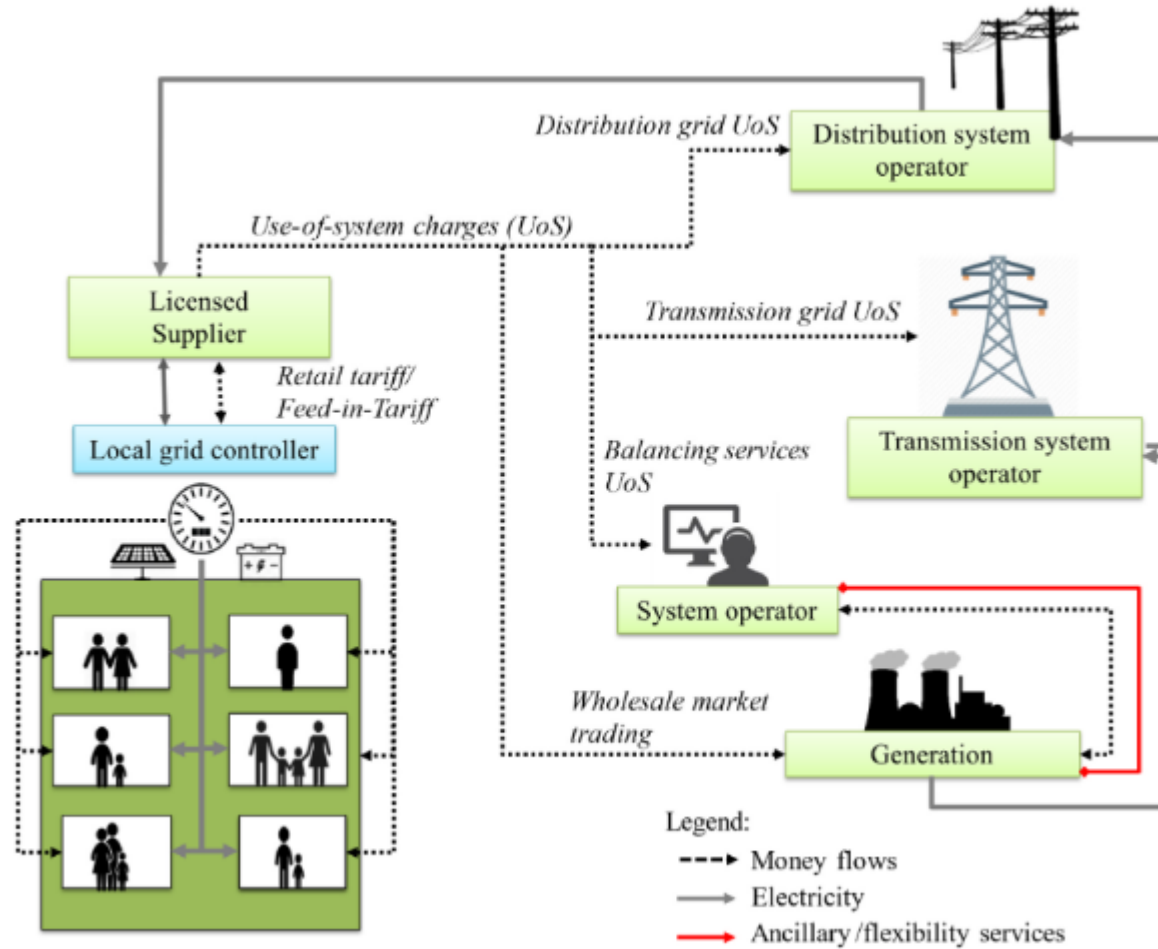
(F.G. Reis et al., 2021)

