The effect of energy inflation on energy expenditure and energy poverty: evidence from microsimulations in ECOP model

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Microsimulation models

Tax	Microsimulation Models (Non-Behavioural) 1st order effects		Economic Equilibrium (Behavioural) 2nd order effects	
	Revenue Effects	Distributional Effects	Partial Economic Equilibrium	General Economic Equilibrium
Personal Income Tax	TAXBEN-DF (I)	TAXBEN-DF (II)	Labour Supply (Income Elasticity of Labour Supply) EUROMOD and TAXBEN-DF (III)	Tax-Focused CGE Model ITAXCGE-DF Regional Environmental CGE Model IRENCGE-DF (Environmental module) IRENCGE-DF (Regional module)
Corporate Income Tax	CITSIM-DF (I)	CITSIM-DF (II)	(Devereux-Griffith- Investment-Tax Adjusted User Cost of Capital) CITSIM-DF (III)	
Value Added Tax, Excise duties and energy tariffs	VATSIM-DF (I)	VATSIM-DF (II) EXCISE-DF ECOP	(QAIDS-Deaton-Muellbauer- Price and Income Elasticity of Demand) VATSIM-DF (III)	

The Energy Consumption and Poverty Model

- The ECOP is a **non-behavioural and static** model aiming at estimating:
  - the distributional impact of inflation on households' disposable income;
  - expenditure-based energy poverty indicators;
  - the direct effect of energy costs on end users;
  - the role of policies implemented to support households and to counteract the rising energy prices (see Cirillo et al. forthcoming).

- The model on energy consumption and poverty integrates data and methodologies used in our existing models: **VATSIM-DF (II), EXCISE-DF and TAXBEN-DF**.

Data

The Department of Finance created a new dataset (Integrated Income, Expenditure and Policies dataset, *IIEP*) by matching data on:

- Households' income (SILC)
- Households' expenditure (HBS)
- Tax registry data
- National Institute for Social Security data
- Data on prices:
  - National Consumer Price Index for the whole nation from the Italian National Institute of Statistics (ISTAT);
  - Energy prices from the Italian Regulatory Authority for Energy, Networks and Environment (ARERA);
  - Petrol and diesel prices from the Ministry of Environment and Energy Security.

The IIEP dataset is updated for the year 2024.

Model characteristics and potential use

Our microsimulation includes:

- Modelling the liberalisation of the energy system in Italy with the phasing out of the protected market in 2024:
  - **Protected market** for electricity and natural gas (*formerly «mercato tutelato»*);
  - **Free market for electricity** and natural gas;
  - **Transitional system** (tutele graduali/ PLACET in deroga) for electricity and gas.

This allows us to:

- Simulating **the effect of exogenous increases in material energy costs on households' energy expenditure**;

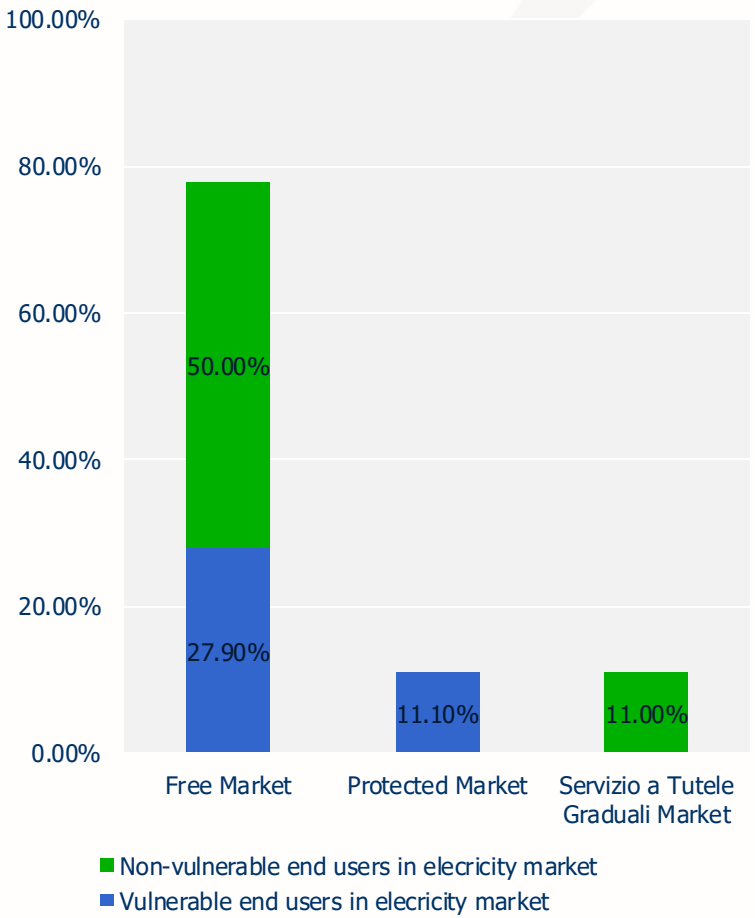
- Calculating the consequences in terms of **energy poverty indicators**.

