

SHIFT IN ELECTRICITY HOUSEHOLD CONSUMPTIONS DUE TO ELECTRICITY COST AND ENERGY POVERTY

Summary

Household electricity consumption plays a vital role of the overall energy demand. Simultaneously, a significant part of the population in both Cyprus, as well as on a global level faces conditions of energy poverty. The present study investigates the changes in electricity consumption in around 250,000 Cyprus households during the past decade (2014-2023). The results have shown that the consumption, in households with PVs as well as in households without, was gradually increasing until 2021, while from 2021 onwards, it decreased significantly following the rise in electricity energy prices and a decrease in household disposal income. Furthermore, the installation of the photovoltaic system led to substantial changes in consumption behaviour, with the respective households showing significantly higher levels of electricity energy use, up to 60% compared to those without rooftop PVs. Overall, this study emphasizes the need for developing integrated strategies to face energy poverty and ensuring the operational stability of household energy systems under conditions of climate uncertainty.

Keywords: Electricity consumption, Energy Poverty, PV Installations

Field of application for the findings: Policy

Addressed audience: Policy Makers, NGOs

1. Introduction

The use of electricity plays a crucial role in the daily life of households. Nowadays, worries have risen about the consumption of electricity that results in the rise of greenhouse gas emissions that end up causing environmental repercussions such as climate change and global warming, but also the depletion of energy resources that have been documented especially in recent years as being the most significant (Nejat et al., 2015). Households play a vital role in electricity consumption, holding an outstanding percentage of 25% in Europe. Residential energy consumption serves multiple purposes. Space heating made up the dominant portion of household energy consumption in the European Union, representing 63.5% of the entire energy usage. Water heating followed with 14.9%, while lighting and electrical appliances constituted 13.9%. Cooking comprised 6.3% of the energy use, whereas space cooling and other minor end uses represented only 0.6% and 0.9%, respectively (Eurostat, 2024). Having noted that, a significant number of households face a phenomenon called “Energy Poverty”. Energy poverty as defined as “the lack of access by a household to essential energy services that provide a basic and decent standard of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances in the relevant national context, applicable social and other relevant policies, caused by a combination of factors including, among others, lack of affordability, insufficient disposable income, high energy expenditure, and low energy efficiency of homes” (Bak et al., 2024). In this study, the aim was to examine how residential electricity consumption patterns in Cyprus have evolved over the past decade, in relation to fluctuations in electricity prices and the growing disposable income. Both at the national level, in Cyprus and at the European level, the promotion of photovoltaic systems has been recognized as one of the policy tools to mitigate energy poverty and reduce the energy prices. Therefore, the study also sought to analyze households that installed PVs, using data over the same period, in order to assess how their electricity consumption behaviour changed following installation and propose ways to further improve the current framework for the benefit of society.

2. Data Collected

The present evaluation concerns data of electricity consumption documented in Cyprus, as collected by the Electricity Authority of Cyprus (EAC) anonymously for the last 10 years, covering the period between 2014 to 2023. The total volume collected concerned an estimate of 250,000 households without PVs installed and around 2,638 with rooftop-PV installed in 2013-2014. The data available for analysis was quantitative since it concerned the consumption of electricity in kWh. Electricity prices (including taxes) were also obtained to study how price changes influence electricity consumption trends. Finally, statistics about household savings were collected from the Statistical Service - Ministry of Finance of Cyprus

3. Results

Key findings reveal a moderate positive correlation between household consumption and savings percentages, indicating that economic factors partially drive usage patterns (with or without PVs installed). Overall consumption for non-PV households exhibited a gradual increase until 2021, followed by a sharp decline coinciding with escalating electricity prices and underscoring price sensitivity as a primary determinant of demand reduction (Figure 1 and Figure 2). The integration of rooftop-PV systems however, markedly altered consumption behaviors, with PV-equipped households consuming approximately 60% more electricity on average than their non-PV counterparts (Figure 3). This "rebound effect" stems from perceived "free" energy, leading to laxer usage habits, though both groups demonstrated parallel responses to price hikes, with normalized consumption dropping post-2021. These results align with global literature, such as studies in Spain, Japan, Jordan, and Germany, which similarly highlight price elasticity and rebound effects ranging from 28.5% to 50%. To address this rebound effect and prioritize the "energy efficiency first" (EE1st) principle, a carrot-and-stick approach is recommended.

