Survey Dataset from 549 Households across Greece on (Environmental) Awareness and Adoption Intentions of Residential Renewable Energy (Microgeneration) Technologies

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Abstract: This article describes a household survey dataset documenting environmental awareness, environmentally responsible behavior, perceptions of renewable energy sources, and the current and intended adoption of residential microgeneration technologies among 549 households in Greece. The data were generated through a structured web-based questionnaire administered to adult residential decision makers in 2019 and provided the empirical foundation for a published study of the determinants of market acceptance of small-scale renewable energy technologies. The instrument combined 32 thematic questions with seven demographic questions and yielded 78 coded variables spanning residential characteristics, environmental awareness and behavior, renewable energy source perceptions, the installation and intended installation of six microgeneration technologies, the factors that shape installation decisions, and respondent demographics. Two composite indices summarizing environmental awareness and environmental behavior, three reverse-coded items, and two embedded attention-check questions were incorporated to support reliability assessment and secondary analysis. What distinguishes the dataset is its integration of attitudinal, behavioral, residential, spatial, and technology-specific information within a single coherent instrument, together with the parallel documentation of realized adoption and future adoption intention. A fully specified and reversible coding scheme accompanies the numerical records, rendering the data immediately usable in standard statistical environments. The resource lends itself to research on renewable energy adoption, environmental behavior, sustainability transitions, technology acceptance, behavioral segmentation, policy analysis, predictive modelling, and machine learning, and it offers a transferable template for future studies on household participation in decentralized energy systems.

Keywords: Residential microgeneration, renewable energy adoption, environmental awareness, environmental behavior, household survey, energy transition, Greece.

1. Background and Summary

The decarbonization of energy systems is among the defining technological and societal undertakings of the present century, and the residential sector occupies a central place within it (Vardopoulos and Vassiliades, 2025). Households account for a substantial share of final energy demand, much of it still met by fossil fuels, which makes domestic energy use a decisive arena for emissions reduction (Vassiliades et al., 2023). Although utility-scale renewable installations have long dominated research and policy attention, the locus of the transition is shifting towards distributed generation and the direct involvement of households as producers rather than passive consumers of energy (Vardopoulos et al., 2023). Residential microgeneration technologies sit at the heart of this shift. By generating heat or electricity at or close to the point of use through small renewable installations, they allow households to meet part or all of their own energy needs while contributing to lower emissions, improved efficiency, and greater energy security (Vardopoulos et al., 2025). Photovoltaic systems, solar thermal collectors, ground-source and air-source heat pumps, biomass boilers, and small wind turbines represent the principal options available at the household scale (Barone et al., 2024). The pace at which these technologies

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diffuse depends on far more than their technical performance or installation cost. Decades of adoption research have shown that household decisions are shaped jointly by economic circumstances, dwelling characteristics, environmental attitudes, awareness of the available technologies, perceived risks and benefits, and the wider institutional and spatial context in which a household is embedded (Vassiliades et al., 2025).

Explaining how these influences combine requires empirical evidence collected at the level of the individual household, yet datasets that capture this particular combination of attitudinal, behavioral, and structural information remain comparatively scarce. High-quality household-level data therefore carry distinct value for researchers seeking to account for adoption, and for the energy agencies, policymakers, and technology providers who design measures intended to accelerate the transition.

The dataset described herein was assembled to examine how households perceive, evaluate, and decide upon residential microgeneration technologies, and it documents the responses of 549 households surveyed across Greece in 2019. It was generated through a structured questionnaire administered to adult residential decision makers and provided the empirical basis for a published comparative study of the factors governing market acceptance of microgeneration technologies (Karytsas et al., 2019), as well as for a subsequent conference analysis comparing two survey periods (Karytsas et al., 2020). Those studies drew on two survey waves conducted in 2012 and 2019 under a common instrument, and the records released here correspond to the 2019 wave. Each observation brings together information on residential characteristics, environmental awareness and behavior, perceptions of renewable energy sources, the current and intended adoption of six microgeneration technologies, the considerations that shape installation decisions, and a full demographic and socioeconomic profile, together with the spatial location of the household at the level of regional units.

What sets this resource apart from many publicly available energy datasets, which tend to record adoption outcomes in isolation, is its representation of the household decision as a whole. Attitudes, behaviors, dwelling attributes, and contextual factors are held within a single framework, and the parallel measurement of realized installation and future installation intention allows diffusion and behavioral change to be studied directly rather than inferred. The accompanying coding documentation, the composite environmental indices, and the embedded quality-control items extend the analytical reach of the data well beyond the questions addressed in the original study and underpin its value for secondary research across several disciplines.

