Sustainable Energy Communities: Understanding their Formation and Progression to Individual Action

Focused Impact Study

Sustainable Energy Communities: Patterns of Formation and Progression to Individual Action

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Report prepared for SEAI by:
The Energy Policy and Programme Evaluation Unit

Sustainable Energy Authority of Ireland
SEAI is Ireland's national energy authority investing in, and delivering, appropriate, effective and sustainable solutions to help Ireland's transition to a clean energy future. We work with the public, businesses, communities and the Government to achieve this, through expertise, funding, educational programmes, policy advice, research and the development of new technologies.

SEAI is funded by the Government of Ireland through the Department of the Environment, Climate and Communications.

SEAI Energy Programme and Policy Evaluation Unit

The Sustainable Energy Authority of Ireland (SEAI) is the expert authority on energy usage in Ireland, using robust, objective data and an evidence-based approach to help inform policy development and behaviours. With a broad range of programmes aimed at demand reduction, energy efficiency and energy decarbonisation, SEAI is at the forefront of Ireland's efforts to sustainably transform its energy system.

To assess the impact and cost-effectiveness of these programmes, SEAI's Energy Policy and Programme Evaluation Unit carries out a systematic review of programme impacts in reference to a range of intended outcomes. Our job is to provide the truth behind the data – the state of play for energy in Ireland, and what part SEAI programmes have played in this.

This report is the first Focused Impact Study, where a limited-scope analysis is carried out using readily available datasets relating to programme inputs, outputs and impacts. These studies are intended to provide insights to inform policy and quantify impacts where available data facilitates assessment. Focused Impact Studies can be seen as intermediate products along a pathway toward comprehensive reviews of programmes' impacts. The insights gained should be seen in the context of potential further insights, once a broader set of considerations is included and further data collection is completed.

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Executive Summary

The SEAI Sustainable Energy Community Programme engages and enables citizens to work together in community groups to increase their knowledge of energy and climate and to develop more sustainable local energy systems. Newly registered community groups are assigned a mentor by SEAI. They are then guided through a 'learn-plan-do' pathway to increase knowledge of energy use and facilitate sustainable energy projects in their locality (see Figure 1).

This impact study examines the evolution of the Sustainable Energy Community network, the prevalence of communities in particular locations and the extent to which communities might be stimulating uptake across multiple household-focused national grant programmes, including home energy upgrades, solar PV and electric vehicles. Due to a lack of data, several objectives of the programme are not assessed in this study, including the impact of the SEC network on energy and climate knowledge as well as links with SEAI Community Grants. These objectives will be assessed as further data becomes available.

What we did

To examine SEC formation, internal administrative data on the SEC network was linked to Census 2022 small area level data, Ireland's smallest statistically defined geographic unit. Using this dataset, areas that have formed SECs were compared to areas that have not seen SEC formation across demographic, energy related and socio-economic variables.

For the analysis of SEC impact on grant activity, anonymised individual level grant data from SEAI administrative databases was summarised by year and small area. This was linked to the timing of SEC establishment, in small areas with SECs. This data enabled a difference-in-differences statistical analysis to assess the impact that SEC presence has on grant uptake in its surrounding areas. The analysis tests alternative 'ranges of influence' surrounding the original SEC small area, namely the nearest 500, 1,000 and 1,500 households. Results are checked with several model variations and robustness tests.

The results provide deeper insights into the likelihood of SEC formation around Ireland than had previously been available. In addition, the analysis provides new evidence of the programme's impact on stimulating grant uptake, which had previously been unquantified.

However, given the reliance on available data, a comprehensive understanding of progress across all the programme's objectives requires further research and new data collection in the form of surveys and interviews. Recommendations and possibilities for future research are summarised in the concluding sections of the report.

What we found

<u>Patterns of SEC formation</u>

The analysis provides insights into the characteristics of areas in which SECs have formed in relation to places where SECs have not emerged. These can potentially be used to inform future network expansion, for example by indicating the types of communities that have been less likely to form SECs for which tailored new approaches could be trialled. In addition, common community traits in areas with SECs could offer a targeted communication channel for future policy objectives, for example targeting communications towards households with standalone oil heating systems.

In summary, the analysis found a number of area characteristics that are associated with a greater likelihood of SECs to form, such as rural areas, areas with greater retirement levels and fewer children, and areas with greater shares of employment in agriculture and skilled trades. A possible explanation is that expansion of the network has been more successful among groups with fewer competing daily responsibilities. This may suggest an opportunity to develop less time-demanding means of engaging with other population groups.

SECs leading to action

The analysis of grant activity in the geographical areas surrounding SECs suggests that SEC establishment may affect uptake for the Better Energy Homes, Solar PV and Electric Vehicle (EV) schemes. Results indicate that SEC establishment is associated with increased grant issuance in Better Energy Homes and Solar PV. However, results also suggest reduced EV grant activity relative to areas without SECs. The size of the impacts appears to be meaningful, with estimated average effects on annual grant expenditure of +10% for Better Energy Homes, +8% for Solar PV and −13% for EVs. These results are supported by several robustness tests, described in the report.

Overall, these results suggest a significant effect of SECs on the adoption of home energy upgrades. The finding of an opposite effect for EVs may illustrate that households' use of limited investment resources can be influenced by SECs, with priority given to those home energy upgrades. It may also indicate that the efforts of SECs in the mobility space are more geared toward active travel projects that are not captured in this study.

Further work participant surveys or new forms of data collection is now needed to understand the drivers of this finding. A way of achieving this is suggested in the concluding section of the report. Note that available data precluded incorporating Community Grants in the analysis. The National Home Energy Upgrade Scheme has also launched too recently for there to be sufficient data to link to SEC activity.

Key findings

SEC formation

- Analysis of census data suggests that SEC formation is associated with rural settings and with relatively higher employment in agriculture and skilled trades.

- Additionally, a majority of SECs are located in the vicinity of other SECs, suggesting proximity to other SECs plays a role in SEC formation.

- Local populations where SECs have been established, compared to those where no SEC is yet established, are more likely to:
    - Have fewer demands on their time with a greater prevalence of older aged residents and lower shares of households with children.
    - Be resident in middle class areas.

SEC impact on grants

- Establishment of an SEC is associated with greater Better Energy Homes and Solar PV grant issuance in a small area in the years following SEC formation.

- No statistically significant effect is found for the Warmer Homes Scheme; however the dataset was unable to incorporate most applications on the waiting list. The data is therefore less representative of the Warmer Homes Scheme compared to the other assessed schemes.

- SEC establishment is associated with lower EV grant issuance in small areas relative to small areas without SECs. This result is robust to several tests and alternative model formulations. It may signify that the information provided through the SEC network has led households to prioritise constrained funds for efficiency projects over EVs.

- Put differently, the findings of this analysis are consistent with the idea that the SEC programme supports overcoming barriers of limited information and motivation amongst citizens. Yet, they cannot overcome other barriers to grant uptake, such as financial barriers, without sufficient supporting additional policies.

- Available data does not allow the identification of the SECs that are most effectively driving grant uptake. However, at the time of analysis, a large majority of SECs are in the learn stage of the programme.[1] It is therefore likely that SECs in the learn stage have also been effective in driving grant activity. This suggests that the information provided through the network also stimulates grant activity, in addition to the Energy Master Plan process.

Future research

- This study utilised available data which precluded analysis of several important goals of the SEC programme. No assessment of the impacts of the programme on climate and energy knowledge is made.

- The links between the SEC and Community Energy Grants are also not assessed. These could be analysed in future with additional data collection.

- The findings of this analysis would benefit from additional supporting primary data collection from SEC members and their wider communities.

[1] At the time of analysis, 72% of SECs were in the learn stage of the programme.

1. Introduction

Informed and motivated communities are an important enabler of Ireland's sustainable energy transition. To this end, SEAI's Sustainable Energy Communities (SEC) programme supports communities in the delivery of sustainable energy systems at the community level, by facilitating information exchange and inspiration. The programme approach guides communities using a 'learn-plan-do' journey focussing on:

- learning and engagement (learn);
- community energy analysis (plan) with a 100% funded Energy Master Plan (EMP); and
- the delivery of projects through the do phase.

Furthermore, the SEC network provides an important avenue of communication and knowledge sharing, enabling interested citizens to directly participate in the energy transition. Many SECs are now organically organising knowledge sharing within their wider communities. Moreover, communities within the network can be directly engaged with and signposted towards relevant opportunities in other grant schemes.

This Focused Impact Study provides an interim assessment of the SEC programme's pattern of growth and impact on household energy measures.

History of the SEC programme

Ireland's SEC programme was launched in 2015 after the Government White Paper on Energy, *Ireland's Transition to a Low Carbon Energy Future 2025-2030*, set out Government actions to achieve a low carbon energy system by 2050. These included actions for communities to effect change in energy use. The SEC network has since experienced rapid growth. [2] At the time of writing, in early 2024, the network of communities has expanded to over 800 with broad representation in all 26 counties of Ireland (see Figure 1).

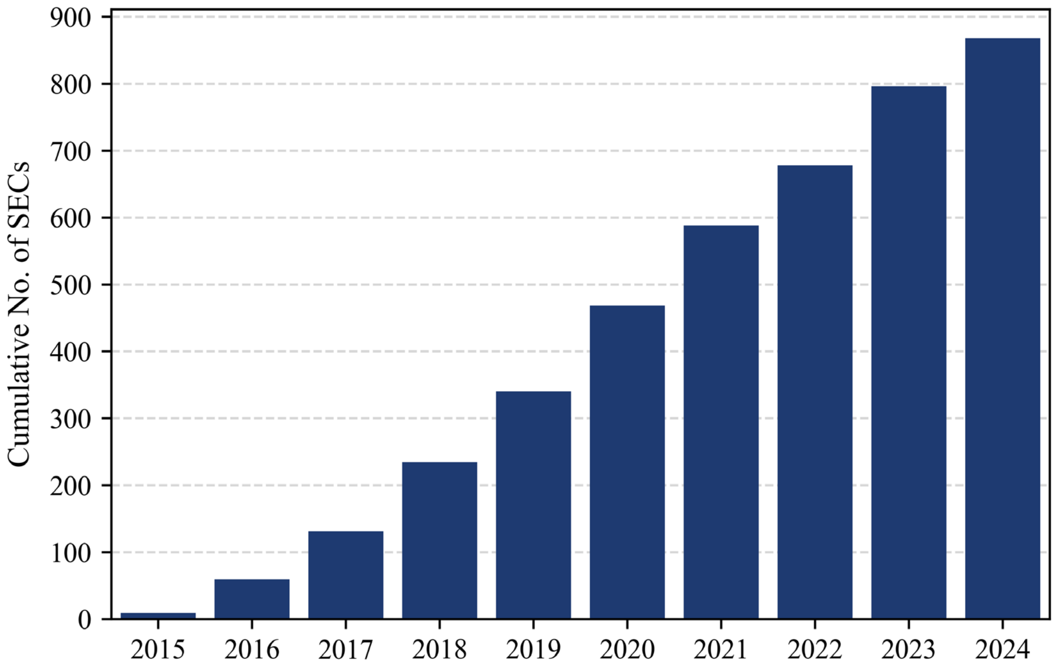

Figure 1. Cumulative number of SECs to end April 2024

[2] Details and news about the programme can be found on SEAI's website: seai.ie.
The 2019 Climate Action Plan established a target of 500 SECs by 2025 and 1,500 by 2030.

SECs can be characterised as community-based groups of people who collaborate to improve the sustainability of their local energy systems. SEC network membership is not strictly conditional and can extend to residents' associations, sports clubs, local businesses, universities or any other community focused organisation. Importantly, the SEC is locally initiated and locally rooted. A SEC emerges out of a specific place-based community, and its focus is on its own local energy system. This definition contrasts somewhat with the more common international version of energy communities which collectively develop local renewable energy generation. To date, development and community ownership of utility scale wind and solar generation has not been a core focus of Ireland's SEC programme.

The SEC approach to impact

The focus of each SEC is to first learn about and then to act to improve the sustainability of its local energy systems. SEAI facilitates this by guiding each SEC through a 'learn-plan-do' process (see Figure 2).

Figure 2. The 'learn-plan-do' pathway

In general, new SECs are locally initiated, either organically or with proactive engagement by a network of county mentors. The interested party first registers on SEAI's website. They are then welcomed into the network and assigned a mentor. At this point, they are in the learn stage of the programme. The mentor is an experienced and knowledgeable energy professional who provides guidance to the SEC. This guidance can take the form of explanations of the benefits and supports available to them in other grant schemes, invitations to events and workshops, or introductions and site visits.

Following a period of learning, the SEC is encouraged to progress to the plan stage. In this stage, SEAI provides grant funding of between €10,000 and €25,000 for the SEC to hire a professional consultant to produce an Energy Master Plan for its local energy system. This plan summarises the community's energy supply and use across the modes of electricity, heating and transport. It also explicitly identifies a list of potential projects to improve energy efficiency and decarbonise energy use.

Once the Energy Master Plan is complete, the SEC progresses to the do stage. The SEC is now signposted towards the various grant funding available in Ireland to carry out some of the recommended energy projects. However, it is important to note that no part of the SEC operational structure is mandatory. SECs do not have to, and indeed often don't, progress beyond the learn stage. This does not preclude them from leveraging the available supports for energy projects. Alternatively, an SEC may progress to the do stage but fail to carry out any energy projects.

The operational structure and approach of the SEC programme place considerable focus on expanding renewable energy and energy efficiency projects for households and communities. However, it is guided by a broader set of objectives, shown in Figure 3. Primarily, it aims to engage citizens with differing levels of energy knowledge and facilitate their participation in the energy transition. Each SEC aims to be energy efficient, use renewable energy where possible, and consider smart energy solutions. Its goals are beyond merely encouraging grant uptake. The SEC programme aims to foster energy knowledge and skills in the population; enable willing citizens to lead the energy transition from the bottom up; provide a means of communication Government and citizens; and increase public support for larger-scale renewable energy and energy efficiency projects.

