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Sustainable energy solutions for the Aegean Archipelago Islands: What is the public attitude?

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Abstract

In contributing towards the realisation of plans to transform the Aegean into a "green" archipelago, the internationally acclaimed TILOS research consortium seeks to transfer tacit knowledge of smart micro-grids beyond the island of Tilos. However, research on public acceptability of sustainable energy technologies suggests that local opposition might undermine such plans. In order to minimize the problems of technological transfers it is, thus, imperative to embark on an early-stage exploration of public attitudes towards proposed interventions. In this paper, we draw on survey data from across the Aegean to uncover the widespread acceptability of green energy solutions. Simultaneously, though, we uncover how broad acceptability does not always translate into actual acceptance of the TILOS energy model, especially with respect to solutions that affect the end-user. In turn, we argue that these findings should inform future interventions with the ultimate aim of securing public support to "green" the Aegean.

Keywords: public attitude; smart grids; renewable energy; TILOS; Aegean; islands

1. Introduction

The electricity generation system of Greece continues to rely heavily on indigenous lignite reserves and oil imports [1]. Nonetheless, policy objectives encouraging energy efficiency, the growing maturity of sustainable energy technologies, as well as advancements in communication technologies lay the groundwork for a "green"

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energy transition [1]. This holds especially true for energy islands. On the one hand, literature has depicted energy supply in isolated systems as a highly problematic process – marked, inter alias, by high operational costs and levels of pollution, and unreliable energy supply [2-4]. On the other hand, the concept of the *green* or *smart* island provides a new way of looking at the role energy plays in everyday life, the evolving relationship between energy utilities and consumers, and its development may create opportunities for transitioning into a sustainable energy future [5-8].

Several international consortia are currently at the forefront of leading sustainable energy transitions for non-interconnected islands. Multiple local innovations have been introduced, and their technological challenges have been addressed in small or large-scale modelling research [7; 9-10]. However, there is also a concerted effort to share tacit knowledge of smart and green energy solutions beyond specific islands. Indicatively, whilst the TILOS-H2020 project primarily engages the islands of Tilos, La Graciosa and Corsica, it aims to 'create a special platform that will enable technological know-how transfer between islands' [11], with members of the consortium developing novel cost-benefit analyses to open-up the dialogue over the transferability of the TILOS energy model [12].

This transfer of best practice experience should not be taken for granted. For instance, the gap between national goals for a green energy transition and local social acceptance has been discussed by several researchers who conclude that social disapproval can restrict the achievement of ambitious objectives [13-20]. Furthermore, researchers differentiate between *acceptability* as a broad, evaluative attitude towards green energy technologies, and consumer *acceptance* as an actual and/or anticipated behavioural response towards specific technological interventions [20-25]. Accordingly, the *'NIMBY'* (not in my backyard) response explains how individuals might oppose bearing any visual, social, economic or environmental costs of having energy-related infrastructure in their proximity, in spite of otherwise favourable attitudes [13-16]. Finally, scholars in the field have discussed how personal, contextual and place-related factors shape local public acceptance of interventions [16; 20-21].

These insights suggest that in order to minimize the problems and maximize the expected results of technological interventions, and prior to strategic plans being drawn-up and governmental decisions taken, it is imperative to research public opinion [22]. In this way, the possibility of failed decisions and interventions is minimised. Nonetheless, previous work in this area has typically used single case studies to understand the emergence of opposition to specific local energy interventions, at a late stage in the implementation process [23-24]. Against this backdrop, a crucial starting point for this research is the realisation of the timely need for an early-stage (*'upstream'*) exploration of whether islanders are likely to accept green energy interventions in the future.

2. A multi-sited exploration of public attitudes to sustainable energy technologies

As part of the research program, a questionnaire survey was used to collect information about the people with respect to the possibility of transferring the energy model of Tilos (where a smart, hybrid energy production and storage system is under development) to 15 further islands of the Aegean. The survey was conducted in September 2017, based on a sample of 1001 households. This sample provides a statistically significant view of public perceptions of sustainable energy technologies, with a statistical error margin of ± 3% (see the sample-to-population ratio adopted in similar studies) [e.g. 18; 25]. Data was collected through computer-assisted telephone interviews, with the researchers involved employing a multi-stage random sampling technique that used a quota based on gender, age and geographical distribution to ensure the representativeness of the results from across the islands considered. In so doing, the population of the islands was divided into eight sampling clusters sharing similar characteristics: a) Agios Eustratios, Astypalaia, Anafi, Donoussa, Kastellorizo and Amorgos, b) Symi, Nisyros and Chalki, c) Milos, d) Sifnos, e) Rhodes, f) Santorini, g) Skyros and h) Ikaria. These islands were purposely selected because they share one or more common characteristics with Tilos (e.g. in terms of size, geographical position, RES potential, etc.) that render the transferability of the TILOS energy model technically and economically feasible.