3. Local energy markets



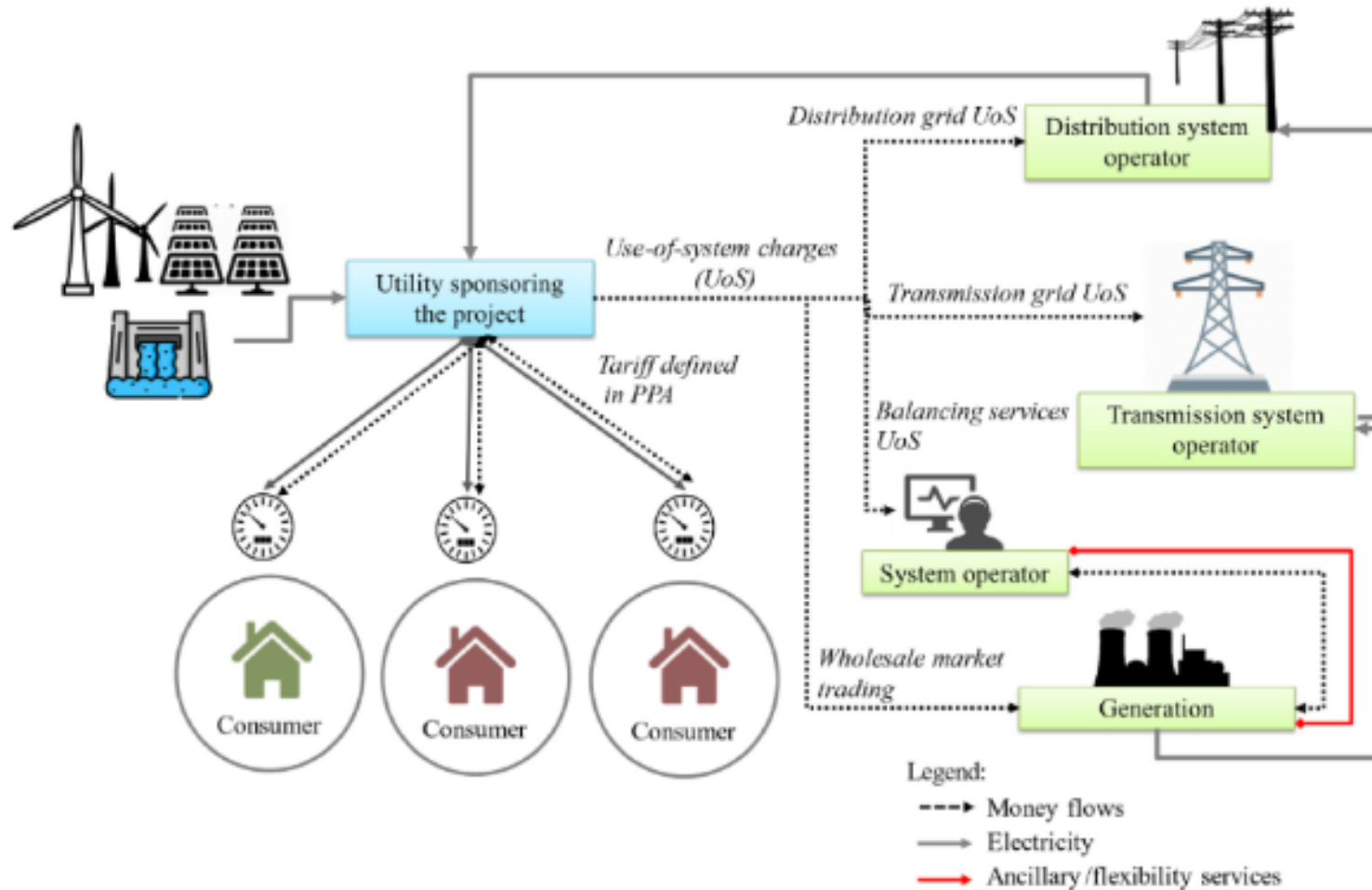
(F.G. Reis et al., 2021)