Primary Objectives
(Short to Medium Term)

1	Establishment of 1,500 sustainable energy communities by 2030	✔
2	Support communities to develop energy management skills and knowledge	~
3	Accelerate and increase uptake of SEAI grants	✔
4	Grow community involvement in the National Retrofit Programme	✔
5	Expand SEC participation and leadership of Community Energy Grant projects	✘
6	Enable communities to participate in available community grant schemes, where knowledge and capacity of the community would otherwise be lacking e.g., RESS auctions	✘
7	Market successful demonstration projects to encourage replication	✘

ASSESSED	
✔	Yes
✘	No
~	Indirectly / Somewhat

Supplementary Objectives
(Longer Term)

1	Reduce energy consumption and emissions, via technological and behaviour change	~
2	Provide avenue of communication with communities on energy policy	✘
3	Increase broader support for energy transition	✘
4	Sustainable Energy Communities share knowledge and positively influence sustainable behaviours in their wider communities	~

Figure 3. Policy objectives of the SEC programme

Scope of the Focused Impact Study

SECs have clearly led to increased organisation and planning for more sustainable local energy systems. Whether and to what extent this organisation and planning has led to higher levels of community and residential energy projects has not previously been quantified. The characteristics of the areas in which SECs emerge have also not been systematically examined.

This Focused Impact Study leverages available internal and external datasets to assess a subset of the objectives in Figure 3, where the focus is on individual action – that is, individuals applying for energy grants. Specifically, the analysis examined:

1. SEC formation: the place-based traits positively associated with SEC emergence;
2. SEC action: whether SEC presence has resulted in observable impacts on sustainable energy grant uptake in their vicinities.

The analysis of SEC formation compares the population characters of areas where SECs have formed to areas where SECs have not so far been formed.

The analysis of individual action undertaken in SEC areas focusses on household grant schemes for which sufficient data was available, namely Better Energy Homes, Solar PV, electric vehicles (EVs), and the Warmer Homes Scheme. For the analysis, SEAI administrative data was combined with relevant publicly available datasets. The methods used are described in detail in the main body of the report and the accompanying technical annex.

The analysis assesses impacts by testing for additional change in grant activity in the households neighbouring SECs, following the formation of the SEC, in comparison to areas without SECs. It is not possible to precisely delineate the true range, or borders, of influence of each SEC in its surrounding area. Therefore, the analysis tests alternative assumed ranges of influence: the nearest 500, 1,000 and 1,500 neighbouring households. The robustness of the results is tested with several model variations and suitable tests.

The objectives in Figure 3 oriented around community-based, rather than individual actions, could not be assessed with currently available data, and nor does this study address more qualitative impacts. The analysis does not explore impacts related to Community Grant uptake, nor the impact of the SEC network on energy consuming behaviours. While no direct measure of energy knowledge and acceptance is included, the analysis of grant uptake could be considered an indicator of knowledge and acceptance levels. However, given this is a core objective of the programme, a more systematic approach to measuring the impacts on climate literacy is warranted. Objectives excluded from the analysis could be assessed with additional future data collection, which is discussed further in Chapter 6.

2. Data

Several data sources are utilised throughout the analysis, all of which can be broadly grouped under the three categories of internal SEC network data, census data at small area level[3] and internal SEAI grant data. This chapter summarises important details of the three main data sources, as well as the key cleaning and transforming steps that were completed.

SEC establishments and details

Data on the SEC network utilises internal administrative data. This data originates from the SECs themselves, through their interactions with SEAI's IT systems, or data reported to SEAI by the SEC programme's regional co-ordinators and mentors. A total of 765 active SECs is incorporated in the analysis with registration dates between 1 January 2015 and 30 September 2023, the cut-off date for analysis.[4] Each SEC is located within a small area. This is necessary to link SECs to census statistics and to SEAI grant data.

Census small area statistics

The second data source is the 2022 Census Small Area statistics published by the CSO. In Census 2022, Ireland is divided into 18,919 small areas, for which detailed statistics are available. Relevant available statistics range across demographic, energy related and socio-economic categories. A comprehensive list of the variables used in the analysis is provided in the Appendix. Linking this data to the SEC network via small area codes facilitates analysis of SEC formation, presented in Chapter 4.

SEAI grant scheme administrative data

Finally, to assess the impact of SEC presence on grant uptake, SEAI's administrative grant databases are utilised. Grant applications typically include the household electricity Meter Point Reference Number (MPRN) and/or Eircode. With this information, SEAI's Geographic Information Systems team has been able to situate individual grants within small areas.[5] For this analysis, anonymised grant data was linked to small area codes. These could then be summarised by year and linked with the timing of SEC establishment, using SEC registration dates. The majority of grants in the assessed schemes could be linked to small area codes, facilitating a comprehensive analysis.

The four largest household grant schemes are assessed to determine whether SEC presence has an observable impact on uptake. These are Better Energy Homes, Solar PV, the Warmer Homes Scheme, and EVs. The first three of these schemes focus on energy efficiency and decarbonised heating systems in the home. While Solar PV funds only solar photovoltaic installations, Better Energy Homes and the Warmer Homes Scheme offer the types of measures shown in Figure 4.

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[3] ,Small Areas are a geographic boundary system designed by Tailte Éireann and the CSO. They are the lowest level of geography for the publication of census statistics in line with data protection guidelines and typically contain between 50 and 200 dwellings. In the 2022 Census, Ireland is divided into 18,919 small areas. Further details are available here: Census 2022 Small Area Population Statistics - CSO - Central Statistics Office

[4] Note that over 800 SECs have now joined the network. The lower number here is due the cut-off date for analysis and removal of a small number of SECs who were identified as inactive.

[5] Geocoding of grant addresses is enabled by Ireland's GeoDirectory service.

Home Energy Upgrade Grants Available

	Better Energy Homes	Warmer Homes Scheme
Home energy assessment		✓
Wall and roof insulation	✓	✓
Windows		✓
Heating Controls	✓	✓
Heat pump	✓	✓
Solar water heating	✓	
Solar electricity	✓	
Ventilation		✓
BER assessment	✓	✓

Figure 4. SEAI home energy upgrade schemes and measures available

Additional details on data cleaning and the methodology used to analyse the impact of SEC presence on grant uptake is provided in Chapter 5 and the accompanying Technical Annex.

Table 1. Details of grant data used in the analysis

	Better Energy Homes	Solar PV	EV	Warmer Homes Scheme
Number of grants	255,982	41,621	42,413	47,476
Years	2010 -2023	2018 - 2023	2012 - 2023	2014 - 2023

It should be noted that one of the main links from the SEC programme to grant uptake is through Community Grants[6]. However, a comprehensive structured dataset was not available for Community Grants at the time of analysis, so this scheme was not included.

Representing SEC catchment areas

All parts of the analysis rely on locational data to link disparate datasets. Locational data for SECs is somewhat less certain than census and SEAI grant data, however, both of which should not suffer from much, if any, measurement error.

The source of location data for SECs comes from the registration process. When a newly formed SEC registers with the network, they are required to place a pin on an interactive map of Ireland to select their location. Programme administrators subsequently manually check a separately provided address to ensure alignment with the pin location. The pin location generates a set of coordinates which can be used to assign the SEC to a specific small area code.

[6] The Community Grants scheme provides funding to retrofit community buildings, also incorporating groups of homes and local businesses. See Community Grant Overview | SEAI for more details.

SECs, being community organisations with a focus on local energy use, have an intrinsic spatial dimension. This means a geographic analysis is an appropriate analytical lens for the programme. Still, SECs cannot be precisely delineated within statistically defined areas. Rather, their influence will range across surrounding populations and distances, and that influence often travels through social rather than physical networks. Furthermore, different SECs vary quite substantially in scale, structure, and context, being variously formed out of universities, sports clubs, agricultural associations, or small groups of interested local people. As a result of the varying sizes and foundations of SECs, the influence of each SEC across people and distance is itself non-uniform across the network. Moreover, the influence that an SEC has over its surrounding area will also vary through time, so in reality each SECs boundary will not be fixed over time.

Given the nature of the available data, the approach taken for the analysis is to assess SECs at varying assumed 'ranges of influence'. Using the pin location of SECs when they register, surrounding small area codes are identified and assigned to each SEC.

As small areas are deliberately constructed to contain a similar number of households per small area, their geographic size can vary quite substantially in different parts of the country. The approach taken implicitly assumes that SEC influence propagates across people rather than distance. This is a necessary assumption to utilise census statistics, which are only available by small area. Moreover, it is not theoretically an unreasonable assumption given the varying lifestyles and geographic spread of communities across urban and rural areas.

While this approach to assuming a range of influence is not perfect, limitations of the data necessitate certain choices. Various robustness tests are carried out where appropriate to further substantiate results.

Table 2 below illustrates the proportion of total small areas assumed to be influenced by SECs at the three ranges of five, ten and fifteen nearest small areas. At the broadest range of assumed influence, nearest fifteen small areas, the collective coverage of Ireland's small areas is 43%, whereas at the narrowest range of five nearest small areas, SECs have only 20% coverage.

Table 2. Proportion of Ireland's population influenced by SECs at varying assumed levels

	Original and 5 nearest SAs	Original and 10 nearest SAs	Original and 15 nearest SAs
SEC small areas	3,853	6,290	8,193
Non-SEC small areas	15,066	12,629	10,726
Total	18,919	18,919	18,919
SEC % of total	20%	33%	43%

Given that the range of fifteen nearest small areas likely results in an unrealistically high combined influence of the SEC network, and that the range of five nearest small areas was considered by the SEC administrative team to be too narrow to capture community influence effects, the results for the middle range of ten nearest small areas are normally presented in the analyses that follow. That said, for each analysis, all three ranges of influence have been tested and compared.

In view of the necessary assumptions for classifying small areas as SEC or non-SEC, the research questions can be stated more precisely. In effect, the analysis explores the following:

1. Whether place-based characteristics systematically differ between areas surrounding SECs and areas without SECs, when classifications are made by assuming the nearest five, ten or fifteen neighbouring small areas are categorised as an SEC area. This translates to, on average, the closest 500, 1,000 or 1,500 neighbouring households.

2. Whether there are observable changes in grant activity in selected schemes in the areas surrounding an SEC following the SEC's formation, in comparison to areas without SECs, in the same time periods. The analysis also questions if these changes can be said to be additional to what would have occurred in the absence of the SEC.

In relation to the latter point, it is important to highlight that the prior expectation for observing a statistically significant effect is low. This is due to the indirect nature of stimulating grant activity through information provision as well as the diffuse and varied nature of the influence of SECs over their surrounding populations.

3. Patterns of SEC formation

The creation of a new SEC is usually organically initiated by interested members of a community. An additional route to SEC formation comes from the proactive efforts of county mentors, who have encouraged existing community groups to become SECs. Once interest has been expressed, SEAI facilitates and guides the group through the formal establishment process.

In this chapter, place-based characteristics are examined to assess whether areas in which SECs have formed are systematically different to areas in which SECs have not yet formed. Assessed traits include demographic, energy-related and socio-economic attributes, examined at the small area level. For each category analysed, results are shown under the assumption that each SEC influences its 10 nearest neighbouring small areas. Results for varying assumed ranges of SEC influence are reported in a Technical Annex, TA.1 of 2. Firstly, a descriptive analysis is completed. Then, the relative importance of the set of place-based characteristics are jointly assessed by means of logistic regression.

Contrasting SEC and non-SEC areas

Several notable differences exist between the small areas in which SECs have formed and those which have not experienced SEC formation to date. In relation to demographic traits, SEC small areas appear to be much less urban on average, as shown in Figure 5.

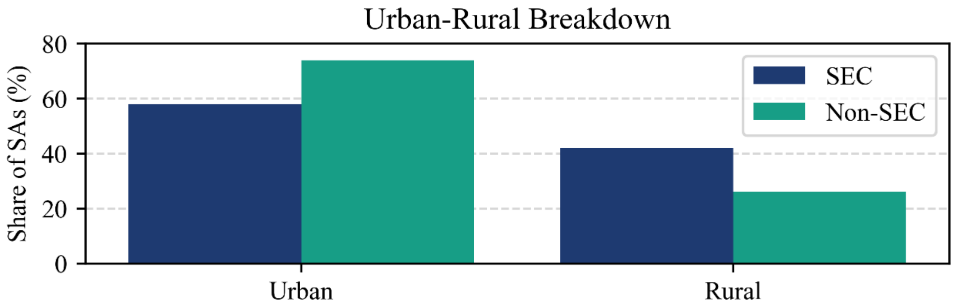

Figure 5. Urban-Rural divides in SEC and non-SEC areas [7]

Comparing the socio-economic data of SEC and non-SEC areas reveals that more affluent areas are less likely to host SECs. Figure 6 illustrates the divide, showing lower average scores on the 2022 Pobal Deprivation Index for SECs at small area level. The lower subplot shows the income decile of the electoral division within which each small area is situated.[8] Again, SECs appear to form in areas of lower average income, with higher shares of SEC small areas located in electoral divisions within the first two income deciles. This may be due to higher shares of pensioners on fixed incomes, however, as SECs are also under-represented in areas of more extreme deprivation, as measured by the Pobal Deprivation Index.

[7] Throughout the report, all graphs are based on the assumed range of influence of the original SEC small area and the 10 nearest small areas. The values in the graphs represent the average value of a particular category across the small areas classified as SEC and non-SEC.

[8] Pobal Deprivation Index scores are the small area relative deprivation scores published by Pobal using the 2022 Census data. The electoral division income deciles are calculated from 2016 data using the CSO publication Geographic Profiles of Income in Ireland. See Appendix A1 for more information on data inputs.