Drawing on past research experience in the field [e.g. 18-21; 26], each questionnaire had a number of closed-type questions exploring the following three topics: a) public attitudes towards possible sustainable energy interventions, b) the willingness of locals to support a green energy transition (e.g. through RES micro-generation), and c) personal and demographic attributes that might influence energy-related perceptions and behaviours. Data collected was subsequently analysed using standardised descriptive statistical tools and significance tests. During this analysis, the research team consistently uncovered common overall trends amongst all demographic categories and between all sampling clusters. As such, the results presented below only provide aggregate-level data.

3. Results and discussion

Against a backdrop of universal agreement that energy supply security constitutes one of the top three main problems faced by islanders [27], this research suggest that locals are largely supportive of a green energy transition – with the ultimate aim of achieving energy autonomy. It is indicative that when asked to choose between energy supply from fossil fuel plants or from hybrid RES and storage systems, preference for RES is overwhelming – especially in islands where there are plans for the expansion of existing power stations which is linked to a long-term understanding of electricity generation induced environmental impacts [28]. Specifically, 73.7% of the islanders partaking in the research are *strongly in favour* of getting electricity through hybrid RES systems (Fig.1a). The example of Rhodes is indicative, with only 8.2% of locals supporting the expansion of the existing fossil fuel based power plant. The majority (78.6%) of respondents are even in favour of the complete retirement of such plants and of an associated transition to a system that is completely supplied through RES (Fig.1b). Moreover, the survey debunks the myth that islanders are concerned by the prospect of local RES installations [29]. For example, only 9.6% of respondents believe that disturbance from wind turbines is *significant*, whilst 54.8% of respondents state that disturbance from fossil fuel stations is *very* or *somewhat significant* (Fig.2a).

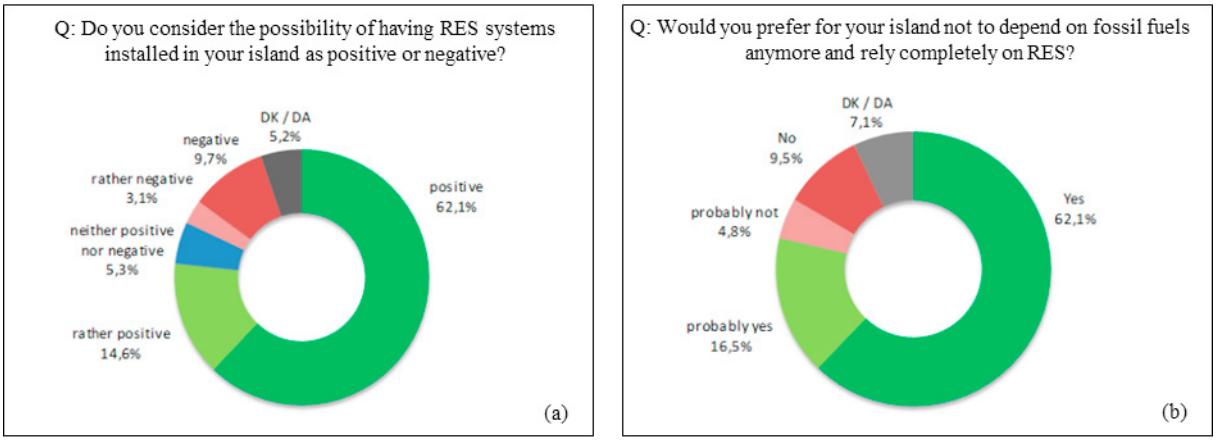

Figure 1: Public acceptability of RES.

