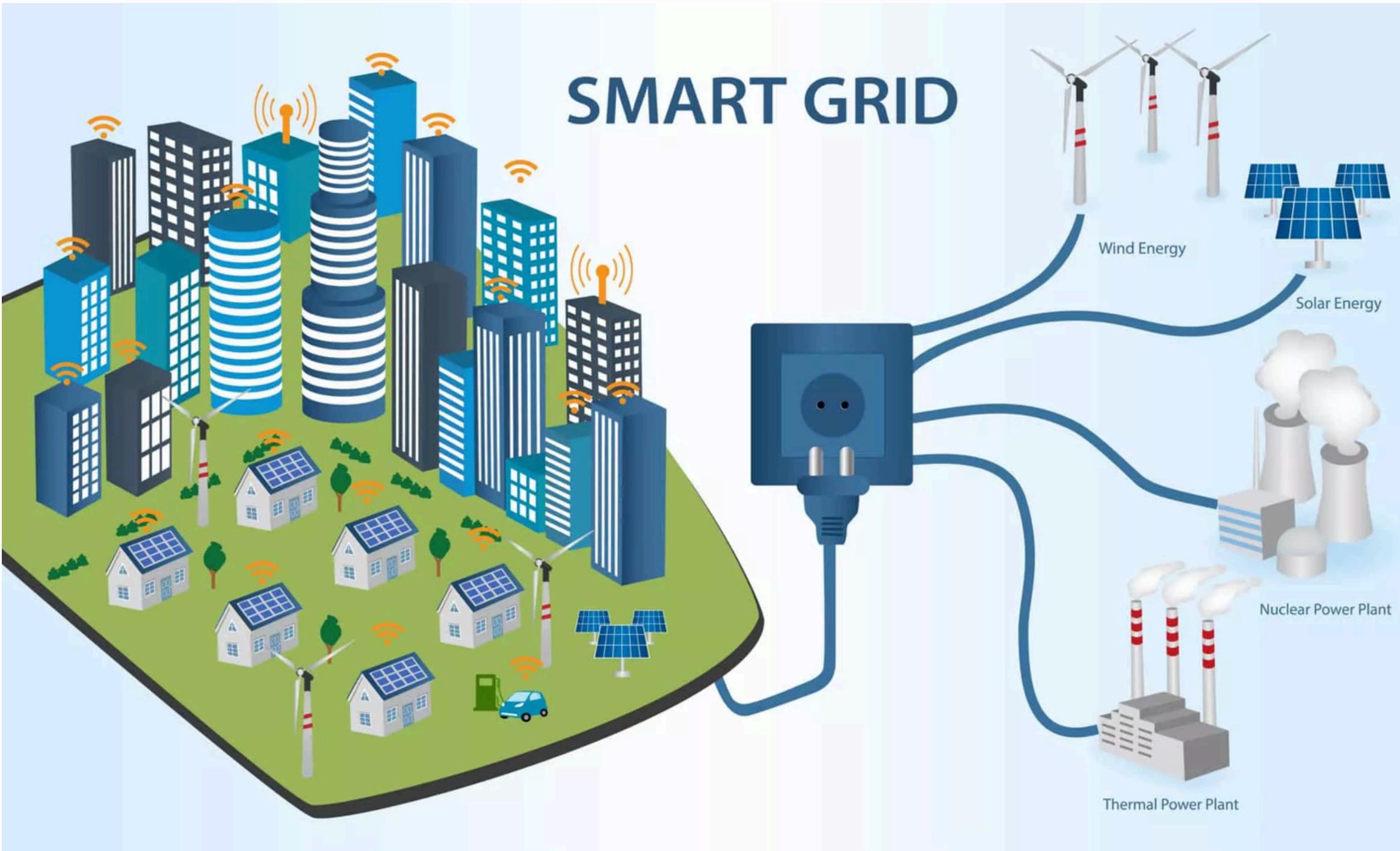


Smart Trading System

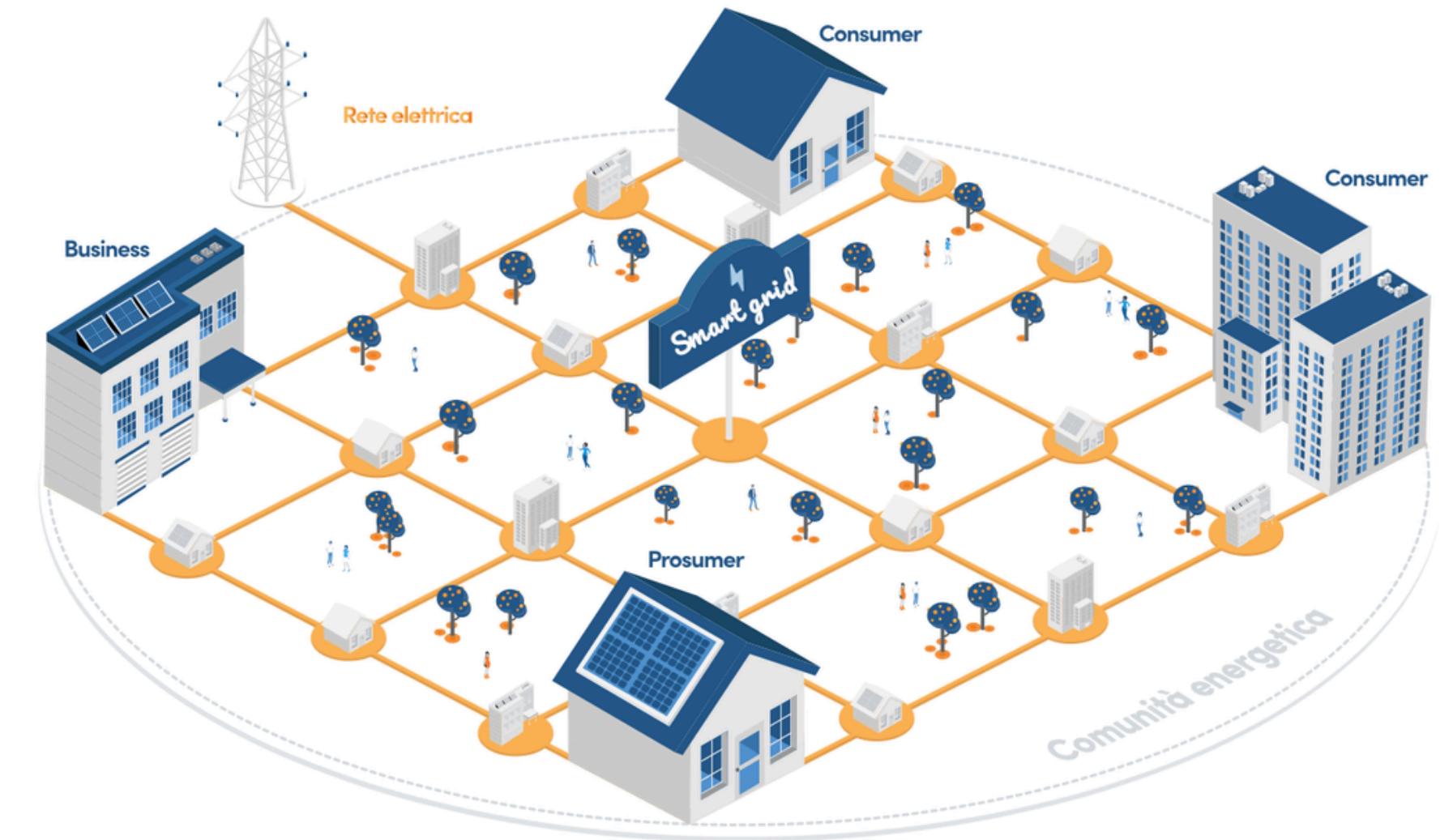


Our Team

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Overview

- Project Definition
- Trading Partner
- Consume Definition
- Trading Strategy
- Conclusion



Project Definition



The “Smart Trading Systems” project is an intelligent energy trading system designed to optimize energy distribution and consumption between various prosumers (producer-consumers) and consumers. It uses optimization algorithms to balance energy production and consumption, reducing costs and improving energy efficiency.