2. Questionnaire Development and Structure

The survey instrument was developed as a web-based questionnaire designed to identify the determinants of household acceptance, adoption, and intended adoption of residential microgeneration technologies. Its construction drew on several literatures at once, combining insights from renewable energy adoption research, environmental psychology, consumer behavior, residential energy studies, and sustainable development, so that both the objective attributes of a dwelling and the subjective perceptions of its occupants could be captured. Particular attention was given to the considerations bearing on investment in decentralized generation, encompassing photovoltaic installations, solar thermal systems, ground-source and air-source heat pumps, biomass boilers, and small wind turbines.

The questionnaire was organized into two complementary parts. The first established the demographic and socioeconomic profile of each respondent, while the second elicited the information needed to characterize the adoption of microgeneration technologies and the factors influencing it. Closed-ended items predominated, inviting respondents to report their knowledge, attitudes, behaviors, and intentions in relation to matters with which they were familiar. The opening group of questions described the residence itself, recording its type, ownership status, size, year of construction, composition of the household, respondent's role in household decisions, any renovation or energy upgrade undertaken, and participation in national energy-saving schemes. A second group, answered on a binary basis, addressed environmental awareness and environmentally responsible behavior and supplied the items from which two composite indices were later constructed. A third group recorded both the actual and the hypothetical installation of the six microgeneration systems under study, with the present dataset retaining the realized decisions alongside the stated intentions. A fourth group, comprising a battery of items rated on a 5-point scale from 'not at all' to 'very much', probed the considerations that respondents weigh when contemplating an installation, ranging from equipment and maintenance costs through reliability,

ease of use, and available incentives to aesthetic impact. The closing group gathered demographic and socioeconomic detail, including gender, age, marital status, education, occupation, household income, and place of residence.

Several features were built into the instrument to safeguard the quality of the responses. Two attention-check items were embedded at separate points in the questionnaire, each instructing respondents to give a specified answer so that inattentive or automated completion could be detected. A small number of statements were deliberately phrased in opposition to the underlying construct and were subsequently reverse-coded, a device that tempers acquiescence bias and offers an additional check on the internal consistency of each respondent's answers. Before full deployment the questionnaire was piloted with a small group of respondents, whose feedback prompted minor refinements of wording and sequencing. The instrument in its final form was the one fielded in the 2019 wave reported by Karytsas et al. (2019), and the dataset released here has been revised and documented for open dissemination. Taken together, these design choices yielded a multidimensional record that joins residential, demographic, socioeconomic, behavioral, attitudinal, and technology-specific information within a single survey.

3. Data Collection Procedure

The data originate from a structured questionnaire survey directed at the adult population of Greece. Because the research centered on genuine household decisions about installing microgeneration systems, the survey sought respondents able to speak to the characteristics of their dwelling, their environmental practices, and the energy-related choices made within their home. Distribution proceeded electronically through two mailing lists, one maintained by the Centre for Renewable Energy Sources and Saving (www.web.cres.gr) and the other by Harokopio University of Athens (www.hua.gr). This initial convenience-based distribution was supplemented by a snowball component, as recipients were invited to forward the questionnaire link to their own contacts. The final sample therefore reflects a combined convenience and snowball sampling strategy, rather than a random or statistically representative sampling design. Successive waves of the wider research program used distinct mailing lists in order to reduce the likelihood of repeat participation across survey periods.

This mode of recruitment also means that a precise response rate cannot be calculated. The total number of active addresses on the mailing lists is not known, some invitations may not have reached their intended recipients or may have been filtered as unsolicited mail, and the onward circulation of the questionnaire link makes it impossible to determine how many individuals ultimately received the survey invitation. For these reasons, the dataset should be interpreted as a voluntary online sample shaped by accessible respondent networks and participant referrals. Its demographic and residential composition, described in the following section, should therefore be taken into account when assessing the scope, transferability, and limits of any analysis based on the data.

The 549 completed questionnaires were screened for completeness and consistency before analysis and were then coded according to a predefined scheme. Every item received a unique variable identifier, and dedicated codes were reserved for missing, unknown, and non-applicable responses. Binary items were coded as 0 for no and 1 for yes, whereas ordinal items followed ascending scales that express increasing agreement, awareness, behavioral engagement, or perceived importance. Selected environmental awareness items were additionally reverse-coded to preserve conceptual consistency and to ease subsequent analysis. The coding scheme was designed to be transparent and fully reversible, so that any user may recover the original response categories where this is required.