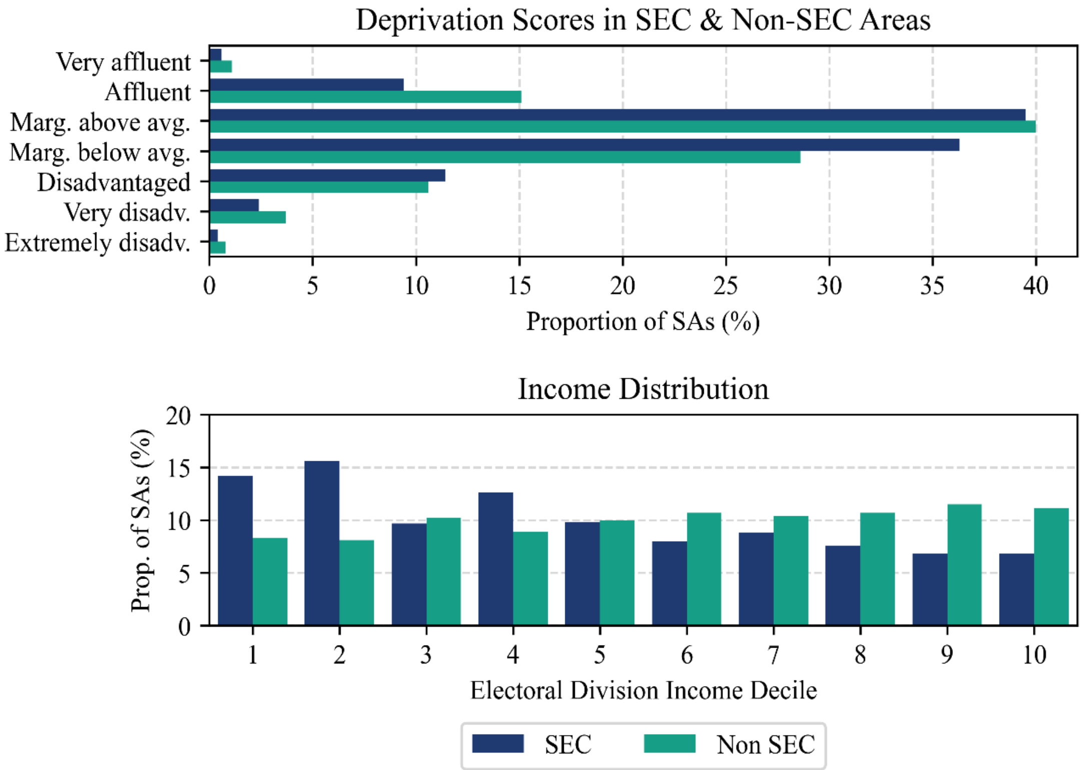

Figure 6. Deprivation scores and income in SEC and non-SEC areas

Lastly, regarding sectors of employment, working populations within SEC small areas are much more likely to be employed in agriculture and skilled trades, with the relative difference in the agriculture sector, as a share of total employment, particularly large.

Overall, several of the differences between SEC and non-SEC areas point to greater SEC formation among rural populations. This is perhaps due to stronger community connections between rural neighbours relative to more populated urban areas. Multiple variables also indicate greater SEC formation in areas where residents are likely to have fewer time-constraining daily responsibilities. This is supported by the higher shares of older residents and retirees in SEC areas and the lower shares of households with resident children in SEC areas. Table 3 summarises a selection of meaningful differences in mean values between SEC and non-SEC areas.

Table 3. Notable differences between SEC and non-SEC areas[9]

Indicator	SEC mean	Non-SEC mean	Relative difference (%)	p-value*
ED population number	4,013	5,991	49.3	<0.00
Percent small areas urban	58	74	28.6	<0.00
Percent HHs with children	44.4	47.7	7.4	<0.00
Percent heating systems fossil fuel	76.9	80.7	5.0	<0.00
Percent HHs with renewable energy	26.7	21.6	-19.0	<0.00
Percent PES retired	17.7	15.8	-10.7	<0.00
Percent occupation - skilled trades	15.1	12.3	-18.6	<0.00
Percent sector - agriculture	5.5	3.2	-41.8	<0.00
Median HH gross income (ED level)	€43,091	€47,849	11.0	<0.00
Percent working age HHs with welfare as primary income (ED)	15.0	13.7	-8.5	<0.00
Percent HHs with State Pension as primary income (ED)	14.6	12.7	-13.3	<0.00

* For a mean value that a statistical model estimates to indicate a real value, the *p*-value indicates the probability that the real value is not equal to zero. A low value indicates high confidence that the indicator shown along the left has a relationship with SEC establishment.

Which variables predict SEC formation?

The preceding results were reported as group mean differences. A risk when interpreting these results is that the different groupings may be highly correlated with each other which can distort interpretation. For example, rural populations may have a higher average age, in which case it is difficult to draw conclusions about the extent to which either variable is related to SEC formation.

[9] Results presented here are for the assumed range of 10 neighbouring small areas. If SEC areas are larger in magnitude, the values are coloured green and red otherwise. Descriptions of all variables and their sources are included in the Appendix, A1. P-values are calculated using bootstrap tests of differences between group means. Further description and results for alternative assumed ranges and a more comprehensive set of variables is presented in the Technical Annex, TA.1.

To assess the effects of the individual variables, it is necessary to estimate the relationship each variable has with SEC formation, while controlling for the influence of all other variables. Logistic regression is employed to this end. In order to avoid the bias that arises from correlation between explanatory variables, principal components analysis is first performed on the census data. This technique effectively transforms a large set of variables into a smaller number of variables, while retaining their explanatory information. For an in-depth discussion of the methodology, please refer to the Technical Annex, TA.1.

The results of the analysis show that the impact of any one variable is typically very small. Moreover, the combined set of variables cannot reliably predict SEC formation. This indicates that the reasons for SEC formation over time have been complex and are not easily captured in the available data. Nonetheless, a subset of variables is estimated to have significant impacts on the likelihood of SEC formation. These are presented in Figure 7 below.

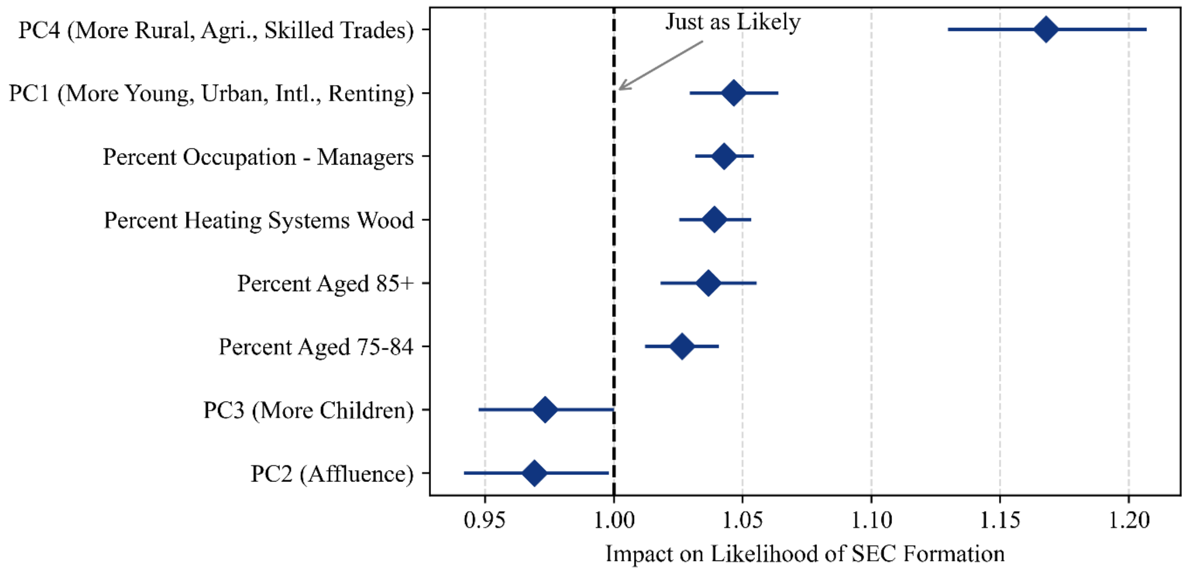

Figure 7. Impact of selected variables on likelihood of SEC formation[10]

Broadly, the results of the regression analysis support the descriptive group differences presented previously. The strongest estimated impact on the likelihood of SEC formation comes from the combination of rural areas with high employment in agriculture and skilled trades.

The positive relationship between older aged residents and SEC formation is also confirmed, with the 75+ age bracket and prevalence of retirees all positively impacting the likelihood of SEC formation. A negative relationship with the prevalence of children is likewise supported by the model. The modelling also reveals additional results which were not previously clear from group differences, namely a positive association between urban areas with high shares of young international renters and SEC formation.

A final question of interest for SEC formation is whether the presence of an SEC makes the establishment of another nearby SEC more likely. Table 4 presents the proportion of SECs in two alternative assumed ranges of influence, which overlap with one or multiple other SECs.[11]

[10] Results are presented in units of odds ratios. The horizontal bars represent the 95% confidence interval of the estimate. If this line crosses 1, there is insufficient evidence for a non-zero effect for this variable. For full tabular results for all assessed variables and further explanation, refer to the Technical Annex, TA.1.

[11] It is not possible to include the presence of overlapping SECs in the logistic regression as perfect separation occurs and the maximum likelihood estimation fails to converge.

Table 4. Percentage of SECs with overlapping ranges of influence

Overlap with another SEC	Range of influence	
	Original small area & 5 nearest SAs	Original small area & 10 nearest SAs
Yes	56%	80%
No	44%	20%

In both of the assessed ranges of influence, a majority of SECs overlap with one or more other SECs. In the case of the 10 nearest small area ranges, the majority is considerable, with 80%of SECs overlapping with other SECs.[12] Thus, the pattern of SEC formation to date is supportive of social network effects with SECs tending to cluster in neighbouring areas.

[12] The share of SECs overlapping with others will naturally increase with increasing assumed ranges of influences, due to the higher shares of small areas which become classified as SEC. As noted in chapter 3, this is 20% and 33% of all small areas at the assumed ranges of 5 and 10 nearest small areas.

4 Impacts of SECs on grant uptake

A core objective of the SEC programme is to enable communities to participate in Ireland's energy transition by educating them about renewable energy and energy efficiency upgrades and their associated grants. The programme also seeks to directly galvanise action through its learn-plan-do process. The SEC network can also impact grant activity by transmitting information and motivation between SECs. Or, as has been occurring in recent years, SECs can arrange energy information sessions within their broader community to motivate grant uptake among non-SEC members within their local communities.

In this chapter, the impact of the SECs on home energy grant and EV grant participation in Ireland is assessed. To estimate the impact of SECs on grant activity, individual grant data is linked to small area codes. Then, the sum of grant awards per scheme per year in each small area is calculated. Using the dates of SEC formation and their location identifiers, it is possible to link the timing of SEC formation to annual grant expenditure. Together, this data enables the use of a quasi-experimental, difference-in-differences approach to estimate the impact of SEC establishment on nearby grant activity. For a detailed discussion of the data and methods used, please refer to the technical annex, TA.2.

The statistical models produce estimates of the relative change in average grant expenditure per year per small area in the years following SEC formation. These estimates account for area- and year-specific fixed effects. In other words, the models estimate whether exposure to a SEC is associated with an increase or decrease in average annual grant expenditure compared to non-SEC areas, once the fixed characteristics of small areas (such as more affluent areas more able to afford upgrades) and years (such as fluctuations in interest rates and energy prices) are accounted for.

As discussed in Section 2, the analysis assumes certain ranges of influence surrounding the original SEC small area. So, what is being analysed is whether changes in grant activity can be isolated and attributed to SEC presence when the nearest five, ten, or fifteen small areas are classified as SEC areas and compared to non-SEC areas. This translates to, on average, the closest 500, 1,000 or 1,500 households to each SEC's registered address. Again, it should be noted that the prior expectation for the analysis is for no effect to be observed at the aggregate level. This is due to the indirect and diffuse nature of grant incentivisation in the SEC programme and the use of rigorous, and often considered conservative, statistical methods. The main results presented below are the results for the 10 nearest small areas as the assumed range of influence. Results for the five and fifteen nearest small areas as the assumed ranges of influence are presented in a separate sensitivity test.

Results

Figure 8 summarises the results for Better Energy Homes, Solar PV, EV Grants, and the Warmer Homes Scheme.[13] Full tabular results are available in the Technical Annex, TA.2.

Each bar in Figure 8 represents the upper and lower bounds of an estimated 95% confidence interval. These confidence intervals indicate the average change in grant expenditure in a small area, (and the uncertainty associated with that average), in the years preceding and following SEC establishment compared to small areas which didn't form SECs. As previously noted, these estimates account for the base level of activity of each small area and the common effects occurring in specific years, providing evidence for additionality in grant activity associated with the SEC programme.

[13] These are the programmes for which comprehensive structured data is available and linkable to small area codes. With the exception of Community Grants, these are the household-oriented grant programmes administered by SEAI and, therefore, the programmes for which SECs may be expected to influence.

Overall, the results indicate that SEC presence meaningfully impacts grant activity in a small area, in the average case. Moreover, SEC exposure has varying effects on grant expenditure across different schemes and over years of SEC presence. Positive effects are found for Better Energy Homes and Solar PV; no statistically significant effects were found for the Warmer Homes Scheme; and a negative impact is found on EV grant expenditure. The following sections discuss the results in more depth.