Trading Partner

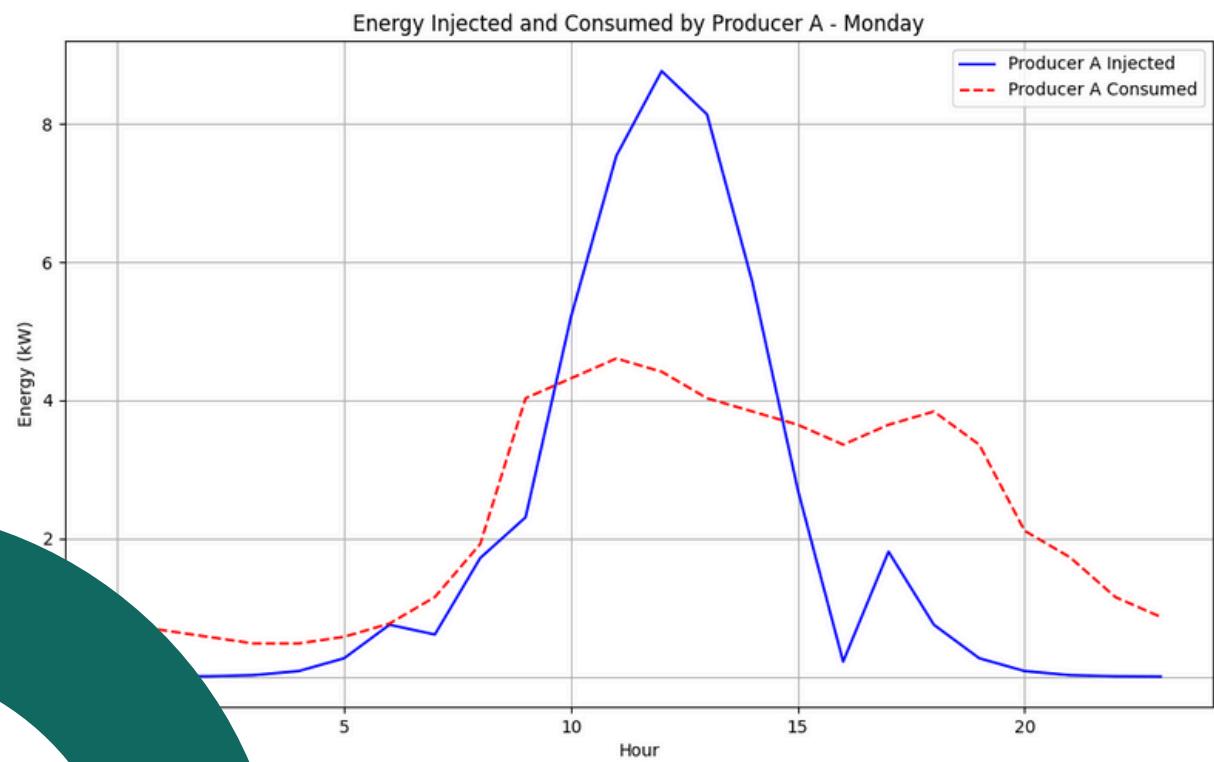
It represents partner with capacity, reliability and a pricing curve in the time.

- Prosumer: An actor who both produces and consumes energy, selling any surplus energy on the market.
- Consumer: An actor who exclusively consumes energy, with a defined energy load.



Prosumer

In the context of the "Smart Trading Systems" project, prosumers play a crucial role in balancing energy supply and demand. They generate energy (e.g., through solar panels or wind turbines) and consume it for their own needs, while any surplus energy can be sold on the market. Prosumers are equipped with specific attributes, such as energy production capacity, consumption patterns, and economic preferences, which influence their behavior and decision-making in the energy market.



Name

The name of the prosumer

Reliability

The reliability attribute is used to calculate the trading partner score. A higher reliability value indicates greater reliability in energy production (value range used is [0.85,0.95]).

Capacity

The maximum amount of energy generated by the prosumer. This value represents the prosumer's production capacity (kW).

Score

A lower score indicates a prosumer with better performance.
It is given by:
$$\text{price} / (\text{capacity} * \text{reliability})$$

Market Cost

The market cost of energy for the prosumer. This value represents the price the prosumer pays for energy purchased from the market.