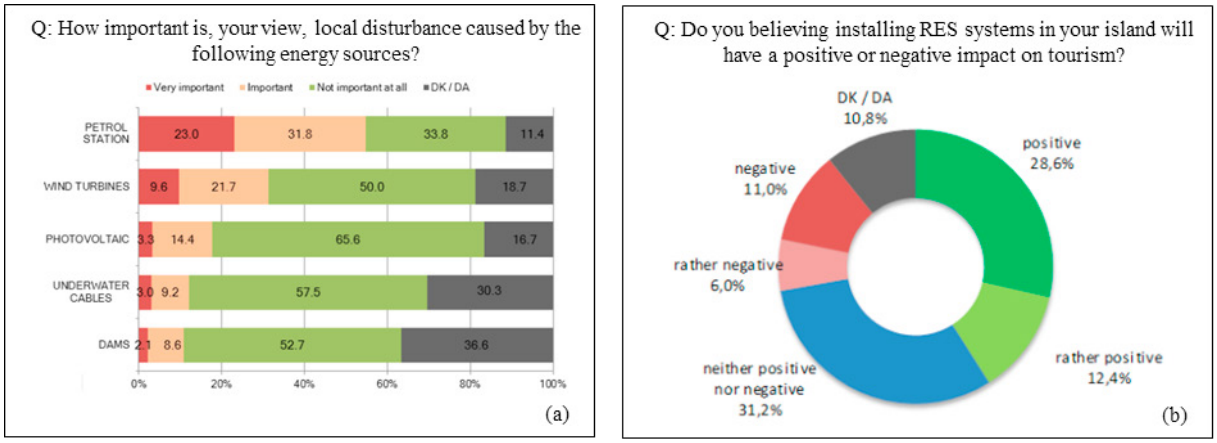

Figure 2: Public perception of the unintended consequences of select energy supply technologies.

Furthermore, as Fig.2a outlines, all renewable-based solutions consistently perform better when compared against either fossil fuels plants or plans for continental interconnections via seabed cables, with PV solutions manifesting themselves as the most favoured forms of energy supply (a statistically significant 65.6% of respondents believe that disturbance from PV installations is negligible). The majority (41%) of respondents even believe that the installation of RES plants might have a positive impact on the tourist industry (Fig.2b). This holds true even in emblematic tourist destinations, such as Santorini, where up to 42% of locals believe that RES installations will benefit the tourist industry. Finally, this positive attitude towards renewable technologies is further reflected by the stated interest of respondents to become active co-providers in a green energy system. Specifically, a majority (42%) of respondents would be interested in producing their own electricity through domestic PV panels (Fig.3a).

Nonetheless, an overall positive attitude towards RES does not result in unconditional willingness to partake in a green energy transition, with the findings empirically validating the need to distinguish between broad *acceptability* of green technologies and actual *acceptance* of specific interventions [15]. With the interventions put forth by the TILOS consortium demanding far more than passive consent for implementation, the fact that many respondents are not willing to accept plans that affect them directly (e.g. DSM, participation in an energy cooperative, co-provision of energy) raises concerns. Specifically, Fig.3a also suggests that the generally positive attitudes towards renewables does not translate into behavioural intention to invest in micro-RES units. Up to 32.1% of respondents indicate that they '*would not'* or '*probably not'* be willing to produce their own energy through domestic PV panels – citing the prohibitive initial installation costs of such technologies as the main reason why they remain reluctant to become active energy co-providers themselves (Fig.3a). Moreover, 51.4% of respondents would '*under no circumstances'* accept DSM, believing that it would act out to the detriment of their energy-use experience (Fig.3b). Conversely, only 7.5% of respondents would accept imposed DSM provided that they benefited from a discount on the price for electricity. Finally, up to 52.6% *would not* or *probably not* be willing to buy shares and co-manage a local energy cooperative producing energy from RES (Fig.3c) – anticipating no net benefits from such involvement.

The challenging nature of securing public support for interventions that affect the end-user is further reflected in the multiple knowledge gaps and in the persistent lack of formed opinions with respect to specific technologies. First, 25.9% of respondents remain uncertain on whether they would be interested in installing domestic PV panels – arguing, inter alias, that there is no certainty they will receive any financial support to cover initial installation costs (Fig.3a). Second, a statistically significant majority (42.8%) remains uncertain on whether they would be interested in installing domestic energy storage batteries to achieve personal energy autonomy – citing, amongst others, a lack of understanding of the technology and their uncertainty with respect to the economic and other costs of this investment (Fig.4a). Third, an overwhelming majority (83.3%) of respondents are completely unaware of smart meter technologies (Fig.4b). With current scholarship celebrating smart metering as a powerful tool permitting the efficient management of energy demand on behalf of the end-user [12], this suggests that islanders might be able to be part of a green grid on the one hand, but are far from ready to become smart energy prosumers on the other.