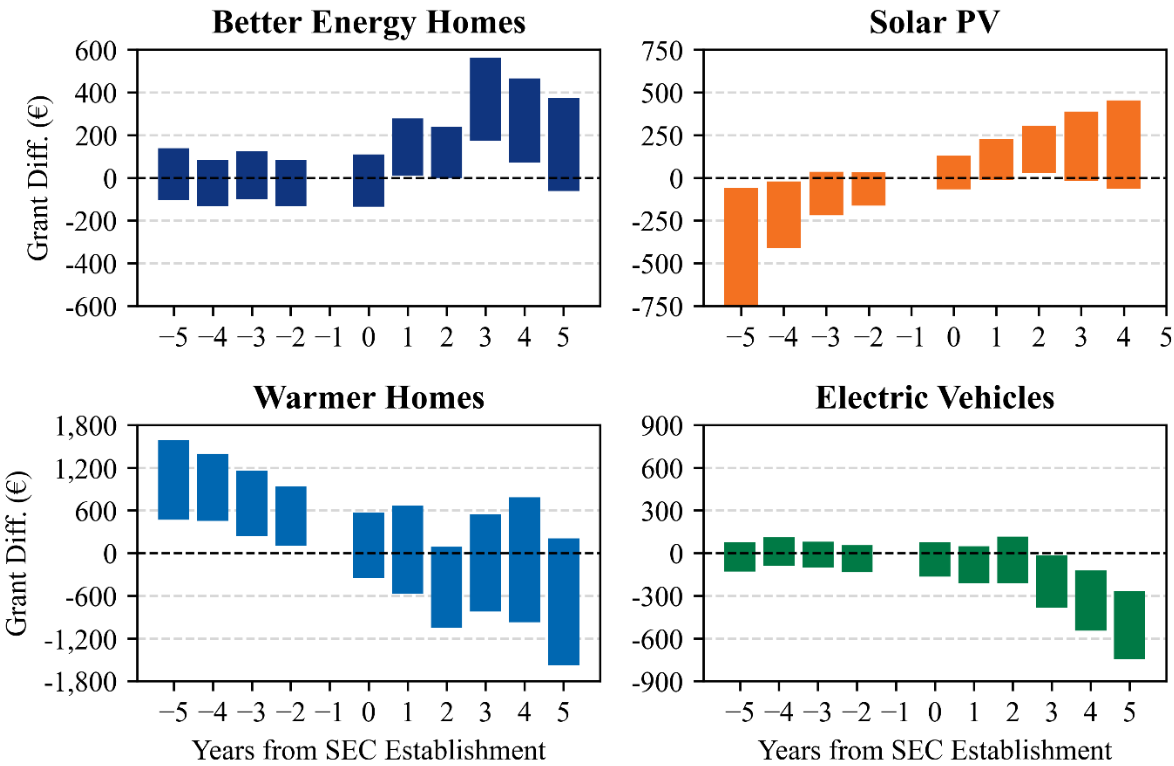

Figure 8. Difference in grant expenditure following SEC establishment[14]

Better Energy Homes

In the case of Better Energy Homes, the introduction of a SEC into a small area is associated with a clear uplift in grant expenditure in the following years. A robust positive relationship with Better Energy Homes grant activity is found in all estimated models, with the effects largely consistent across the different model formulations. This trend begins in the first year after SEC formation, peaking in year three before reducing slightly in years four and five. These timelines are consistent with the theoretical journey of SECs through learn-plan-do.

Statistical methods such as the difference-in-differences method used here cannot unequivocally demonstrate causality. Support for a causal impact of a policy intervention is found by testing whether significant effects are observed in the years leading up to the intervention. It is expected that these should be zero. If they are not zero, they indicate that there are some differences between the comparison groups that are likely contributing to post-intervention differences also. While all leading coefficients are statistically insignificant in the case of Better Energy Homes, additional statistical tests of leading coefficients do not pass. This suggests that caution should be exercised in a causal interpretation of SEC influence on grant expenditure. Further testing for causal identification is conducted and discussed later in this chapter.

[14] The graphs correspond to results reported in the Technical Annex, TA.2, Tables TA.2.1 & TA.2.2, model numbers 1, 5, 9 and 13. If the bars cross zero, it cannot be statistically ruled out that there is zero change relative to the non-SEC areas.

Solar PV

Expenditure on Solar PV grants, as with Better Energy Homes, is found to increase following SEC formation. However, the results are somewhat weaker than the estimates for Better Energy Homes. A statistically significant effect on Solar PV grant expenditure is found in year two only, although positive point estimates are also found for the other years and year three is very close to statistical significance. This may be due to the more expensive one-off cost of Solar PV relative to cheaper more accessible opportunities in the Better Energy Homes scheme.

In the Solar PV effect models, two of the coefficients leading SEC formation are estimated as negative. This casts some doubt on the conclusion that SECs cause an increase in Solar PV grants post-establishment. The difference-in-differences approach is only reliable when the background trends for areas where SECs are established evolve consistently with areas where SECs are not established. If those trends are different even prior to SEC formation, there is a risk they will also be different after SEC formation, meaning the parallel trends assumption, required for causal interpretation, does not hold.

Despite this, those negative pre-SEC coefficients may imply that the change brought about by SECs is underestimated. If the SEC areas were to continue to experience lower levels of grant activity than non-SEC areas, in the absence of SEC formation, the real positive impact of SEC formation would be higher than the model's estimates. This possibility is discussed later in this chapter.

Warmer Homes Scheme

For the Warmer Homes Scheme, Figure 8 shows that no effects statistically different from zero are found in the years following SEC formation. Positive effects are seen in the years preceding SEC formation, however, relative to the year just preceding SEC formation.[15]

A possible explanation for these positive effects in leading years is that the process of learning about and applying for the Warmer Homes Scheme stimulates interest in energy issues and leads to SEC formation in some cases, which does not, in turn, lead to increased Warmer Homes Scheme activity in the affected small area.

Overall, the results indicate that, when averaging effects across the whole SEC network, a clear and consistent signal of SEC formation impacting Warmer Homes Scheme grant activity is not observed. It may be the case that a subset of SECs is active in this space. It should be noted that the data for the Warmer Homes Scheme does not capture total activity as comprehensively because, unlike the other schemes, there is a substantial waiting list of Warmer Homes Scheme applications. Only a minority of applications on the waiting list have an estimated grant amount recorded, so many waiting list applications cannot be included in the model estimates. Discussions with the programme team indicate that in recent years, SECs have held both Warmer Homes Scheme-specific information sessions in their communities as well as more general information sessions which include the Warmer Homes Scheme. But these effects would not be incorporated in the data if there is no estimated grant amount available or if the effects have not yet manifested up to late 2023, the cut off for the analysis.

[15] These preceding SEC effects become statistically insignificant following a pseudo-log transform. See Table TA.2.2 in the Technical Annex.

Electric Vehicle grants

Finally, the introduction of SECs into small areas appears to reduce EV grants expenditure, relative to non-SEC areas. Years three, four and five following SEC formation have lower levels of grant expenditure compared to non-SEC areas and these estimates are statistically significant across all model formulations. As will be discussed later in this chapter, these results are also robust to several further tests.[16] Note that this estimate of a lower grant expenditure may signify that SEC areas have not experienced the same increases, or the same rate of increase, in EV grant applications that occurred in non-SEC areas, rather than actually reducing their grant applications.

In either case, this relatively lower grant uptake estimated in SEC areas could be happening for several reasons. It may be that communities choose to prioritise building efficiency and producing their own renewable electricity over purchasing electric vehicles, after learning more about their energy use. Furthermore, EVs have been much more expensive than petrol and diesel cars for most of the lifetime of the SEC programme. As such, a greater understanding of energy opportunities may have led people in SEC areas to reallocate limited energy expenditure from transport to other more cost-effective purposes. In other words, this negative impact result may reflect the fact that, for many households, it is not possible to participate in all grant schemes and SECs tend to direct communities towards home energy upgrades and solar PV in the first instance.

It is also possible that SEC members and wider influenced communities reduce car use in favour of other transport methods and therefore deprioritise EV purchases. Many SECs implement active travel initiatives rather than emphasise electric vehicles, but active travel projects are not captured in this study. A proper understanding would require additional data collection, which is not presently available.

Overall, the evidence presented here indicates that the SECs do exert influence on grant activity in their localities, with relative increases observed in Better Energy Homes and Solar PV expenditure, decreases in EV grant expenditure and no clear effect on Warmer Homes Scheme activity, with available data.

How large are the impacts on grant expenditure?

The results presented above show the estimated average change in a small area's grant expenditure in individual years of exposure to an SEC. The method used for the analysis can also calculate an overall estimated effect for the SEC programme since it began in 2015. These are presented in Table 5 below for Better Energy Homes, Solar PV and EVs. These figures should be interpreted as the average effect of SEC presence on annual grant uptake in small areas exposed to SECs, across all grant scheme years and SECs.

While the numbers may appear small, it is important to remember that they are estimates of *average annual* changes at the small area level. Ireland has more than 18,000 small areas and many of these do not have any grant activity in a particular year, which serves to lower averages. The second row in Table 55 shows the average observed expenditures in small areas across schemes since 2015, for Better Energy Homes and EVs, and since 2018 for the Solar PV scheme. [17] The bracketed figures are the period range.

[16] In addition to the tests described later in this chapter, the models were run after removing outlier grants, defined as those in which multiple grants were linked to the same MPRNs. Removing these did not impact results.
[17] These averages are calculated from the same processed datasets used for the modelling. Refer to the Technical Annex, TA.2, for details of the cleaning process.

The final row displays the estimated average change from SEC presence in percentage terms relative to the observed average annual expenditure.[18] These results indicate that SEC presence has had meaningful effects in the areas exposed to them. The overall estimates of SEC presence range from the positive 8% and 10% levels of average Solar PV and Better Energy Homes expenditure to the negative 13% of average EV grant expenditure.

Table 5. Overall estimated impact of SEC presence on annual small area grant expenditure[19]

	Better Energy Homes	Solar PV	EV
Estimated SEC impact *[95% CI]*	€118 *[45 to 192]*	€78 *[11 to 147]*	-€190 *[-271 to -108]*
Observed average expenditure (Period range)	€1,161 *(€763 to €2,702)*	€966 *(€21 to €2,240)*	€1,498 *(€129 to €4,021)*
Estimated % change relative to observed expenditure	10%	8%	-13%

Causality and range of SEC influence

In theory, the methods employed account for the unique influences inherent to each small area as well as the common impact of events in specific calendar years that influence grant uptake. The models should therefore identify the additional uplift in grant expenditure brought about by the introduction of an SEC into a set of small areas. In practice, models are imperfect and the finding of statistically significant differences in years preceding SEC formation for Solar PV and the Warmer Homes Scheme creates doubt for a causal interpretation of SEC influence. As such, this section describes several robustness tests which were carried out to substantiate the baseline results.

Four tests are completed. The first re-estimates the models after controlling for the 2022 Pobal Deprivation Index at small area level. The second test runs the models on the subset of SEC areas only. The third conducts a placebo test to assess the likelihood that results are due to random effects, and the final test varies the assumed range of SEC influence.

Together the tests largely support the baseline effects presented earlier in this section. The EV results appear to be the most robust. The positive Better Energy Homes and Solar PV effects, meanwhile, are substantiated by three of the four tests.

Other factors influencing grant uptake

As demonstrated in Chapter 4, SEC areas differ from non-SEC areas in ways that may impact grant uptake. In particular, SEC areas have lower Pobal Deprivation Index scores and appear to be in areas with lower average incomes. Figure 9 highlights that Better Energy Homes, Solar PV, and EV expenditure in small areas tends to rise with increasing affluence. Although the (univariate) relationship does not appear to be strong or linear, with grant uptake dropping off at the highest levels of affluence.

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[18] These should be thought of as rough approximations of the average size of SEC impact in areas exposed to SECs since 2015. In any given year the impact of SECs varies, as demonstrated in the first part of chapter 6. The often wide confidence intervals indicate that effects also vary strongly across SECs.

[19] Rows 1 and 2 are measured in euros of grant expenditure per small area per year. Row 1 is the overall estimated change in annual expenditure in small areas which have been exposed to SECs since the programme's inception. Row 2 is the average annual expenditure observed in individual small areas in the period of comparison. The percentage in row 3 is the overall estimated effect divided by the observed average expenditure over the appropriate period, 2015 to 2023 for Better Energy Homes & EV and 2018 to 2023 for SPV.

Nonetheless, the relatively lower levels of affluence in SEC areas may manifest with lower relative grant expenditure in schemes that require a higher upfront investment by households, especially the Solar PV and EV schemes.

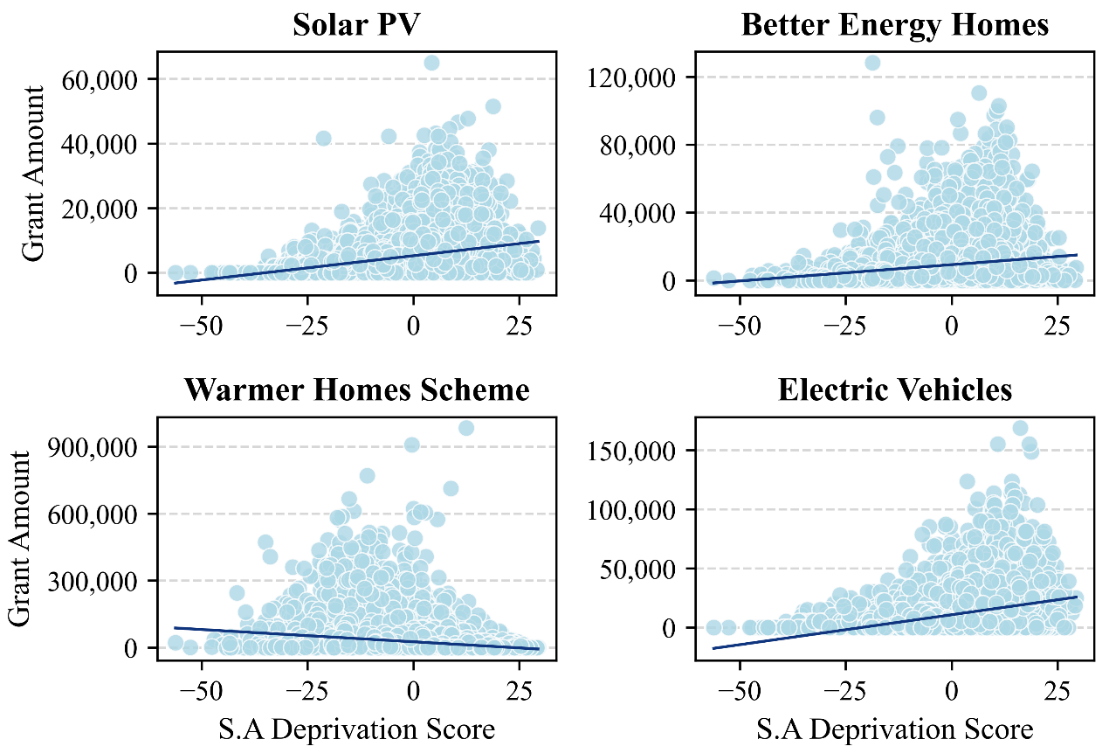

Figure 9. Total grant expenditure by relative affluence in small areas[20]

Differences in affluence may partly explain the lower relative Solar PV expenditure and the higher relative Warmer Homes Scheme expenditure in SEC areas compared to non-SEC areas observed in the years preceding SEC formation. Unfortunately, socio-economic variables at small area level are not available as a time series and may themselves be impacted by grant uptake and by the presence of SECs. In such a scenario, it is generally recommended not to include such covariates in the methods used for this kind of analysis.[21] In addition, variables that don't change with time as well as common changes due to specific years should already be captured by the models. Nevertheless, as a robustness check, additional models were run using the 2022 Pobal Deprivation Index as an additional covariate. The model balances group comparisons based on similar levels of deprivation and subsequently estimates the impact of SECs after removing the effect of the level of deprivation. [22]

Overall, results remain very similar to the baseline model, with slightly enhanced effect sizes. Estimates of SEC influence on Better Energy Homes and Solar PV expenditure become slightly more positive after the inclusion of the deprivation index as a control. Estimates of SEC impact on EV grant expenditure becomes even more negative. The statistically significant effects found in years preceding SEC formation remain for Warmer Homes Scheme and Solar PV. For full results, see Table TA.2.3 in the technical annex.

