

Economic Analysis of Hydrogen Household Energy Systems including Incentives on Energy Communities and Externalities: A Case Study in Italy

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Cost of raw material (i.e. electricity) depends on the quarter of the year and on the time.

Slot, called F1, refers to hours between 8 a.m. and 7 p.m. of working days, the rest of the week is considered into the slot F2

Table S1. Price of electricity.

| Quarter | Raw material (electricity) | | Transport | Other | VAT |
|---------|----------------------------|---------------|---------------|----------------|-----|
| | F1 | F2 | | | |
| Oct-20 | 0,07418 €/kWh | 0,06234 €/kWh | | | |
| Jul-20 | 0,04516 €/kWh | 0,042 €/kWh | | | |
| Apr-20 | 0,04058 €/kWh | 0,03713 €/kWh | 0,00833 €/kWh | 0,041817 €/kWh | 10% |
| Jan-20 | 0,07666 €/kWh | 0,06799 €/kWh | | | |

Natural gas price varies as a function of the consumption quota, the quarter, and the reference region. In this study, the considered price refers specifically to the geographic region where the house is located and shown in Table S2. Northeast Area (includes Milan) and a consumption quota between 481 and 1560 kWh are considered for the selection of the tariff. A fixed cost of 100€/year is added along with 10% VAT.

Table S2. Price of natural gas.

| Quarter | Raw material (natural gas) | Transport | Other | Fixed | VAT |
|---------|----------------------------|-----------|-------|-------|-----|
|---------|----------------------------|-----------|-------|-------|-----|

| | | | | | |
|---------------|---------------------------|---------------------------|-------------------------|-------|-----|
| Oct-20 | 0,183070 €/m ³ | 0,116062 €/m ³ | | | |
| Jul-20 | 0,121413 €/m ³ | 0,119536 €/m ³ | | | |
| Apr-20 | 0,159727 €/m ³ | 0,101091 €/m ³ | 0,0482 €/m ³ | 100 € | 10% |

Incentives' parameters used from Eq. 8 to Eq. 12.

Table S3. Incentives' parameters.

| VARIABLES | Net metering | Self-consumers group | |
|------------------------|---------------------|-----------------------------|--------------|
| CU_{sf} | 8,001 c€/kWh | 8,6132 c€/kWh | - |
| CU_{Af} | - | - | 8,22 c€/kWh |
| C_{PR} | - | - | 2,60 c€/kWh |
| TP_{AC} | - | - | 10,00 c€/kWh |