Consume

The amount of energy consumed by the prosumer. This value represents the prosumer's energy demand

Consumer

A consumer is an entity that solely consumes energy. In the context of the "Smart Trading Systems" project, consumers represent the energy demand within the system. Each consumer has a specific energy load, which corresponds to the amount of energy they require for their operations or daily activities. Consumers are key players in the energy market, as their demand patterns directly influence energy prices.

Name

The name of the consumer

Consume

The amount of energy consumed by the consumer. This value represents the prosumer's energy demand

Consume definition

The amount of energy consumed by the actors



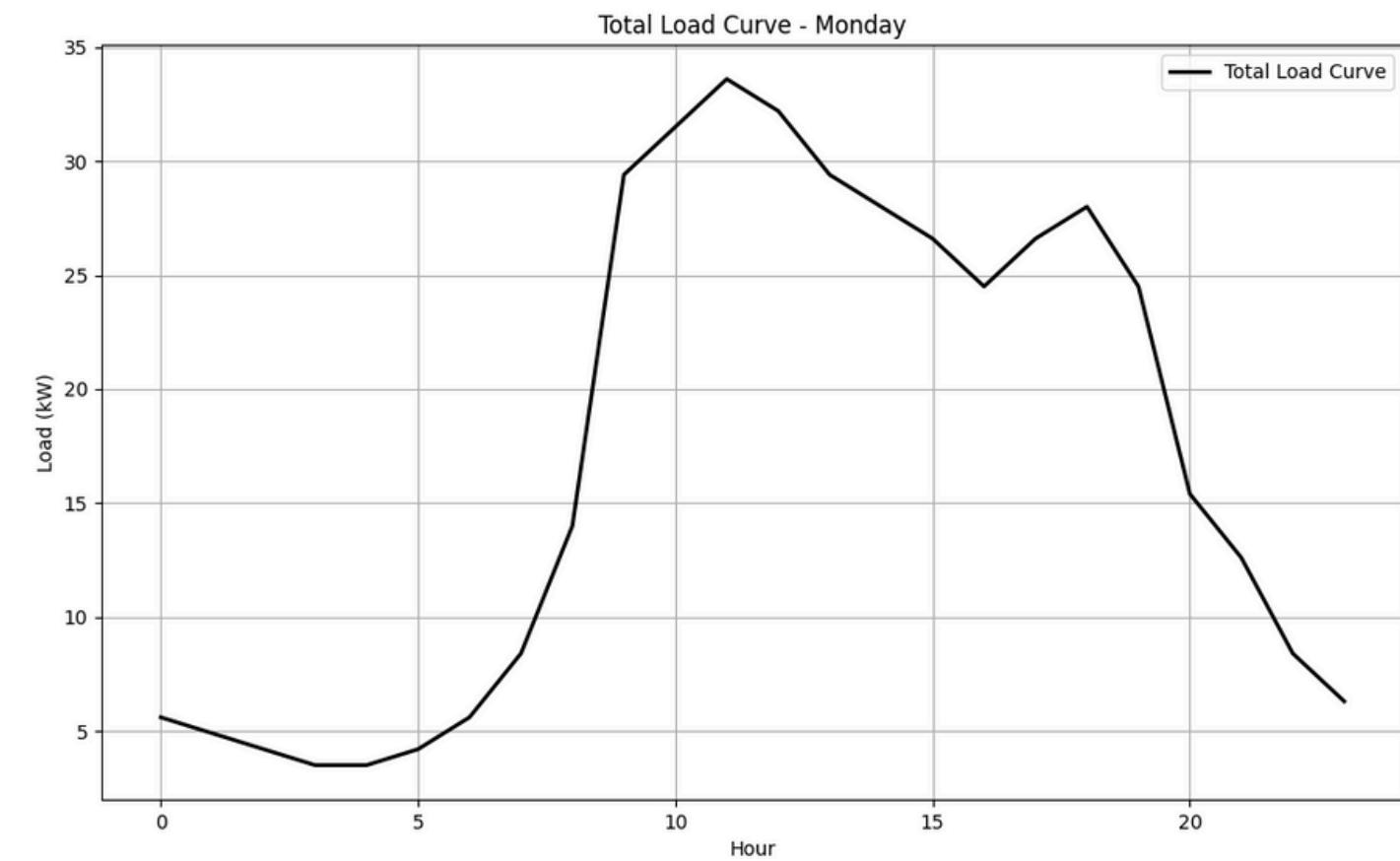
Defined as a function of the time of day and distributed among partners.