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[20] Each graph is a scatterplot of total grant amount issued to a small area over all years for which data is available and its 2022 Pobal Deprivation Index score. The lines are simple linear regressions of grant amount versus the deprivation score and so do not capture the many influences underlying a true model of grant uptake.

[21] Many authors caution against the use of covariates in staggered difference-in-differences approaches, see Roth et al (2023, p.27-28) for a relevant discussion.

[22] For more detail on how the estimation is done, please refer to the technical annex, TA.2.

Strength of the SEC impact signal

Despite accounting for base effects of small areas before making comparisons, estimates of SEC influence may still be distorted by uncaptured time-varying differences between SEC and non-SEC areas. For example, populations with growing concerns about climate change may be more likely to form SECs and also more likely to apply for grants, thereby distorting the causal impact of SEC presence. To test this issue, the models are estimated after dropping non-SEC areas from the dataset. In other words, small areas in which SECs have established themselves are compared to other small areas from earlier years, where we now know SECs will be established in the future, but which haven't yet formed at the time of comparison. This will strongly affect the magnitude of results, as close to two-thirds of the dataset is removed.[23] However, if a strong signal of SEC impact on grant activity is present, it may remain in this subset of data.

Results show that the positive Better Energy Homes and Solar PV effects of SEC presence become statistically insignificant when comparisons are restricted to SEC areas only.[24] This suggests caution should be exercised when making causal interpretations of SEC presence on grant activity. However, another way to make sense of the positive change in SEC areas observed relative to non-SEC areas, which does not appear when comparing SEC areas to themselves, may be that the presence of SECs prevented reductions in grant activity that occurred in non-SEC areas over the period studied. It may also merely reflect a noisy variation in timing around SEC formation and change in grant activity across the subset of SEC areas, which distorts estimated effects.

Meanwhile, the negative average impact on EV grant expenditure remains in years four and five in this estimation. Overall, this test provides supporting evidence for the baseline EV results but does not substantiate the positive results found for the Better Energy Homes and Solar PV schemes. Please refer to Table TA.2.4 in the appendix for tabular results.

Placebo test

Placebo tests in observational studies are commonly used to detect potential model misspecifications.[25] To conduct this test, the treatment variable is falsified, and the models are re-estimated many times. The expectation is that the randomized and falsified treatment variable will be centred around zero. If the falsified variable does not centre around zero, it may indicate that the baseline model is incorrectly specified in some way, for example due to omitted variable bias or spurious correlations in the data.

This test was completed on the Better Energy Homes, Solar PV and EV schemes. In each case, the placebo results centre around zero. For the Better Energy Homes and EV schemes, the baseline estimate of the overall effect of SEC presence on grant expenditure lies outside the range of placebo test results. For Solar PV, the baseline estimate is a clear outlier but lies within the range of generated placebo results.[26] Further description is available in the Technical Annex, see Figure TA.2.1.

Based on this, the view that the impact of SECs on grant activity is real, rather than spurious, and not driven by some other unobserved variable is strengthened, especially for the Better Energy Homes and EV schemes.

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[23] A common critique of fixed effects models is low statistical power and conservatively large standard errors, (Hill et al, 2020), as they don't fully incorporate observations with little to no variation over time. This applies also to the Callaway and Sant'Anna method used for the baseline models. Thus, restricting the dataset may exacerbate this issue further if it is present in the data.

[24] As the model doesn't allow already treated units to be used as comparison, the remaining SPV dataset is only sufficient to enable construction of 2 lagging indicators, compared to 4 in the baseline model. Hill et al (2020) note that restricted time periods are likely to conservatively bias estimates in fixed effect models.

[25] See Cai et al (2016) and Penasco & Anadón (2023) for examples.

[26] The SPV effect lies at the 97.5 percentile of the placebo effects, placing it just within a 5% statistical significance level.

Varying the range of SEC influence

All results presented so far have assumed that SECs exert influence on the 10 nearest surrounding small areas, as discussed earlier in this chapter. Table TA.2.5 in the Technical Annex shows the results when the assumed range of influence is changed to the five or fifteen nearest small areas. The exercise is completed for the Better Energy Homes, SPV and EV schemes. Effect sizes vary somewhat depending on the assumed range of influence, but the direction of the effect is consistent, increasing our confidence in the findings on the impact of SEC localities on grant activity.

In summary, this test supports the notion that the small areas in the vicinity of SECs witness changes in grant activity following the establishment of a new SEC.

5. Conclusions

Findings and policy implications

The analysis of the evolution and impacts of the SEC programme has produced several relevant insights. Growth in the network of communities has been rapid over the past nine years resulting in an impressive social network of over 800 SECs spanning the entire country. If new SEC formation continues at the rates observed since 2021, the network will likely come close to the target of 1,500 SECs by 2030, perhaps falling slightly short on current trajectories.

The analysis revealed that, to date, some areas have been more likely to form SECs than others. The odds of a SEC forming in a particular area is positively associated with higher shares of people with fewer daily time constraints, namely a prevalence of older and retired residents. This finding is reflected in the lower odds of SEC formation in areas with a high share of children resident. As such, follow-on qualitative research should consider the required time commitments of effective participation. This would help decide whether an expansion of the SEC network to include underrepresented groups would require programme adaptations to facilitate a lower time commitment for interested parties.

A further interesting result is that SEC network expansion appears to have been particularly successful in rural areas with higher shares of agricultural and skilled trades employment. This prevalence of SECs in rural areas potentially provides a means of communication with communities that may benefit from more targeted intervention in certain areas of climate policy. For example, rural areas have substantially more houses with decentralised oil heating which may be heat pump ready. In addition, the network may provide an effective means to communicate with the agricultural sector during future efforts to decarbonise this sector.

Proximity to nearby SECs seems to be an important factor in inspiring neighbouring communities. This provides evidence of the efficacy of local influence to positively impact climate efforts among their peers. It also supports the strategy of the SEC programme to facilitate cross-network learning through regular case studies and demonstration projects.

The SEC programme has several policy objectives related to increasing knowledge of energy management and accelerating uptake of grants. The programme specifically targets increased community involvement in the National Retrofit Programme. The analysis focusing on the impacts of SECs on grant uptake shows that the network of SECs does appear be associated with increased grant uptake in Better Energy Homes and Solar PV. The results suggest that this increase in grant issuance is additional to what would have occurred in the absence of the SEC programme. This indicates that the objective related to expanding the National Retrofit Programme is being met.

However, the evidence also points to a lower uptake of EV grants in areas with SECs relative to areas without SECs. Several theories as to why this may have occurred are discussed in Section 4. Overall, the combined findings of increased uptake of Better Energy Homes and Solar PV and lower uptake of EV grants may indicate limited investment capacity among many individuals wishing to decarbonise their energy consumption. It may also reflect a preference among SECs for active travel initiatives rather than EV grants, although we lack reliable data on active travel uptake. Information provided through the SEC network may result in a re-prioritisation of spending for impacted communities towards efficiency projects in the first instance. This evidence is consistent with the idea that the SEC network reduces barriers of limited information and motivation but does not sufficiently reduce financial barriers for households to engage with all available schemes.

Finally, available data does not facilitate a comparison of impacts on grant uptake by SECs in different stages of the programme. It's unlikely, given the low share of SECs that had progressed beyond the learn stage at the time of analysis, that the results on grant impact are driven entirely by the subset of communities that have progressed to Energy Master Planning stages of the programme. As such, it is possible that alternative routes to accelerating grant uptake in the grant schemes analysed are also effective, in addition to the structured route through the plan and do stages. In essence, this finding supports the idea that information provision alone, either from the network to SECs, or from SECs to their wider communities, has also been effective in driving grant activity. Moreover, a finding in the analysis of SEC formation revealed a positive association between SEC formation and location in areas with high shares of younger international renters. This may indicate that, for certain SECs, stimulating household energy projects, which are largely targeted towards homeowners, will be challenging due to the inherent demographics of the surrounding areas.

Lessons learned and data recommendations

Data limitations were encountered during the study which slowed analysis and prevented deeper assessment of relevant questions. Resolutions to these issues as well as a means to enable ongoing and more granular tracking of the impact of the SEC network could be facilitated by first centralising the SEC Network and Energy Master Plan tracker into a single longitudinal database. This would enable easy tracking of different rates of progression across the network. In turn, this would allow comparisons between counties and regions to facilitate cross-learning and identify region-specific issues slowing SEC progression to action.

Second, this analysis explored the impact of SEC presence on grant uptake at an 'area' level, but explicitly linking specific SECs to grant applications would enable a supplementary view. This linking could be achieved by adding a drop-down field in the grant application screens asking applicants to select the SEC they are associated with (if any) or the SEC from which they learned about the grant. This data could then be centralised in an analysis-ready form for the SEC programme, or automated reports could be generated in an ongoing fashion. If this SEC to individual grant link existed, it would facilitate:

- Annual tracking of the SEC programme's impact on grant uptake and the associated estimated emission reductions.[27]
- Ongoing tracking of the varied impacts across grant schemes and over time.
- Identification of SECs that are more successful in driving grant uptake to facilitate additional programme and cross-network learning.
- Explicit analysis of the relative efficacy of more progressed SECs in the learn-plan-do operational structure in driving grant uptake.

Future research

A comprehensive impact evaluation of the SEC programme requires further research, both to understand the findings of this report's data analysis as well as to explore the additional objectives of the programme not addressed in this analysis.

In future, surveys and interviews will help to provide supporting evidence for the finding that the influence of the network has seemingly led to a prioritisation of investment in home energy upgrades offered by the Better Energy Homes and Solar PV schemes over EVs, and to explore potential reasons for this pattern. Furthermore, using surveys and interviews, SEC members could provide their insights into the impact of the production of an Energy Master Plan on their subsequent grant activity. SECs that have progressed to undertaking energy projects without completing the planning stage could also be identified and provide insight into what they found to be most useful and inspiring from their participation in the network.

[27] Note that this would not necessarily demonstrate evidence of additionality of the SECs in driving this grant uptake in comparison to areas without SECs, i.e., simply associating SECs with grants does not conclusively demonstrate that the activity wouldn't have happened anyway. The methods employed in this analysis provide evidence of such additionality.

In addition, surveys could be used to explore the reasons why SEC formation is more prevalent in certain areas, to confirm whether the existence of nearby SECs stimulates new SECs, and to understand the demands of active participation in the network, which may disincentivise participation by some cohorts in Irish society.

Finally, this analysis leveraged available internal data. As such, there are additional impacts of the SEC programme which were not explored. As per the programme objectives described in Chapter 2, these impacts include:

- How effectively the SEC programme improves climate and energy literacy in Ireland.
- The links between the SEC programme and Community Grants.[28]
- The impact of the SEC programme on the National Home Energy Upgrade Scheme's grant uptake. Since the launch of the National Home Energy Upgrade Scheme, the SEC network has held many information sharing sessions with communities about availability of the scheme's supports.[29]
- The impact of the SEC network on energy-consuming behaviour in SEC members and their wider communities.
- Future impacts of the SEC network on Community Renewable Energy Support Scheme projects and smart networks.
- The impact of the SEC network on general support for climate policy and related infrastructure projects, such as wind and solar farms and grid expansion.

These impacts could also be explored with future data collation both internal to SEAI as well as by conducting appropriate surveys and interviews.

[28] A suitable centralised dataset of Community Grants was not available. Even if it was, the number of grants would be too low to incorporate in the statistical analysis. Causality is also distorted due to the explicit incentive for Community Grant project managers to associate themselves with SECs.

[29] At the time of analysis, the National Home Energy Upgrade Scheme had not been running long enough to facilitate a statistical analysis of the type done in this analysis.

References

Baker, A. C., Larcker, D. F., & Wang, C. C. (2022). How much should we trust staggered difference-in-differences estimates? Journal of Financial Economics, 144(2), 370-395.

Cai, X., Lu, Y., Wu, M., & Yu, L. (2016). Does environmental regulation drive away inbound foreign direct investment? Evidence from a quasi-natural experiment in China. Journal of development economics, 123, 73-85.

Callaway, B., & Sant'Anna, P. H. (2021). Difference-in-differences with multiple time periods. Journal of econometrics, 225(2), 200-230.