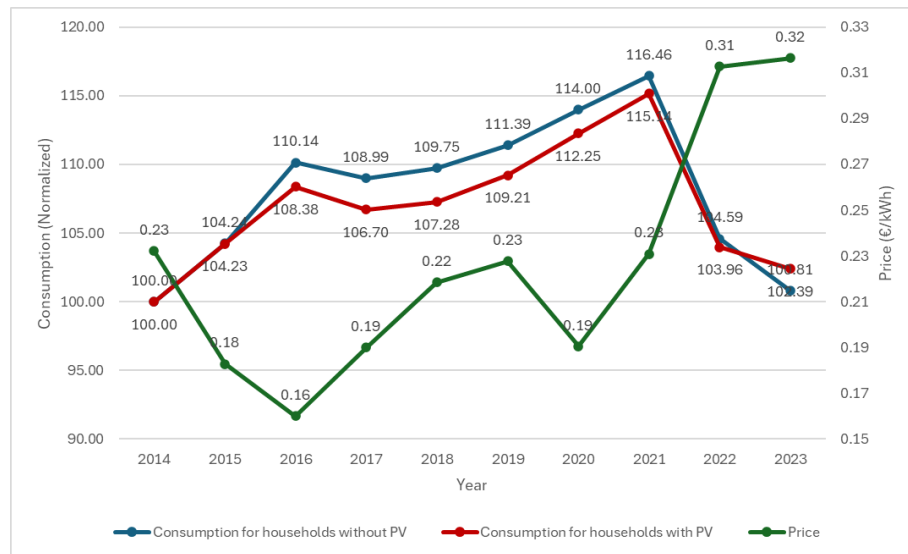


Figure 1: Normalized electricity consumption and price evolution over the last 10 years for PV and non-PV households.

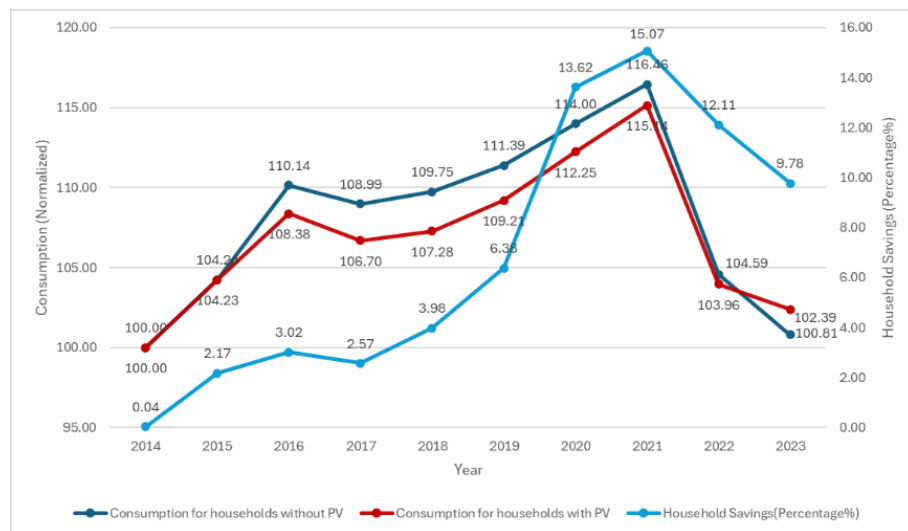


Figure 2: Household savings and monthly electricity consumption for households with and without PV over the years

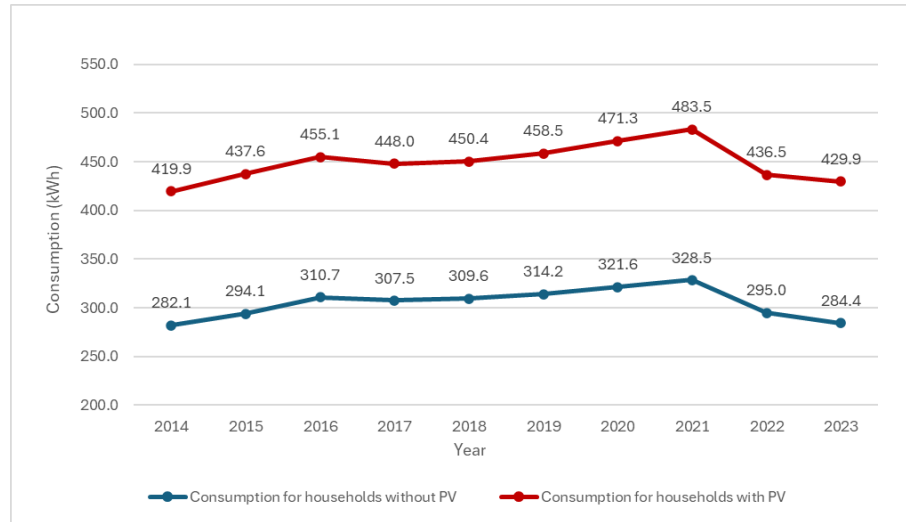


Figure 3: Ten-year comparison of monthly electricity consumption in households with and without PV.

4. Conclusions

This study investigated the shifts in household electricity consumption patterns in Cyprus over the decade from 2014 to 2023, with a focus on the influences of electricity prices, disposable income (proxied by household savings), energy poverty, and the adoption of photovoltaic systems. The implications of these findings are profound for addressing energy poverty in Cyprus and broader Europe. The promotion of PV installations emerges as a double-edged tool: it reduces net costs and mitigates poverty for adopters but may inadvertently encourage overconsumption, potentially undermining emission reduction goals. Policymakers should prioritize targeted subsidies for low-income groups, dynamic pricing mechanisms to curb rebound effects, and incentives for energy-efficient appliances to ensure equitable transitions. Furthermore, integrating socioeconomic data in future energy policies could refine interventions, particularly in vulnerable regions like Southern and Eastern Europe, where climate extremes exacerbate reliance on heating and cooling.

5. References

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