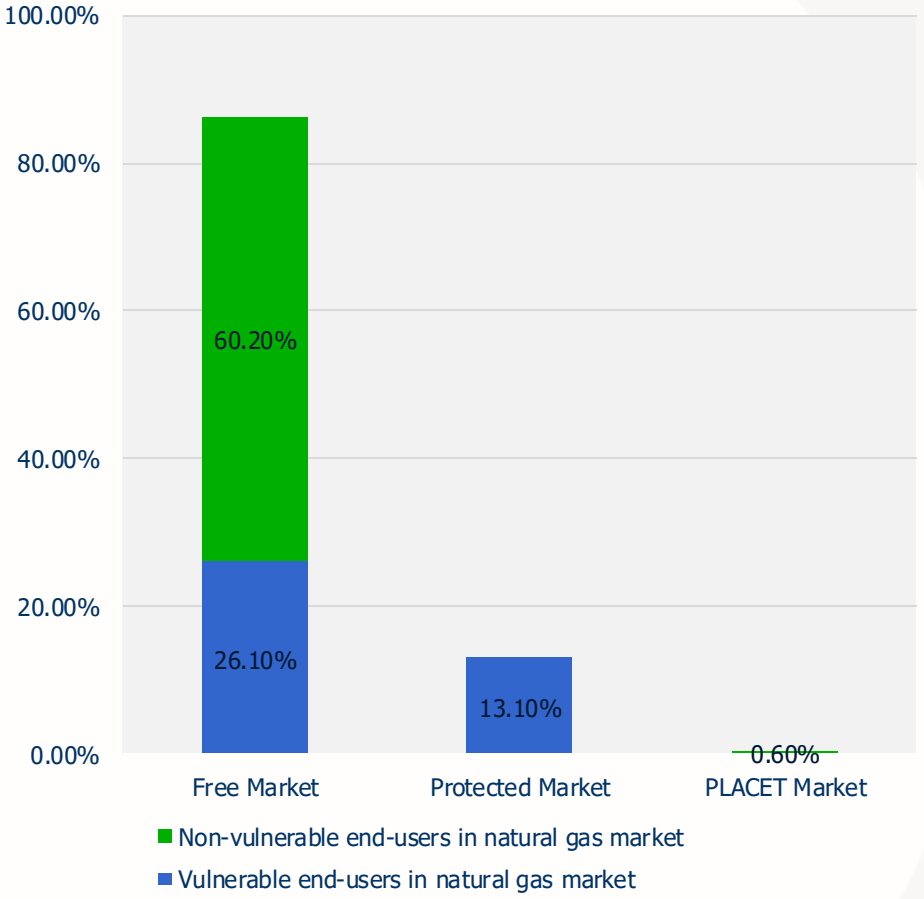
First step: allocate families in different energy systems in Italy

We randomly assign households to different markets according to the shares provided by ARERA, conditional on the **distribution of vulnerable and non-vulnerable end users**:

- We first identify the criteria for defining a vulnerable end user.
- Vulnerable and non-vulnerable households are randomly assigned to the free market, until the specified percentage is reached.
- The remaining vulnerable households are assigned to the protected market.
- Finally, remaining non-vulnerable households are allocated to the transitional systems, either the "**Mercato a tutele graduali"** or the **"Placet in deroga".**

Distribution of end users in 2024





Source: ARERA (Gennaio,2025), Monitoraggio sull'evoluzione dei mercati di vendita dell'energia elettrica e del gas

Methodology: prices and quantities

Energy and natural gas prices:

1. **Protected market**: we rely on ARERA data about both fixed and variable system charges, transmission and distribution costs, and material energy costs of gas and electricity.
2. **Free market:**
   - **Electricity:** We first use the relative price difference between the protected and free markets, applying this to the 2023 protected market prices, weighted to the consumption bands. Then, we update the prices up to 2024 through the relative variation in the NIC for the unregulated market in the last year.
   - **Natural gas**: We apply to the price of the protected market the relative variation in the NIC for the unregulated and regulated market in the last year.
3. **Transitional system:**
   - **Electricity:** We rely on ARERA data for all the price components of the «*Servizio a Tutele Graduali*».
   - **Natural gas**: In the absence of specific data, we adopt the price components from the free market for material energy and transmission and distribution costs, while for the protected market price components, we use the system charges derived from the protected market.

Quantities: we compute energy quantities starting from HBS data and applying corresponding energy prices.

Testing the model for different energy price scenarios

The ECOP model simulates the characteristics of families entering into energy poverty following **5%, 10%, 15% and 20% energy price increases**. As such, we estimate the impact of energy price hikes on households' expenditure.

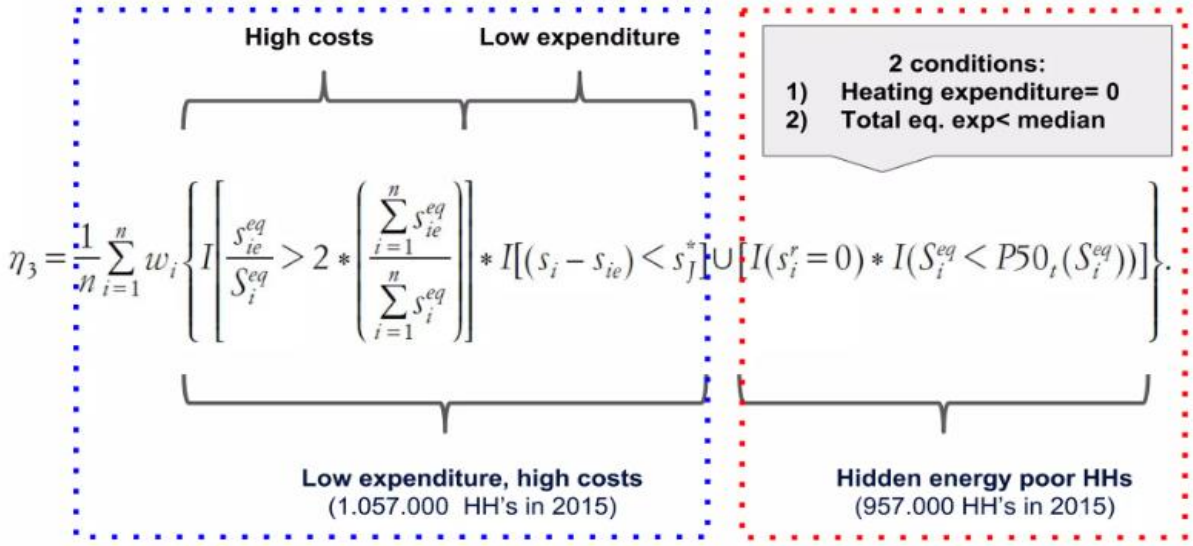
We compare results with respect to the following baseline scenarios:

1. Baseline scenario, represented by 2024;
2. Baseline scenario for 2024 which includes the "bonus sociale" measure.

Energy poverty indicator

- The energy poverty indicator follows the definition of the **modified LI-HC indicator** proposed by **Faiella and Lavecchia (2015).**

- **Total energy expenditure** includes housing-related energy costs (including heating) and transportation expenses.