Hill, T. D., Davis, A. P., Roos, J. M., & French, M. T. (2020). Limitations of fixed-effects models for panel data. Sociological Perspectives, 63(3), 357-369.

Penasco, C., & Anadón, L. D. (2023). Assessing the effectiveness of energy efficiency measures in the residential sector gas consumption through dynamic treatment effects: Evidence from England and Wales. Energy Economics, 117, 106435.

Roth, J., Sant'Anna, P. H., Bilinski, A., & Poe, J. (2023). What's trending in difference-in-differences? A synthesis of the recent econometrics literature. Journal of Econometrics, 235(2), 2218-2244.

Appendix

A.1 Variable names and descriptions

Variable name	Explanation
Small area population	The population of the small area
Total population - electoral division	Population of electoral division within which the small area is situated
ED population number	The population of the electoral division within which the small area falls
Percent female	Percentage of SA that are female
Percent aged 75-84	Percentage of SA aged between 75 and 84
Percent aged 85+	Percentage of SA aged between 85 and over
Average age	Average age of the population in the small area. For the calculation an age of 87 was assumed all persons in the 85+ category. Other categories were calculated by multiplying the number of persons in an age bracket by the midpoint of that age bracket.
Percent citizenship Irish	Percentage of usually resident population persons in the small area with Irish citizenship
Percent different Irish address 1yr Prev	Percentage of usually resident SA population that were living in a different residence in Ireland one year previously
Percent same address 1yr prev	Percentage of usually resident SA population that were living in the same residence one year earlier
Percent HHs with children	Percentage of households in the SA with children presently living in their accommodation.
Average no. persons per HH	Average number of people living in each household in the small area
Percent caravan	Percentage of households living in caravans
Percent bedsit	Percentage of households living in bedsits
Percent house	Percentage of households living in houses
Average year dwellings built	Average year of building for dwellings in the SA. The calculation assumes a mid-range age in each category, except for the pre-1919 category and post 2015 categories for which ages are assigned as 1910 and 2018. Not stated responses are excluded from the calculation.
Percent heating systems fossil fuel	Percentage of household heating systems run on fossil fuels (includes oil, gas, coal, peat, LPG)
Percent heating systems coal / peat	Percentage of household heating systems run coal or peat
Percent heating systems wood	Percentage of household heating systems run on wood
Percent HHs with renewable energy	Census 2022 included a question asking if the respondents' accommodation had any of the following forms of renewable energy: solar panels for water heating, solar panels for electricity, ground or air source heat pumps, wood, other.
Percent HHs commute with private motor	Percentage of households that mostly commute with private motorised transport (includes motorcycles, cars, vans, lorries)
Average num cars per HH	The calculation assumes four cars for the four or more category, not stated excluded from calculation.

Variable name	Explanation
Percent HHs owner occupied	The percentage of households in the small area which are occupied by owners
Percent HHs other	The percentage of households in the small area which are occupied by means other than owner occupied, market or non-market rented
Percent HHs non-market rented	The percentage of households in the small area which are occupied by non-market renters (social housing)
Percent PES working	Percentage of persons aged 15 years and over in the small area that are working as their principal economic status (PES). Respondents are assigned to one category only.
Percent PES unemployed	Percentage of persons aged 15 years and over in the small area that are unemployed as their principal economic status (PES). Respondents are assigned to one category only.
Percent PES retired	Percentage of persons aged 15 years and over in the small area that are retired as their principal economic status (PES). Respondents are assigned to one category only.
Percent PES student	Percentage of persons aged 15 years and over in the small area that are students as their principal economic status (PES). Respondents are assigned to one category only.
Percent PES looking after home	Percentage of persons aged 15 years and over in the small area that are looking after the home as their principal economic status (PES). Respondents are assigned to one category only.
Percent edu ordinary degree or higher	Refers to the highest level of education reached for all persons aged 15 years and over in the small area who were not in education at the time of response - ordinary degree or higher
Percent edu technical or certificate	Refers to the highest level of education reached for all persons aged 15 and over in the small area who were not in education at the time of response - sum of technical or vocational qualification, advanced certificate/completed apprenticeship, higher certificate
Percent commuting - public transport	Percentage of persons using public transport as main method of commuting to work or education
Percent occupation - skilled trades	Percentage of persons at work or unemployed by type of occupation - skilled trades
Percent occupation - managers	Percentage of persons at work or unemployed by type of occupation - managers
Percent occupation - admin. and secretariat	Percentage of persons at work or unemployed by type of occupation - administrative and secretarial services
Percent occupation - caring, leisure and other service	Percentage of persons at work or unemployed by type of occupation - caring, leisure and other services
Percent occupation - sales & cust. service	Percentage of persons at work or unemployed by type of occupation - sales and customer service
Percent occupation - process, machinery operatives	Percentage of persons at work or unemployed by type of occupation - process, plant and machinery operatives
Percent occupation - elementary occupations	Percentage of persons at work or unemployed by type of occupation - elementary occupations

Variable name	Explanation
Percent sector - agriculture	Percentage of persons at work by industry - agriculture
Percent sector - construction	Percentage of persons at work by industry - construction
Percent sector - manufacturing	Percentage of persons at work by industry - manufacturing
Percent sector - public admin	Percentage of persons at work by industry - public administration
Percent sector - commerce and trade	Percentage of persons at work by industry - commerce and trade
Percent sector - transport and comm.	Percentage of persons at work by industry - transport and communication
Percent sector - prof. services	Percentage of persons at work by industry - professional services
Pobal Deprivation Index	This research uses the 2022 Small Area level Pobal Deprivation Index. For more details on the index, please refer to The 2016 Pobal HP Deprivation Index (SA) | Trutz Haase
Median HH gross Income ED	Gross Income of the median household in the electoral division within which the small area falls. The data is from 2016 (Census 2022 update not currently available). It includes welfare transfers and rental income. Calculated from CSO publication Geographical Profiles of Income in Ireland
ED income decile (2016)	The income decile of the electoral division within which the small area falls, based on the gross income measure from 2016. Calculated from CSO publication Geographical Profiles of Income in Ireland
Percent working age HHs with welfare as primary income (ED)	Percentage of working age households in the electoral division, within which the small area falls, for which social welfare forms the majority of their income (2016 data; 2022 update not presently available)
Percent HHs with State Pension as primary income (ED)	Percentage of households in the electoral division, within which the small area falls, for which the state pension forms the majority of their income (2016 data; 2022 update not presently available)
SEC existence duration	Number of days since the SEC registered with SEAI. Calculated as the number of days between the SEC's registration date and 22 September 2023.
Percent small areas urban	Indicator highlighting whether the small area falls within an urban area as defined by the CSO and Tailte Éireann. The indicator is based on groups of buildings and distances to buildings. See here for more information.

Technical annex

TA.1 SEC formation

This annex provides technical descriptions of the methodology used to assess the relative importance of variables for the formation of SECs in small areas. Full tabular results of regressions are also reported here.

To jointly assess the importance of multiple variables in SEC formation, logistic regression is employed on the available data. The dependent variable is either a binary variable indicating that a small area contains an SEC, or indicating that a small area contains a 'plan' or 'do'-stage SEC. In the second case, the regressions are run on a subset of the small areas, where only SEC areas are included. It is important to note that small area demographic and socio-economic data is a timestamp from Census 2022 , whereas SECs have formed over time since 2015. As such, the models are using point-in-time values for what in reality are time-varying variables. The true value at the time of SEC formation will be slightly different. However, the majority of the variables are likely to be slow to change and this flaw in the analysis should not overly distort results.

Logistic regression results can be biased and unstable when the explanatory variables are strongly correlated with each other. This is very likely to be the case with multiple variables of interest in this dataset, such as the relationship between age and owner-occupied housing or rural areas and oil heating.[30] To overcome this issue, as a first step, principal component analysis (PCA) is applied to the set of explanatory variables. PCA serves to both reduce the number of variables and extract new decorrelated variables. This lower number of uncorrelated variables can then be used in the set of explanatory variables in a logistic regression.
[31]

PCA is performed with Python's SciKit-Learn library with the following sequence of steps:

- The full set of variables in the explanatory dataset is first manually reduced by removing columns that are sums or labels of other sets of columns, for example removing the over 65 age category which is a sum of the 10-year brackets from 65 onwards.
- The region and county categorical variables are also removed prior to performing PCA, as the method is intended to reduce numerical data.
- ID variables are also removed, including small area and electoral division codes.
- Rows with missing values in any remaining column are removed, this amounts to six small areas out of 18,919.
- The remaining data is standardised and the PCA function is performed.
- Iterations of the PCA process are performed so that the original variables that are not correlated to principal components, as well as principal components that are not correlated to original variables, are removed. This process is repeated until a robust set of principal components is determined.
- Four and seven principal components are selected based on the process of iteration, in the analysis of SEC formation and SEC progression.
- These are used to project the included original variables to the four principal component axes, (reducing circa. 48 variables to four or seven).

[30] A pairwise correlation matrix was computed and confirmed substantial correlation between many variables in the dataset.

[31] PCA is a common method used to extract information from high dimensional datasets which suffer from multicollinearity between variables. The method works by transforming the original dataset into a smaller number of new variables which, nonetheless, retain most of the information in the original dataset. The new variables are formed from linear combinations of the original variables. They are uncorrelated with each other and can thus be used as explanatory variables in a regression analysis.

- The remaining original variables not used in the PCA are rejoined to this transformed dataset for the subsequent logistic regressions.

Thus, the full set of available data is jointly assessed for its importance in predicting SEC formation.

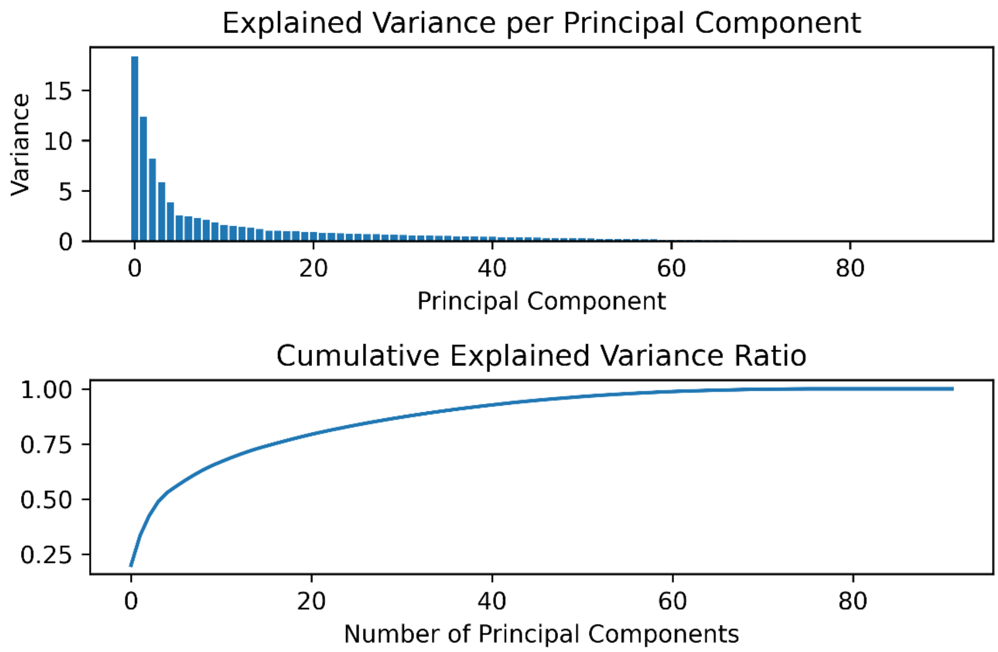

Figure TA.1.1. Results of full PCA

Finally, to aid interpretability of regression results, the transformed variables are given aliases where possible. Aliases are assigned based on correlations with the original variables. These correlations are calculated from the formula:

$$pca.components\_.transpose() * np.sqrt(pca.explained\_variance\_)$$

Following the PCA, logistic regressions are performed using Python's StatsModels package. Tabular results are presented in the following pages, following the full results from group differences between SEC and non-SEC areas.

Table TA.1.1. Full results of group comparisons – SEC versus non-SEC small areas

Demographic variables								
10 nearest small areas					5 nearest small areas		15 nearest small areas	
Variable	SEC mean	Non-SEC mean	Relative difference (%)	P-value	SEC mean	Non-SEC mean	SEC mean	Non-SEC mean
Small area population	267	274	2.9	0.00	268	273	268	274
ED population number	4013	5991	49.3	0.00	3937	5749	4056	6217
% Small areas urban	58	74	28.6	0.00	59	72	56	77
% Female	50.2	50.7	0.9	0.00	50.2	50.6	50.2	50.7
Average age	40	39	-3.5	0.00	40	39	39.9	38.5
% Citizenship Irish	84.1	84.3	0.3	0.20	83.8	84.3	84.4	84.2
% Same address 1yr prev	92.8	92.9	0.1	0.38	92.7	92.9	92.9	92.8
% HHs with children	44.4	47.7	7.4	0.00	43.8	47.4	44.9	47.8

Notes:

P-values are calculated using bootstrap tests of differences between group means. For each variable, the means of both SEC and non-SEC areas are shifted so that they are equal. 10,000 bootstrap samples, in other words samples of equal size with replacement, are then drawn from each group. For each pair of samples, group differences are calculated. The p-value represents the proportion of tests that were at least as extreme as the observed difference in the groups of SEC and non-SEC areas. These results are for the assumed range of influence of 10 nearest small areas.