Calculated as:

$\text{actor load} = \text{total load per hour} / \text{number of actors}$

where the actor load follow a Dirichlet distribution.



Trading Strategy

Goals

Optimize energy distribution between producers and consumers, ensuring:

01

Cost efficiency

Choosing the best value for money.

02

Reliability

Prioritize partners with high capacity and stability.

03

Adaptability

Respond to variations in demand and production.

04

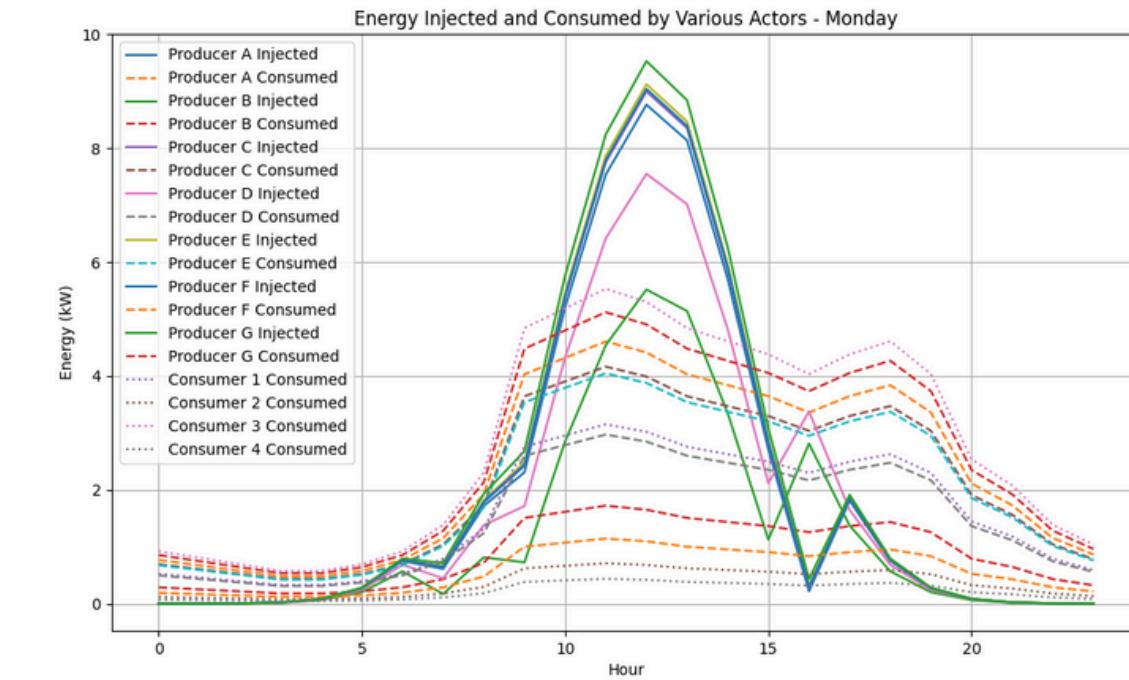
Key Components

- **Prosumer:** Energy providers with variable prices and reliability.
- **Consumer:** Entities purchasing energy to meet their loads.
- **Load Curve:** Energy demand at a given time.
- **Production Curve:** Energy generated for distribution.

Strategy

Load Curve Distribution

The total load curve is distributed among partners and consumers. The division is made in a random way using the Dirichlet Distribution. It is, then, Normalized to ensure consistency with the total load.