Source: Faiella and Lavecchia (2015).

Preliminary Results

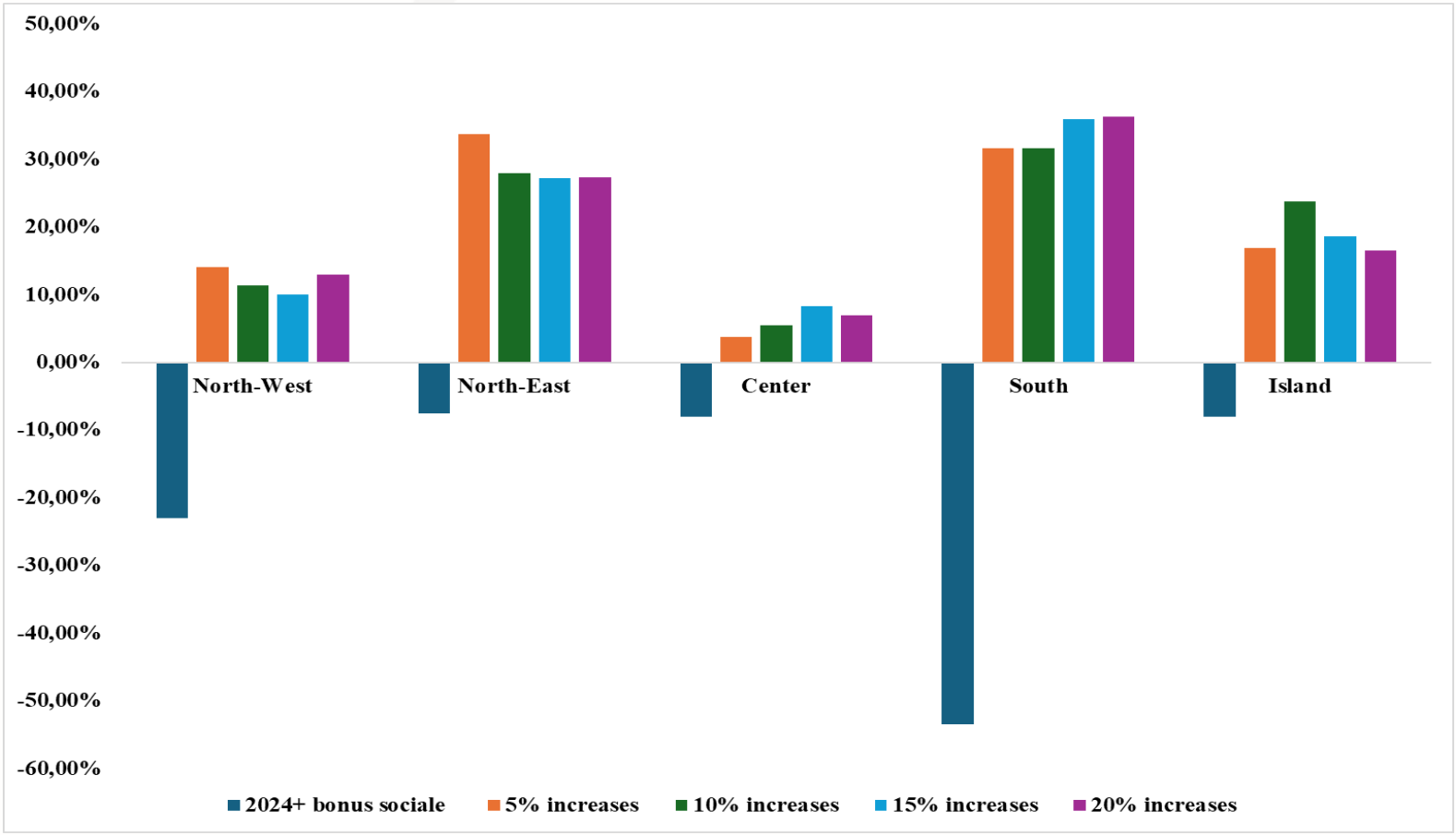
Table 1: Energy Poverty Distribution and Characteristics by Scenario