Energy related								
10 Nearest small areas					5 Nearest small areas		15 Nearest small areas	
Variable	**SEC mean**	**Non-SEC mean**	**Relative difference (%)**	**p-value**	**SEC mean**	**Non-SEC mean**	**SEC mean**	**Non-SEC mean**
% House	87.1	87.2	0.1	0.00	86.4	87.3	87.7	86.9
Average year dwellings built	1976	1980	0.2	0.00	1976	1979	1976	1980
% Heating systems fossil fuel	76.9	80.7	5.0	0.00	76.3	80.4	77.5	80.9
% HHs with renewabl e energy	26.7	21.6	-19.0	0.00	26.4	22.2	27.0	20.9
% HHs commute with private motor	60.3	57	-4.8	0.00	59.8	57.9	60.7	57
Average num cars per HH	1.4	1.4	-1.7	0.0	1.4	22.2	1.4	1.4

Socio-economic								
10 Nearest small areas					5 Nearest small areas		15 Nearest small areas	
Variable	**SEC mean**	**Non-SEC mean**	**Relative difference (%)**	**p-value**	**SEC mean**	**Non-SEC mean**	**SEC mean**	**Non-SEC mean**
% HHs owner occupied	67	66	-0.7	0.00	66	67	68	66
% PES working	54.4	56.6	4.0	0.00	54.1	56.4	54.5	56.8
% PES unemployed	5.2	5.1	-1.5	0.10	5.3	5.1	5.2	5.1
% PES retired	17.7	15.8	-10.7	0.00	17.9	16.0	17.6	15.6
% PES looking after home	6.8	6.5	-3.8	0.00	6.8	6.6	6.8	6.5
% Edu ordinary degree or higher	32	34	8.1	0.00	32	34	32	35
% Edu technical or certificate	19.1	18.6	-2.6	0.00	18.9	18.7	19.1	18.5
% Occupation - skilled trades	15.1	12.3	-18.6	0.00	14.9	12.7	15.2	12.0
% Sector - agriculture	5.5	3.2	-41.8	0.00	5.3	3.5	5.6	2.9
% Sector - construction	6.1	5.7	-6.2	0.00	6.1	5.8	6.2	5.7
% Sector - manufacturing	12.1	11.7	-3.4	0.00	12.0	11.8	12.1	11.5
% Sector - public admin	5.9	5.7	-2.9	0.00	5.8	5.7	5.9	5.7
Pobal Deprivation Index	-0.8	0.3	-137.1	0.00	-0.9	0.2	-0.7	0.4
Median HH gross income ED	43,091	47,849	11.0	0.00	42,866	47,322	43,283	48,344
ED income decile (2016)	4.7	5.8	22.0	0.00	4.7	5.7	4.8	5.9
% Working age HHs with welfare as primary income (ED)	15.0	13.7	-8.5	0.00	15.2	13.8	14.9	13.6
% HHs with State Pension as primary income (ED)	14.6	12.7	-13.3	0.00	14.7	12.9	14.6	12.5

Table TA.1.2 Full Results of SEC formation logistic regressions[32]

	SEC in original and 5 nearest small areas				SEC in original and 10 nearest small areas				SEC in original and 15 nearest small areas			
Variable (alias)	Coefficient	Odds ratio	Std. error	P-value	Coefficient	Odds ratio	Std. error	P-value	Coefficient	Odds ratio	Std. error	P-value
Intercept	3.48	32.58	2.79	0.21	1.44	4.22	2.41	0.55	4.06	58.06	2.30	0.08
PC1 (more young, urban, intl., renting)	0.05	1.05	0.01	0.00	0.05	1.05	0.01	0.00	0.03	1.03	0.01	0.00
PC2 (less affluence) *(Sign reversed in main report)*	0.02	1.02	0.02	0.38	0.03	1.03	0.02	0.04	0.04	1.04	0.01	0.01
PC3 (more children)	-0.03	0.97	0.02	0.03	-0.03	0.97	0.01	0.05	-0.02	0.98	0.01	0.26
PC4 (more rural, agri, skilled trades)	0.16	1.18	0.02	0.00	0.16	1.17	0.02	0.00	0.17	1.18	0.02	0.00
% Aged 75-84	0.02	1.02	0.01	0.00	0.03	1.03	0.01	0.00	0.02	1.02	0.01	0.00
% Aged 85+	0.05	1.06	0.01	0.00	0.04	1.04	0.01	0.00	0.04	1.04	0.01	0.00
% Different Irish address 1yr prev	0.01	1.01	0.01	0.19	0.01	1.01	0.00	0.00	0.01	1.01	0.00	0.00

[32] Variables preceded by ‘PC’ indicate that they were formed from the principal components analysis and thus combine information from multiple variables. Aliases derived from the relevant variables are provided in brackets.

Highlighted rows are statistically significant at the 5% level and non-zero. Green indicates a positive association with SEC formation and orange indicates a negative association. The LLR P-Value is the p-value associated with the log-likelihood ratio test. This test compares the reported model to the null-model (an intercept-only model with no additional explanatory variables). A significant p-value suggests the model explains the data better than the null model.
Accuracy represents the percentage of correct predictions made by the model. Sensitivity refers to the percentage of correct positive predictions, i.e., how well the model can predict SEC formation based on the set of explanatory variables.

	SEC in original and 5 nearest small areas				*SEC in original and 10 nearest small areas*				*SEC in original and 15 nearest small areas*			
Variable (alias)	**Coefficient**	**Odds ratio**	**Std. error**	**P-value**	**Coefficient**	**Odds ratio**	**Std. error**	**P-value**	**Coefficient**	**Odds ratio**	**Std. error**	**P-value**
Average year dwellings built	0.00	1.00	0.00	0.03	0.00	1.00	0.00	0.22	0.00	1.00	0.00	0.03
% Caravan	0.00	1.00	0.01	0.75	0.01	1.01	0.01	0.50	0.01	1.01	0.01	0.39
% Bedsit	-0.10	0.91	0.05	0.07	-0.05	0.95	0.02	0.03	-0.03	0.97	0.01	0.02
% HHs other	0.00	1.00	0.01	0.91	0.00	1.00	0.00	0.27	-0.01	0.99	0.00	0.03
% HHs non-market rented	0.00	1.00	0.00	0.58	0.00	1.00	0.00	0.35	0.00	1.00	0.00	0.32
% Heating systems coal / peat	0.01	1.01	0.00	0.00	0.01	1.01	0.00	0.00	0.01	1.01	0.00	0.00
% Heating systems wood	0.03	1.03	0.01	0.00	0.04	1.04	0.01	0.00	0.04	1.04	0.01	0.00
% PES student	0.00	1.00	0.00	0.24	0.00	1.00	0.00	0.14	0.01	1.01	0.00	0.09
% PES looking after home	0.02	1.02	0.01	0.01	0.02	1.02	0.01	0.04	0.01	1.01	0.01	0.08
% PES unemployed	0.03	1.03	0.01	0.00	0.02	1.02	0.01	0.00	0.02	1.02	0.01	0.00
% Edu technical or certificate	0.01	1.01	0.01	0.13	0.01	1.01	0.00	0.02	0.01	1.01	0.00	0.00
% Commuting - public transport	-0.02	0.98	0.00	0.00	-0.02	0.99	0.00	0.00	-0.01	0.99	0.00	0.00
% Occupation - managers	0.05	1.05	0.01	0.00	0.04	1.04	0.01	0.00	0.04	1.04	0.01	0.00
% Occupation - admin. & secretariat	0.00	1.00	0.01	0.89	-0.01	1.00	0.01	0.39	-0.01	0.99	0.01	0.26
% Occupation - caring, leisure & other service	0.01	1.01	0.01	0.04	0.01	1.01	0.01	0.12	0.01	1.01	0.01	0.37

	SEC in original and 5 nearest small areas				SEC in original and 10 nearest small areas				SEC in original and 15 nearest small areas			
Variable (alias)	Coefficient	Odds ratio	Std. error	P-value	Coefficient	Odds ratio	Std. error	P-value	Coefficient	Odds ratio	Std. error	P-value
% Occupation - sales & cust. service	-0.02	0.98	0.01	0.02	-0.02	0.98	0.01	0.00	-0.02	0.98	0.01	0.00
% Occupation - process, machinery operatives	0.01	1.01	0.01	0.04	0.01	1.01	0.01	0.03	0.01	1.01	0.01	0.09
% Occupation - elementary occupations	0.02	1.02	0.01	0.00	0.01	1.01	0.01	0.05	0.01	1.01	0.01	0.02
% Sector - Construction	0.01	1.01	0.01	0.32	0.00	1.00	0.01	0.92	0.00	1.00	0.01	0.68
% Sector - manufacturing	0.00	1.00	0.01	0.41	0.00	1.00	0.00	0.46	0.00	1.00	0.00	0.62
% Sector - commerce & trade	0.00	1.00	0.01	0.73	0.00	1.00	0.00	0.93	0.00	1.00	0.00	0.56
% Sector - transport & comm.	-0.02	0.98	0.01	0.01	-0.02	0.98	0.01	0.00	-0.02	0.98	0.01	0.00
% Sector - public admin	0.02	1.02	0.01	0.00	0.02	1.02	0.01	0.00	0.02	1.02	0.01	0.00
% Sector - prof. services	0.00	1.00	0.01	0.55	0.00	1.00	0.00	0.31	0.00	1.00	0.00	0.26
Total population - electoral division	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.01	0.00	1.00	0.00	0.02
LLR P-value	*0.00*				*0.00*				*0.00*			
Accuracy	*80%*				*68%*				*63%*			
Sensitivity	*1%*				*16%*				*49%*			

TA.2 SEC Impact on grant uptake

This section describes the data, methodology and robustness tests used to estimate the impact of SEC presence on grant uptake. Results tables are also provided.

Data

Comprehensive administrative grant data is available for several large scale and long running household grant schemes in SEAI, namely Better Energy Homes, Solar PV, EV[33] and the Warmer Homes Scheme. Access to anonymised versions of these datasets was provided for this study.

To estimate the impact of SEC formation on grant uptake, the grant data is linked to small areas using (masked) MPRN or Eircodes provided with grant applications. In cases where a grant cannot be matched to a small area, they are dropped from the dataset. This occurred for a small number of grant schemes, mostly Better Energy Homes and EVs. For Better Energy Homes, Solar PV and EVs, only completed grants are included. Better Energy Homes and EVs also contained outliers. In the case of Better Energy Homes, these outliers manifested as extremely large numbers of grants being issued in particular small areas in certain years. For EVs, there are cases of multiple grants being associated with the same MPRN over time. In both cases, the models were run with and without outliers and effects were largely unchanged. As such, reported results include outliers.

The Warmer Homes Scheme has a long waiting list of applicants with a multiple-year backlog. As the purpose of the exercise is to estimate the impact of SECs on grant activity, applications on the waiting list that had available estimated expenditure were also included in the analysis along with completed grants. However, most waiting list applications did not have an estimated grant amount and as a result cannot be included in the analysis.

A cutoff date of 30 September 2023 is set for all schemes. Beginning dates vary per scheme, with included Better Energy Homes data starting in 2010, Solar PV in 2018, EV in 2012 and Warmer Homes Scheme from 2014. Following the cleaning process, the final dataset includes the following grant totals per scheme:

	Better Energy Homes	Solar PV	EVs	Warmer Homes Scheme
Number of Grants	255,982	41,621	42,413	47,476

The individual grants were then summarised to a small-area-year view. For model estimation, each observation represents a small-area-year and has a sum of total grant amount issued to that small area in that year.

As will be discussed below, the methodology used for estimating the impact of SECs on grant activity is a staggered difference-in-differences event study which adjusts for unit and period fixed effects. Reliability of the results depends on the fixed effect controls capturing the non SEC-related influences on grant uptake in a particular area and year. This may not be a reasonable assumption, however, if significant change has occurred in the small area over the years of estimation. As such, small area codes which have been split between Census 2016 and Census 2022 are excluded from the estimation. This is justified by the fact that small areas are designed to include circa 100 households. In cases where a single small area has been split into more than one, it signifies a large population increase in the area as well as substantial construction and new build activity. This step removes 1,081 of 18,919 small areas from the analysis, equal to 5.7% of total small areas.

[33] Only EV grants for households are included. Demo car grants issued to car dealerships are excluded from the analysis.

Methodology

The research design utilised is a staggered event study, which is a generalisation of the difference-in-differences design. This approach is commonly used to assess the impacts of policies when 'treatment' occurs at varying times and a 'control' group of untreated units is available. The models estimate the additional change in the outcome variable brought about by the introduction of a policy relative to the control group. In this case, the models estimate the difference in grant expenditure in small areas in the years following SEC formation, compared to small areas without SECs in the same years.

The prototype difference-in-differences design is applied in scenarios with a single treatment period for all units. Provided certain assumptions are met, the effect of the treatment is the additional change in the treated group relative to the observed change in the untreated group. Traditionally, two-way fixed effects models that control for unit and period fixed effects are employed to estimate the change brought about by the treatment variable. Causal interpretation requires that the differences which occur over time, pre- and post-treatment, are the same for the treated and untreated groups, termed the 'parallel trends' assumption. This is an unobservable requirement as it would necessitate observation of the outcomes of the treated group in the counterfactual scenario in which they are untreated. However, support for causal interpretation comes from demonstration of parallel trends between the observable treated and untreated groups in the pre-treatment period, as well as a plausible expectation that the groups would not diverge over the period studied, for reasons other than the effect of the treatment.

The prototypical difference-in-differences approach is not suitable for a study of the SEC programme as SECs have formed at varying times since the programme's inception in 2015. To estimate the effect that SEC formation has on grant uptake, a generalisation of the difference-in-differences approach to multiple time periods is performed. For a recent example of this approach in the energy space, refer to Penasco & Anadon, (2023).

In theory, the SEC programme can impact grant uptake in local areas by guiding SECs through the official learn-plan-do process or by merely providing information and motivation through the SEC network. SECs can also themselves arrange energy information sessions with the broader community, as has been occurring in recent years. Discussions with the programme team highlight that SECs do not need to progress beyond the learn stage of the programme to begin the process of improving their local energy systems. Progression to the plan stage requires signing contracts for grant funding and finding (often scarce) energy consultants to produce the energy master plan. Many SECs may choose not to take this path due to the effort involved. Thus, in the applications of the models, there is no differentiation made between learn, plan and do SECs.