Best Partner

Selection based on the score and the one with the lowest score is selected

$$Score = \frac{Price}{Capacity \times Reliability}$$

Market Cost and Price Strategy

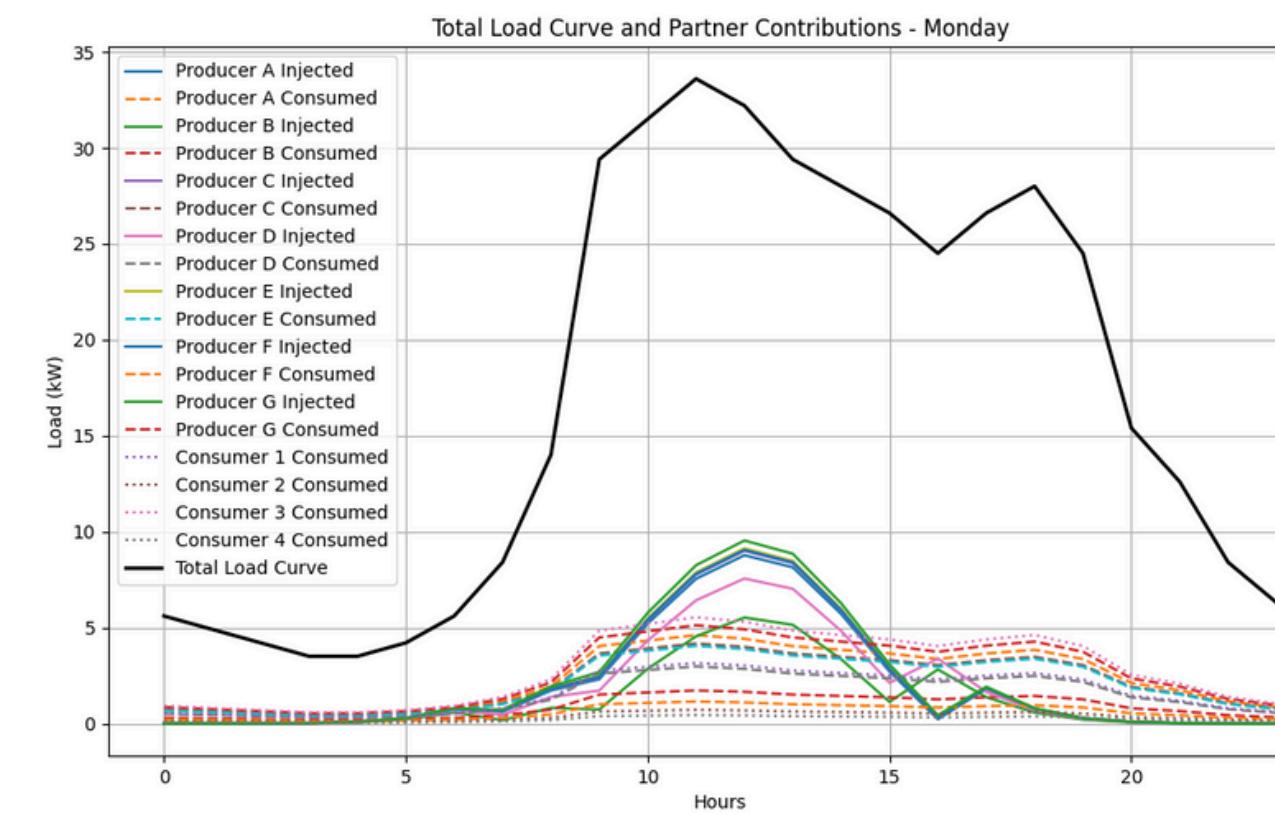
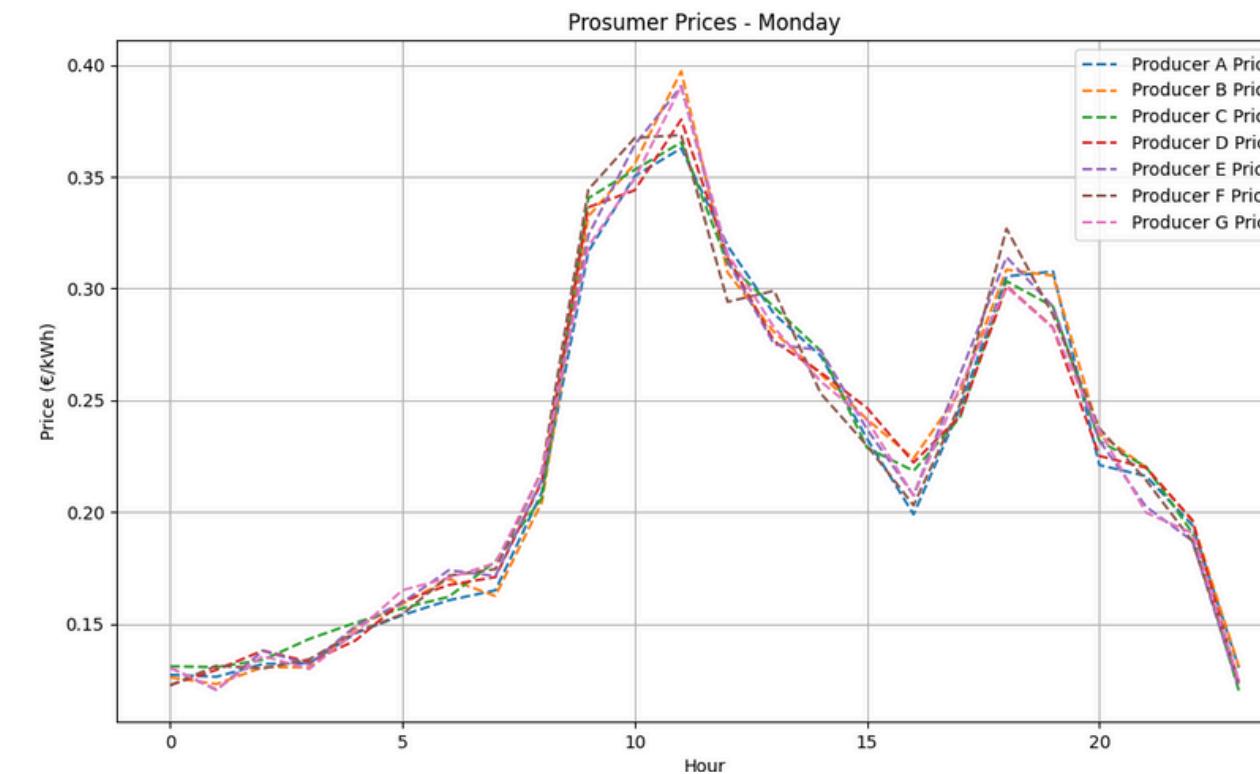
It is represented by the price of energy that changes over time. Time is divided into time slots (F1, F2, F3), each representing a price change. The amount of energy available for sale, `to_sell`, is determined by the difference between production and consumption. If production is high and consumption is low, more energy can be sold at a lower price (`partner.price_curve[hour]` *= 0.95). Otherwise, if consumption is high and production is low, the price increases by 5% (`partner.price_curve[hour]` *= 1.05).