	Energy Poverty indicator	Number of Energy Poor Families: Change Compared to Base Scenario	Energy Expenditure: Average Change Compared to Base Scenario (Euros)		ISEE of Families Transitioning to Energy Poverty Compared to Base Scenario (Euros)		Family Type Transitioning to Energy Poverty Compared to Base Scenario			
			Total families	Energy Poor Families	Average	Median	One member household	Two or more components without Children	Up to three Children	Four or More Children
2024	8.73%	2,254,738			17,315	11,887	798,398	1,025,839	432,050	14,450
2024 + energy benefit schemes	7.88%	-218,505			10,835	6,556	-62,456	-108,536	-47,513	-
5% increases	9.07%	87,575	105	69	28,290	20,340	27,792	47,579	12,205	-
10% increases	9.21%	123,669	161	111	24,936	17,637	35,491	65,097	23,081	-
15% increases	9.35%	161,247	218	145	23,943	14,673	44,368	80,790	36,088	-
20% increases	9.50%	198,434	275	190	23,581	17,451	44,368	98,495	55,029	542

Source: Authors elaboration

Preliminary Results

Figure 1: Distribution of Families in Energy Poverty by Geographical Area



Source: Authors elaboration.

Further development

The model is still on-going and the next step will encompass:

- Simulation analysis for 2025;
- Analysis of the future developments in the liberalisation of the energy market;
- Impact assessment of other policies;
- Estimation of the main energy poverty indicators;
- Analysis of households behavioural responses.

MEF Dipartimento delle Finanze

Thanks for your attention!

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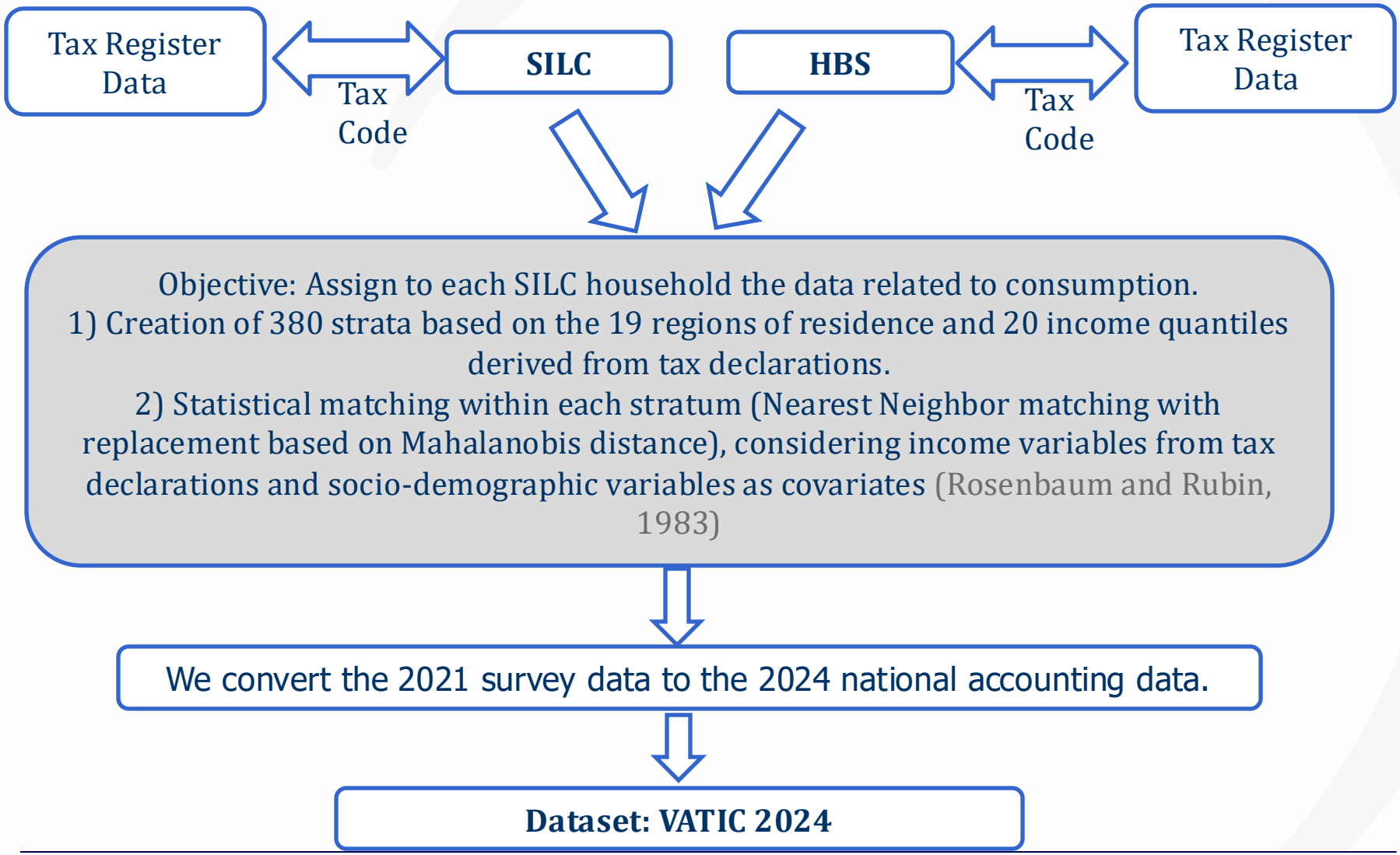
Appendix