4. Data Records and Variable Description

The dataset is distributed as a spreadsheet workbook comprising three worksheets. The first sets out the coding scheme, pairing every variable with its original question text and mapping each numeric code to the response category it represents. The second holds the coded data, a matrix of 549 rows and 78 variables preceded by a single identifier column, in which each row corresponds to one respondent and each column to one variable. The third provides a concise overview of the variable groups. Because the coding scheme is supplied in full and is reversible, the numerical records can be analyzed directly in standard statistical environments or translated back to their original categorical form without loss of information. The 78 variables fall into a small number of thematic groups, summarized in Table 1. Residential characteristics account for 13 variables, environmental awareness and behavior blocks for six and seven, respectively, perceptions of renewable energy

Table 1. Variable categories

Variable Category	Variable
Residential characteristics ($Q_1 - Q_{10}$)	13
Environmental awareness items ($Q_{11} - Q_{16}$)	6
Environmental behavior items ($Q_{18} - Q_{24}$)	7
Renewable energy source perception items ($Q_{25}^1 - Q_{25}^7$)	7
Technology adoption and intention items ($Q_{26}^1 - Q_{31}^2$)	12
Microgeneration adoption factor items ($Q_{32}^1 - Q_{32}^{20}$)	20
Demographic variables ($D_1 - D_7$)	7
Attention-check item (Q_{17})	1
Composite scales (S_1, S_2)	2
Reverse-coded variables (INV_{11}, INV_{14}, INV_{16})	3
Total	**78**

Note: Two attention-check items are embedded in the instrument. The first, Q_{17}, is reported as a distinct quality-control variable. The second, ${Q_{32}}^{10}$, is positioned within the microgeneration adoption-factor battery and is therefore counted among its 20 items, so that the instrument contains two attention-check items in total.

sources for seven, current and intended adoption of the six technologies for 12, and battery of installation-decision factors for 20. Seven variables capture demographic and socioeconomic attributes. The remainder consists of derived quantities, namely two composite indices, three reverse-coded items, and a single free-standing attention-check variable. Of the 78 variables, 73 correspond directly to survey responses and five were generated during data processing.

Table 2 maps each group to the variable identifiers used in the dataset. Multi-part questions were expanded into individual variables so that each component could be analyzed separately, which is why, for example, the seven renewable energy perception items appear as Q_{25}^1 through Q_{25}^7 and the 20 decision factors as Q_{32}^1 through Q_{32}^{20}. Two of the items serve solely as attention checks. The first, Q_{17}, sits between the environmental awareness and behavior blocks, while the second, Q_{32}^{10}, is positioned within the decision-factor battery.

Two composite indicators summarize the environmental dimension of the data. The Environmental Awareness Index aggregates binary responses concerning knowledge of and attitudes towards environmental issues, among them beliefs about the causes of climate change and about responsibility for addressing them, and ranges from 0 to 5 with a sample mean of 3.27. The Environmental Behavior Index aggregates binary responses concerning environmentally responsible practices,

Table 2. Variable groups and identifiers

Variable Group	Variable Identifier
Residential characteristic	$Q_1 - Q_{10}$
Environmental awareness	$Q_{11} - Q_{16}$
Environmental behavior	$Q_{18} - Q_{24}$
Renewable energy source perception	$Q_{25}^1 - Q_{25}^7$
Technology adoption and intention	$Q_{26}^1 - Q_{31}^2$
Microgeneration adoption factor	$Q_{32}^1 - Q_{32}^{20}$
Demographic characteristic	$D_1 - D_7$
Attention-check item	Q_{17}, Q_{32}^{10}
Derived variable	S_1, S_2, INV_{11}, INV_{14}, INV_{16}

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Table 3. Sample composition ($N = 549$)