4. Community collective generation



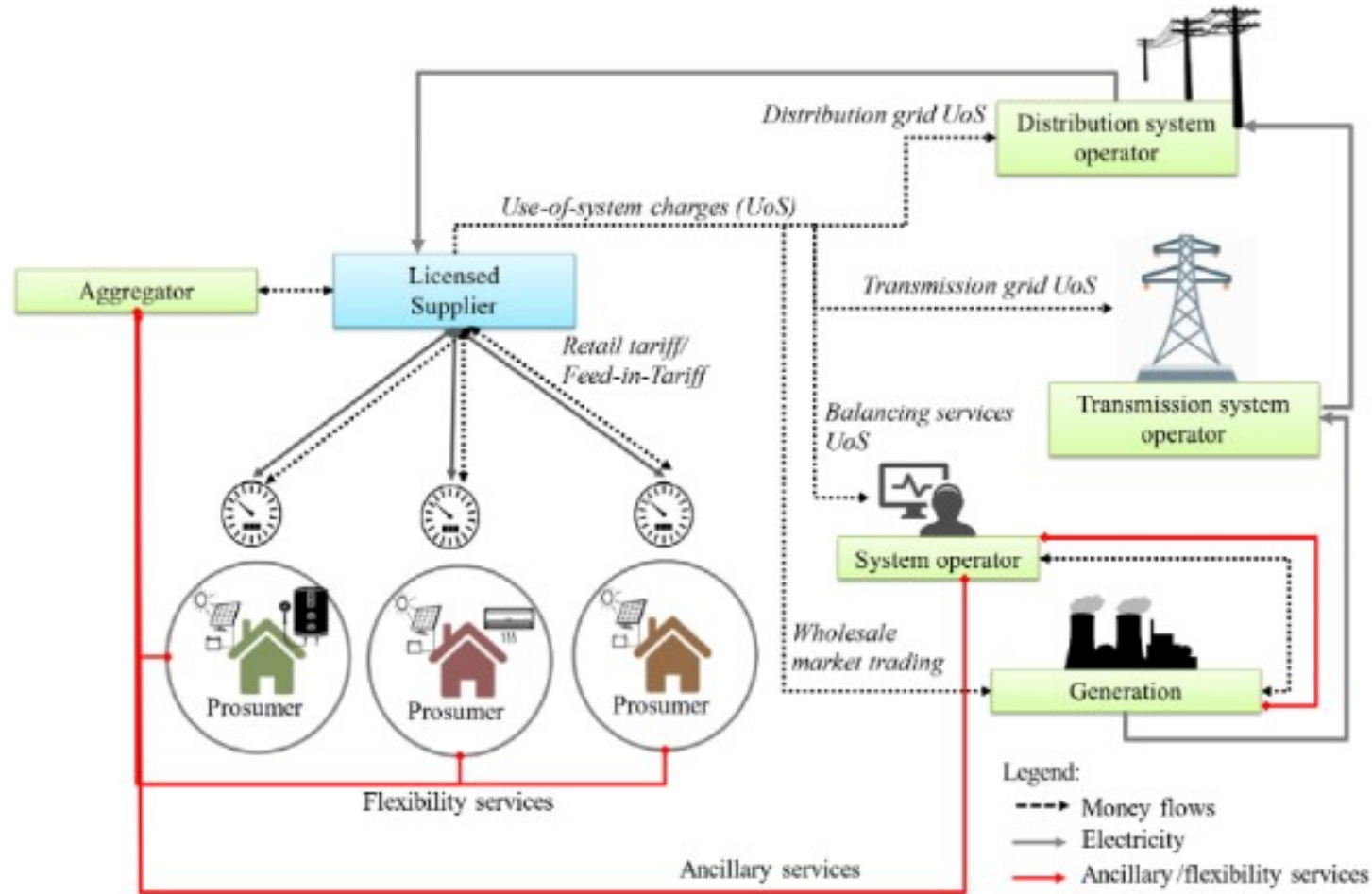
(F.G. Reis et al., 2021)