Creation of an Integrated Dataset: VATIC Dataset



Protected market energy tariffs

For the protected market, we rely on ARERA data about **both fixed and variable system charges, transmission and distribution costs, and material energy costs of gas and electricity**.

Ottobre - Dicembre 2024

CLIENTI VULNERABILI

Abitazioni di residenza anagrafica

Servizio di maggior tutela 1 ottobre - 31 dicembre 2024	Materia energia			Trasporto e gestione del contatore	Oneri di sistema	TOTALE		
	Monorario	Biorario				Monorario	Biorario	
	fascia unica	*fascia F1*	*fascia F23*			*fascia unica*	*fascia F1*	*fascia F23*
Quota energia (euro/kWh)	0,12222	0,12931	0,11866	0,01220	0,038637	0,173057	0,180147	0,169497
Quota fissa (euro/anno)	41,3183			22,0800	-	63,3983		
Quota potenza (euro/kW/anno)	-			22,3988	-	22,3988		
Sconto bolletta elettronica	*Ai clienti che ricevono la bolletta in formato elettronico e la pagano con addebito automatico è applicato uno sconto di 6 euro/anno.*							

Source: ARERA(2024).

Social Electricity Bonus: Eligibility and Conditions

In 2024, the eligibility for the social electricity bonus is limited to households with an ISEE (Equivalent Economic Status Indicator) **not exceeding €9,530, or families with at least four dependent children and an ISEE not exceeding €20,000**. Additionally, families whose 2023 ISEE is between €9,530 and €15,000 may still benefit from the bonus throughout the year. These families will receive **80% of the compensation components (CCE and CCG)** compared to those in the standard eligibility classes, as outlined in the regulations.

	Description	2024 (1) CCE	Extraordinary Contribution (CS) Q1 2024
		€/year per withdrawal point	€/quarter per withdrawal point
E1	Household size 1-2 members	142,74	76,44
E2	Household size 3-4 members	183	102,83
E3	Household size over 4 members	201,3	113,75

Source: ARERA(2024).