Characteristic	*n*	%
Gender		
Male	321	58.5
Female	225	41.0
Not reported	3	0.5
Age		
Mean 38.0 years, standard deviation 10.8, range 16–75, with 3 respondents not reported		
Education		
Tertiary (university, master's, doctoral degree)	419	76.3
Secondary or vocational	127	23.1
Not reported	3	0.5
Annual household income		
6000 € or less	79	14.4
6000-12,000 €	115	20.9
12,000-18,000 €	131	23.9
18,000-24,000 €	103	18.8
More than 24,000 €	118	21.5
Not reported	3	0.5

including recycling, avoidance of standby consumption, moderate thermostat settings, and purchase of energy-efficient products, and ranges from 0 to 10, with observed values reaching 9 and a sample mean of 5.56. Reported alongside the individual items from which they are built, the two indices allow the relationship between environmental consciousness and its behavioral expression to be examined either at the level of single practices or in aggregate. Three items were written in the opposite direction to the construct they measure and were reverse-coded during preparation. They concern the attribution of climate change to natural rather than human causes, perception that economic pressures preclude engagement with environmental issues, and the view that a financial inducement is necessary before adopting more sustainable behavior. Recoding these items places them on a common positive scale with the remaining variables and, by interrupting any tendency towards uniform agreement, provides a further indication of how attentively each respondent engaged with the questionnaire.

The composition of the sample is summarized in Table 3. The dataset contains 549 completed records. Respondents report residence in Greece, distributed across the country's regional units, although with a marked concentration in Attica. Men accounted for a slight majority of respondents and the mean age was 38.0 years, with individual ages spanning the working-age range. The sample was comparatively well educated, roughly three-quarters of respondents holding a tertiary qualification, and household income was spread across all five recorded brackets. Among the technologies surveyed, solar thermal systems were by far the most widely installed, present in 270 households, reflecting their long establishment in the domestic market, whereas the remaining technologies were found in only a small fraction of households, a distribution that is itself informative for the study of early-stage adoption.

All variables carry unique identifiers and follow a consistent coding logic, which renders the dataset machine-readable and directly compatible with widely used statistical packages. The combination of binary and ordinal measures, the separation of realized from intended adoption, and the retention of spatial information together support both descriptive and multivariate analysis despite the cross-sectional design. Users wishing to treat the awareness and behavior items as psychometric scales may apply established procedures for reliability and dimensionality assessment, including internal-consistency estimation and factor-analytic techniques, and may adapt the construct definitions to their own analytical objectives.

5. Data Reusability, Value, and Impact

Although the dataset was created to investigate the factors governing market acceptance of residential microgeneration technologies, its scope extends well beyond that original purpose. The breadth of the variables, which span demographic, residential, spatial, attitudinal, behavioral, and technology-specific information, allows a single body of data to serve many lines of enquiry, and the consistent coding, standardized response formats, and embedded quality-control items lend the resource the reliability required for rigorous secondary analysis.

Several research applications follow naturally from the structure of the data. The joint measurement of realized and intended adoption supports the modelling of technology diffusion and the analysis of the behavioral transition from intention to action, while the rich set of explanatory variables lends itself to regression and discrete-choice models of the adoption decision. The 5-point battery of decision factors provides a basis for behavioral segmentation and for studying the relative weight that households place on cost, reliability, incentives, and other attributes. The environmental awareness and behavior items, together with their composite indices, offer material for work in environmental psychology and sustainable consumption, including investigation of the gap between stated attitudes and observed practice.

Because the variables are coded numerically and consistently, the dataset can support exploratory predictive analysis, particularly where the binary adoption and intention variables are treated as outcome measures and the attitudinal, behavioral, residential, and demographic variables as explanatory inputs. Such uses should, however, remain attentive to the size and composition of the sample, and are better understood as exploratory rather than as a basis for highly generalizable machine-learning applications.

The spatial information retained at the level of Greek regional units allows geographical variation within Greece to be examined and provides scope for contextual analysis across areas with different residential, socioeconomic, and energy-related characteristics.

The documented coding framework and variable structure make the instrument straightforward to replicate, so that researchers in other countries may field comparable surveys and conduct cross-national studies of microgeneration acceptance. For policy, the dataset offers evidence on the considerations that shape household decisions and on the demographic and attitudinal correlates of adoption, information of direct relevance to the design of subsidies, information campaigns, and other measures intended to encourage decentralized renewable generation.

The dataset has already demonstrated its research value, having underpinned a peer-reviewed comparative study of market acceptance (Karytsas et al., 2019) and a related analysis of change across two survey periods (Karytsas et al., 2020). Its release in documented and reusable form invites further work of this kind, including incorporation into systematic reviews and meta-analyses of renewable energy adoption and environmental behavior, for which the explicit coding scheme and transparent variable definitions are particularly well suited. By making the data openly available, this contribution aims to support continued research on household participation in the energy transition and to provide a reusable foundation for comparative and policy-oriented studies of decentralized renewable energy.

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