ORARIO	LUNEDI'	MARTEDI'	MERCOLEDI'	GIOVEDI'	VENERDI'	SABATO	DOMENICA
1	F3	F3	F3	F3	F3	F3	F3
2	F3	F3	F3	F3	F3	F3	F3
3	F3	F3	F3	F3	F3	F3	F3
4	F3	F3	F3	F3	F3	F3	F3
5	F3	F3	F3	F3	F3	F3	F3
6	F3	F3	F3	F3	F3	F3	F3
7	F2	F2	F2	F2	F2	F2	F3
8	F1	F1	F1	F1	F1	F2	F3
9	F1	F1	F1	F1	F1	F2	F3
10	F1	F1	F1	F1	F1	F2	F3
11	F1	F1	F1	F1	F1	F2	F3
12	F1	F1	F1	F1	F1	F2	F3
13	F1	F1	F1	F1	F1	F2	F3
14	F1	F1	F1	F1	F1	F2	F3
15	F1	F1	F1	F1	F1	F2	F3
16	F1	F1	F1	F1	F1	F2	F3
17	F1	F1	F1	F1	F1	F2	F3
18	F1	F1	F1	F1	F1	F2	F3
19	F2	F2	F2	F2	F2	F2	F3
20	F2	F2	F2	F2	F2	F2	F3
21	F2	F2	F2	F2	F2	F2	F3
22	F2	F2	F2	F2	F2	F2	F3
23	F3	F3	F3	F3	F3	F3	F3
24	F3	F3	F3	F3	F3	F3	F3

Benefit

- 1. Cost Optimization:** Competitive prices for consumers.
- 2. High Reliability:** Partners selected for capacity and stability.
- 3. Dynamic Flexibility:** Adapts to demand and supply variations.

Results



Conclusion

The proposed trading system achieves an effective balance between energy supply and demand, promoting operational sustainability, ensuring transparent pricing, and maximizing profits for energy producers while offering the best price for consumers.