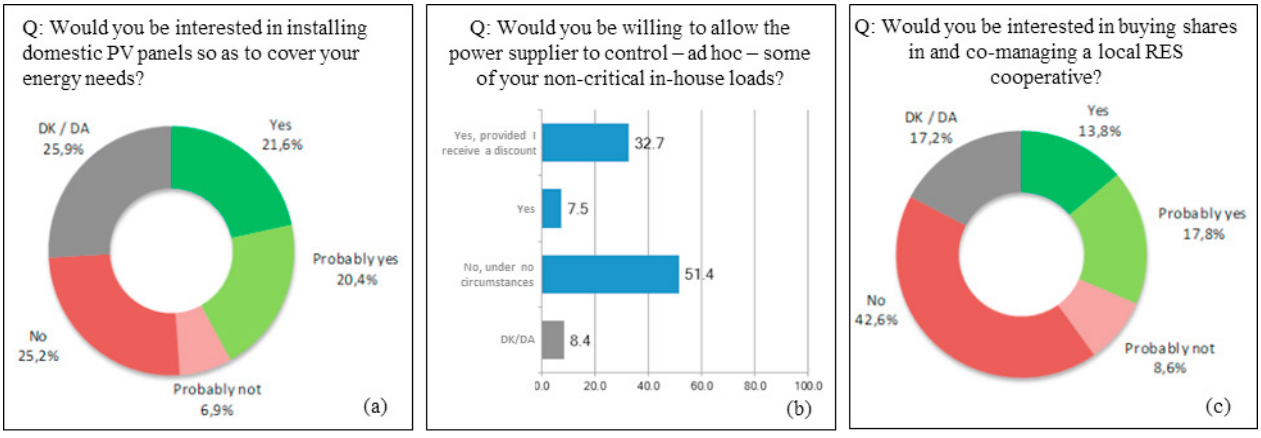

Figure 3: Public willingness to accept plans/technologies that affect them directly.

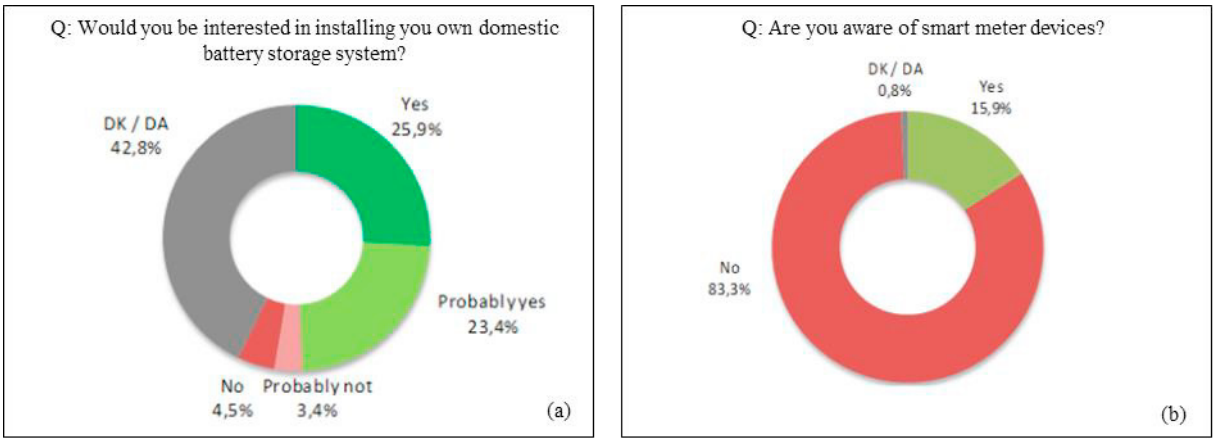

Figure 4: Lack of public awareness of select green and smart grid technologies.

4. Conclusions

Acknowledging the need for timely *'upstream'* deliberation on energy futures [22-23], this paper set out to explore the potential of transferring the TILOS energy model across the Aegean. Our evidence challenges past accounts of acute local resistance to green energy solutions in Greek islands [28]. Public attitudes towards green energy technologies across the 15 islands studied are generally supportive of the interventions put forth by the TILOS consortium. Most of the respondents support the transition to an energy system that is completely supplied by RES, and recognise that renewable technologies are likely to improve the local environment. Nonetheless, broad *acceptability* of such technologies does not equate to universal *acceptance* of all long-term interventions put forth by the TILOS consortium. This holds particularly true for DSM technologies that directly affect the energy-user experience. Moreover, a general lack of understanding of key smart technologies such as smart meters further hinders the actual ability of islanders to take on a more active role in the proposed smart energy transitions.

Whilst definitive statements regarding the ease of transitioning to a green energy system remain premature, these findings suggest two fruitful areas for future research and practice. First, as many research informants lack an understanding of numerous green energy technologies, we argue that there is a pressing need for information dissemination. To this end, we are committed to ensuring that the TILOS intervention plays an important role (e.g. via expert-led site visits) in helping islanders across the Aegean develop a better understanding of promoted technologies. By clarifying uncertainties and demonstrating the positive impact such interventions might have, such disseminated information is expected to stimulate further support to green energy technologies. Second, it is important to better understand how islanders form an opinion on sustainable energy technologies, as this would yield important information on how an intervention should be adapted and communicated such that acceptance increases. In so doing, our future work will develop an in-depth understanding of the socio-psychological and contextual determinants of public acceptability. We hope that, alongside the generally positive trends recorded in this paper, this future work will further inform efforts to transform the Aegean into a "green" archipelago.

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