5. Third-party-sponsored communities



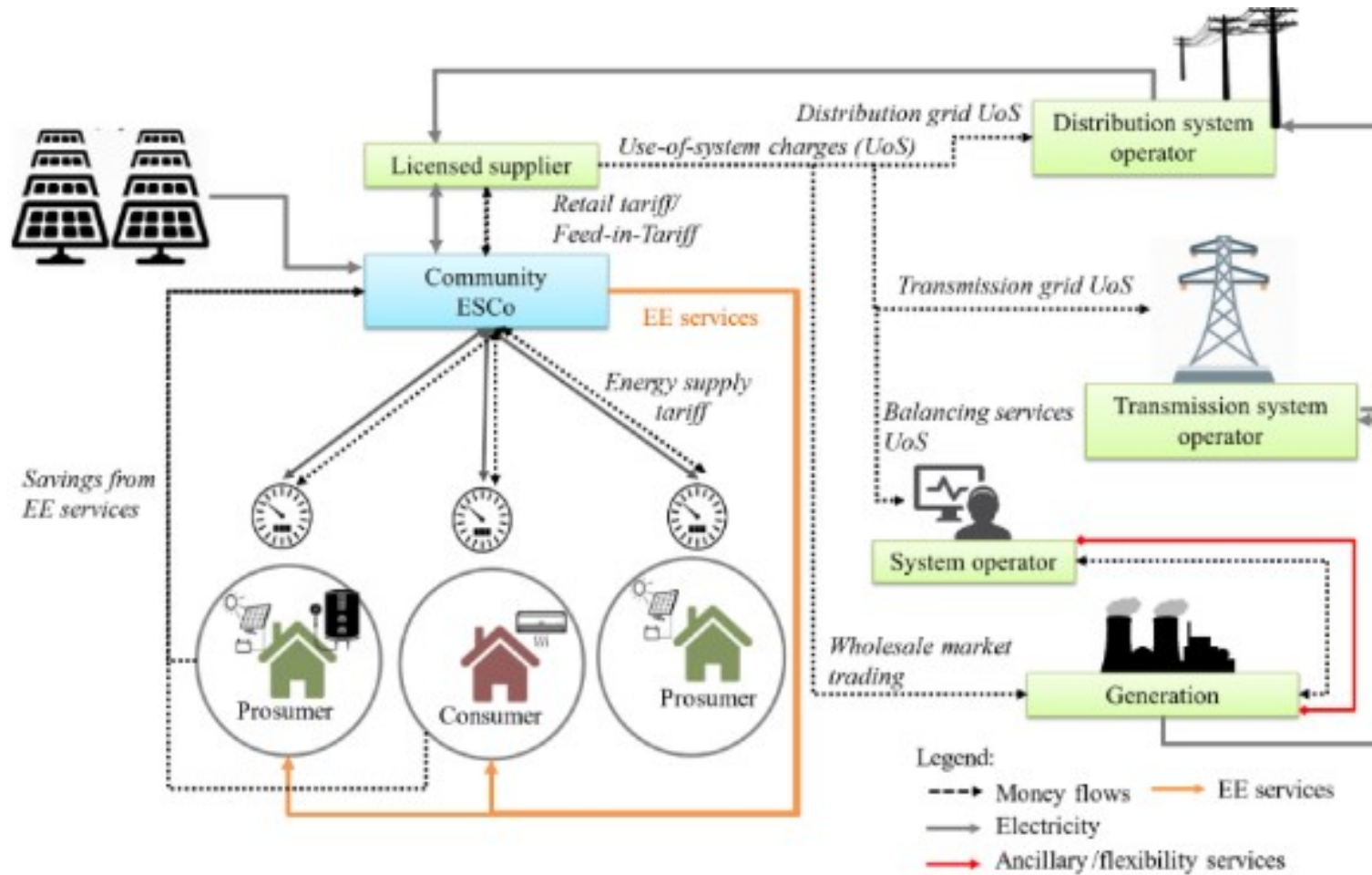
(F.G. Reis et al., 2021)

6. Community flexibility aggregation



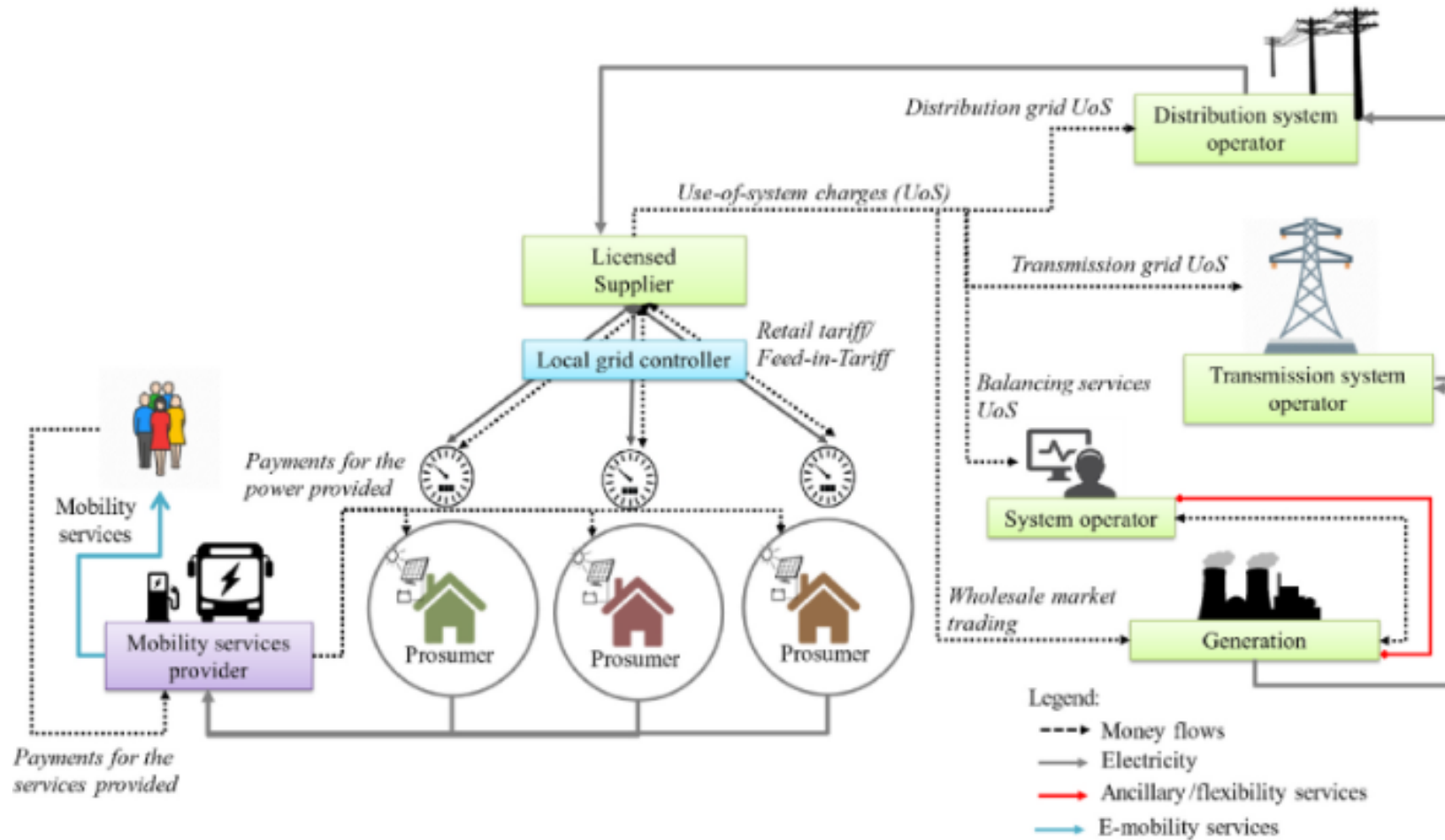
(F.G. Reis et al., 2021)

7. Community ESCo



(F.G. Reis et al., 2021)

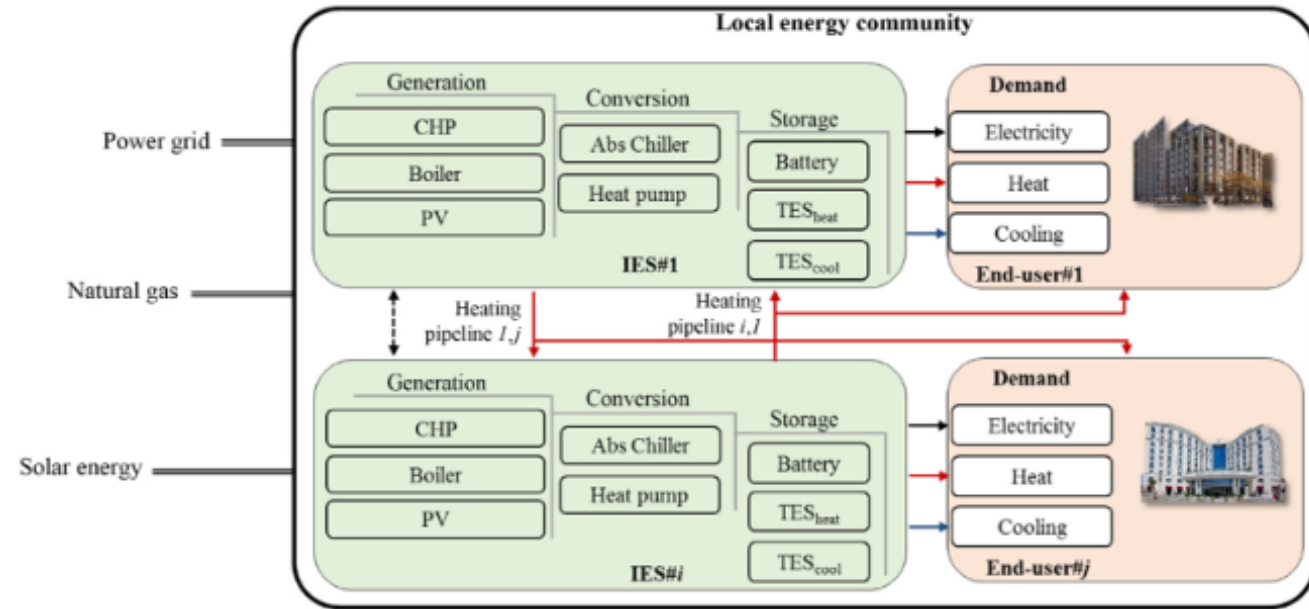
8. E-mobility cooperatives



(F.G. Reis et al., 2021)

Design methods

- Several models exist regarding the design and operation of energy communities:
 - Optimization models for Distributed Energy Systems: Optimal configuration, design, and operation of energy systems
 - Multi-agent approach: Optimize the goals of each agent (e.g. consumers)
 - Models for fair revenue sharing (e.g. Shapley value which gives each member a share of the whole value proportional to the average of his/her marginal contributions to all possible coalitions)



(Yan et al., 2021)



Conclusions

- Multiple options of possible business models in energy communities
- The majority are involved in self-consumption and surplus generation trading
- Aiming to engage citizens in local energy generation and achieve some autonomy from the power grid
- Energy cooperatives the most popular option: the initial shared investment and the provision of the complete value chain (generation, distribution, and supply)
- REC the most prevalent type
- Most of the existing projects are financial supported by small local investors (involved as asset owners, investors, and consumers). Third-party investment mostly used to create value in low-income zones
- Emerging models to allow communities controlling their distribution network and develop local energy markets

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Thank you for your attention

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