SEC formation is defined to be a binary treatment indicator for small area i in year t:

$$SEC_{it} = \begin{cases} 1, \text{if a SEC forms in small area } i \text{ in year } t \\ 0, \text{otherwise} \end{cases}$$

Treatment is considered to be absorbing, in other words once a small area has experienced the formation of an SEC, it remains categorised as an SEC area going forward.

In the case of treatment effect heterogeneity over time, which is very likely to be true for SEC impact on grant uptake, dynamic models are considered more robust than static treatment estimation. For all models estimated, the SEC indicator is extended to dynamic form with initial SEC establishment centred in year 0 and lag and lead treatment year indicators added to the estimations.

Until recent years, these types of staggered event studies have conventionally been estimated with a two-way fixed effect (TWFE) model. These models take the form of:

$$Y_{it} = \alpha + \sum_{j=1}^{J} \beta_j^{pre} SEC_{i,t-j} + \sum_{k=0}^{K} \beta_k SEC_{i,t+k} + \mu_i + \gamma_t + \varepsilon_{it} \quad (1)$$

where Y_{it} represents the sum of grant amounts awarded in small area i in year t, α is a constant, β_j^{pre} represent potential 'anticipatory' effects of SEC presence in the years leading up to SEC formation, the β_k coefficients are the effects of interest, representing the impact of the SEC on grant amount in that small area in the year of, and years following, SEC formation, μ_i are small-area fixed effects and γ_t are period fixed effects. Lastly, ε is the residual error term. The , β_j^{pre} coefficients are used to support causal interpretation of SEC presence by testing for parallel trends and anticipation effects. They should be close to zero and statistically insignificant in each estimation if SEC presence has a causal impact on grant uptake, although random variability means this may not strictly be the case in all leading years.

In recent years, several publications have demonstrated serious issues of potential bias from the use of TWFE models for staggered difference-in-differences designs in the presence of heterogeneity of treatment effects over time or space. These biases largely occur due to the OLS estimation procedure using 'bad comparisons' of later versus earlier treated observations. Authors in this space have comprehensively demonstrated that this can lead to substantial biases in the estimated coefficients, even changing the sign of the effect at times. For useful summaries of the issues, see Roth et al (2023) and Baker et al (2022). Multiple solutions to the problem have been proposed and new methods have been developed to overcome the issue. In this study, the method and software package developed by Callaway & Sant'Anna (2021) is utilised. Their approach centres around the estimation of '*group-time-average-treatment effects*', in which a group is categorised by the year of treatment and the time refers to the year for which the effect is being estimated. The 'group-time-average-treatment effect' is estimated by comparing the difference in changes between two specific periods for two explicitly specified groups. The comparator groups used in this analysis are the treated group, defined by year of treatment, versus the never-treated group of small areas. Other comparisons are considered in robustness tests.

The method explicitly identifies the comparisons being made to ensure the bad comparison issue is avoided. It also provides a way of aggregating treatment effects into event-study parameters and overall effects, by combining the group-time-treatment-effects together. For full details of the method please refer to Callaway and Sant'Anna (2021). The method will be referred to as the CS method henceforth.

Given that the CS method has convincingly demonstrated that it avoids the pitfalls of the TWFE models, it is used for baseline estimates in this study. It is the results from this method that are reported in the main body of the report. However, the TWFE approach is also modelled, and results are presented for comparison in this Technical Annex. Baseline estimates are in levels of grant expenditure per scheme; additional models also estimate the effect size when a log transformation is applied.[34] In all cases, standard errors are clustered at the small area level, which should account for autocorrelation in the data.

The TWFE models are estimated in Python using the Linear Models package. The CS models are estimated in R using the Difference-in-Differences packages developed by Callaway & Sant'Anna. Full results are reported in Tables TA.2.1 & TA.2.2 in the following pages. Subsequent tables and charts correspond to the robustness tests described in Chapter 5.

The results indicate that SEC establishment has varying effects on grant expenditure across different schemes, with positive effects found for the Better Energy Homes and Solar PV schemes, no statistically significant effects for Warmer Homes Scheme and a negative impact on EV grant expenditure in the years following SEC formation. In all cases, estimated impact varies over time. Different formulations of the models broadly substantiate baseline results. For more in-depth discussion of results, refer to Chapter 5.

[34] The log transformation is applied for grant amount + 1, to deal with the issue of 0 grant amounts, for which logs are not defined. As grant amounts are either 0 or numbered in the hundreds or thousands, the addition of 1 does not change outcomes substantially, as ln(1) equals zero and the change in logs of large numbers changes very slowly.

Table TA.2.1 Results of SEC formation on grant uptake – Better Energy Homes and Solar PV[35]

	Better Energy Homes				Solar PV			
Model no.	1	2	3	4	5	6	7	8
Dependent variable	*Grant amount per small area per year*	*Grant amount per small area per year*	*Log (grant amount +1)*	*Log (grant amount +1)*	*Grant amount per small area per year*	*Grant amount per small area per year*	*Log (grant amount +1)*	*Log (grant amount +1)*
Estimator	*CS*	*TWFE*	*CS*	*TWFE*	*CS*	*TWFE*	*CS*	*TWFE*
Time from SEC formation (years)								
-5	17.85 [-103.7, 139.4]	38.26 (43.39)	0.12 [-0.05, 0.29]	0.06 (0.06)	-404.04** [-749, -59.08]	-242.78** (69.97)	-0.60** [-1.09, -0.11]	-0.37** (0.12)
-4	-25.76 [-134.4, 82.88]	-0.77 (36.09)	0.08 [-0.08, 0.24]	0.03 (0.06)	-216.75** [-412.7, -20.8]	-168.97** (55.06)	-0.34 [-0.68, 0.00]	-0.19* (0.096)
-3	12.17 [-100.2, 124.6]	41.58 (38.00)	0.09 [-0.07, 0.25]	0.05 (0.06)	-91.99 [-218.8, 34.8]	-86.22* (41.22)	-0.17 [-0.41, 0.07]	-0.11 (0.07)
-2	-24.44 [-133.3, 84.5]	6.43 (37.69)	0.01 [-0.14, 0.15]	-0.04 (0.06)	-65.11 [-162.9, 32.7]	-28.39 (33.38)	-0.08 [-0.28, 0.13]	0.01 (0.06)
-1								
0	-12.79 [-135.5, 110]	12.01 (42.93)	0.04 [-0.12, 0.21]	-0.03 (0.06)	31.23 [-68.1, 130.5]	32.83 (33.48)	0.08 [-0.11, 0.26]	0.08 (0.06)
1	144.05** [9.8, 278.3]	134.19** (51.19)	0.23** [0.06, 0.40]	0.10 (0.06)	108.18 [-12.1, 228.4]	103.98** (38.8)	0.14 [-0.05, 0.34]	0.15* (0.07)
2	119.69 [-0.7, 240.1]	60.27 (50.11)	0.30** [0.11, 0.49]	0.10 (0.06)	165.49** [26.3, 304.7]	129.19** (44.32)	0.28** [0.04, 0.52]	0.20** (0.07)
3	368.48** [172.6, 564.4]	277.38** (68.59)	0.48** [0.27, 0.69]	0.21** (0.07)	184.64 [-18.3, 387.6]	140.34** (52.23)	0.28 [-0.01, 0.57]	0.16 (0.08)
4	267.89** [70.6, 465.1]	218.76** (74.50)	0.39** [0.15, 0.62]	0.17* (0.08)	195.52 [-63.5, 454.6]	120.06* (59.76)	0.40 [0.00, 0.81]	0.14 (0.09)
5	156.30 [-62.3, 374.9]	163.81* (76.90)	0.50** [0.21, 0.79]	0.30** (0.09)		124.24 (73.24)		0.05 (0.11)
Parallel trend test passed (P-value)	*No (0)*	*Yes (0.53)*	*No (0)*	*Yes (0.44)*	*No (0)*	*No (0.004)*	*No (0)*	*No (0.01)*
R-squared	*N.A*	*0.08*	*N.A*	*0.11*	*N.A*	*0.18*	*N.A*	*0.2*

Table TA.2.2 Results of SEC formation on grant uptake – EV and Warmer Homes Scheme

	EVs				Fully Funded Energy Upgrade			
Model No.	9	10	11	12	13	14	15	16
Dependent variable	*Grant amount per small area per year*	*Grant amount per small area per year*	*Log (grant amount +1)*	*Log (grant amount +1)*	*Grant amount per small area per year*	*Grant amount per small area per year*	*Log (grant amount +1)*	*Log (grant amount +1)*
Estimator	*CS*	*TWFE*	*CS*	*TWFE*	*CS*	*TWFE*	*CS*	*TWFE*
Time from SEC formation (years)								
-5	-27.08 [-128.7, 74.6]	-42.29 (32.23)	-0.02 [-0.13, 0.09]	-0.04 (0.04)	1027.67** [467.6, 1587.8]	871.81** (160.56)	0.11 [-0.11, 0.34]	0.11 (0.07)
-4	10.82 [-88.9, 110.6]	-0.02 (30.98)	0.04 [-0.06, 0.15]	0.03 (0.04)	923.33** [451.8, 1394.9]	818.85** (152.07)	0.19 [-0.02, 0.4]	0.17** (0.07)
-3	-11.67 [-103.7, 80.3]	-23.10 (31.71)	0.01 [-0.11, 0.12]	-0.002 (0.04)	696.00** [235.7, 1156.3]	690.18** (153.1)	0.08 [-0.09, 0.26]	0.10 (0.06)
-2	-39.84 [-134.3, 54.6]	-47.64 (34.40)	-0.01 [-0.12, 0.11]	-0.01 (0.04)	520.95** [108.1, 933.8]	475.90** (142.67)	0.09 [-0.07, 0.02]	0.09 (0.06)
-1								
0	-43.94 [-165.5, 77.6]	-51.34 (41.85)	-0.002 [-0.13, 0.13]	-0.01 (0.05)	108.36 [-350.3, 567]	85.86 (159.98)	-0.01 [-0.18, 0.16]	-0.01 (0.06)
1	-83.13 [-214.8, 48.5]	-78.49 (47.89)	-0.06 [-0.22, 0.10]	-0.06 (0.05)	47.42 [-570.5 665.3]	281.88 (218.7)	-0.04 [-0.21, 0.13]	-0.01 (0.06)
2	-48.60 [-212.4, 115.2]	-91.33 (57.41)	-0.09 [-0.26, 0.07]	-0.13* (0.06)	-481.21 [-1049.6,87.2]	-301.86 (195.15)	-0.15 [-0.34, 0.04]	-0.12 (0.06)
3	-200.47** [-384.2, -16.7]	-270.07** (64.86)	-0.19** [-0.37, -0.01]	-0.26** (0.07)	-139.96 [-823.6, 543.7]	-107.33 (260.86)	-0.08 [-0.29, 0.12]	-0.07 (0.07)

[35] The estimator row identifies whether the Callaway & Sant'Anna (CS) method or a two-way fixed effect model has been used. For the CS models, the bootstrapped 95% confidence intervals are reported in brackets below the estimate. The authors demonstrate that their procedure for estimating CIs by bootstrap clustered at the unit level is robust to multiple testing issues. For the TWFE, standard errors clustered at the small area level are reported in brackets below the coefficient estimate. * denotes significance at the 5% level for the TWFE estimates. ** denotes significance at the 1% level for the TWFE or in the case of the CS estimates, that the bootstrapped 95% confidence interval does not cross zero. The CS method control group is set to 'never treated' so that the estimates show the change in SEC areas compared to areas without SEC areas. The parallel trends test refers to the p-value of a Wald test that all leading coefficients are simultaneously equal to zero. For SPV results – the CS estimator doesn't allow already treated units to be included so t+4 is max coefficient given the programmes initiation in 2018.

	EVs				Fully Funded Energy Upgrade			
Model No.	9	10	11	12	13	14	15	16
Dependent variable	*Grant amount per small area per year*	*Grant amount per small area per year*	*Log (grant amount +1)*	*Log (grant amount +1)*	*Grant amount per small area per year*	*Grant amount per small area per year*	*Log (grant amount +1)*	*Log (grant amount +1)*
Estimator	*CS*	*TWFE*	*CS*	*TWFE*	*CS*	*TWFE*	*CS*	*TWFE*
4	-333.54** [-544.7, -122.3]	-417.47** (74.63)	-0.30** [-0.51, -0.09]	-0.39** (0.08)	-92.94 [-970.3, 784.4]	64.21 (283.16)	-0.03 [-0.26, 0.2]	0.02 (0.07)
5	-505.93** [-746.4, -265.4]	-539.65** (90.67)	-0.43** [-0.70, -0.16]	-0.46** (0.09)	-686.86 [-1579.3, 205.6]	-443.16 (318.06)	-0.06 [-0.33, 0.21]	-0.04 (0.08)
Parallel trend test passed (P-value)	*No (0)*	*Yes (0.09)*	*No (0)*	*Yes (0.1)*	*No (0)*	*No (0)*	*No (0)*	*Yes (0.1)*
R-squared	*N.A*	*0.18*	*N.A*	*0.21*	*N.A*	*0.06*	*N.A*	*0.06*

Table TA.2.3 Results with Pobal Deprivation Index as a covariate[36]

Dep. variable	Better Energy Homes			Solar PV			EVs			Warmer Homes Scheme		
	Grant amount per small area per year											
	Point estimate	Lower CI	Upper CI	Point estimate	Lower CI	Upper CI	Point estimate	Lower CI	Upper CI	Point estimate	Lower CI	Upper CI
Years from SEC formation												
-5	-1.65	-119.56	116.25	-444.32**	-803.03	-85.61	-38.50	-135.40	58.40	1092.99**	581.34	1604.64
-4	-36.41	-139.85	67.04	-233.80**	-425.52	-42.08	1.13	-91.33	93.60	1004.72**	520.76	1488.68
-3	3.54	-102.65	109.72	-100.06	-228.03	27.91	-19.33	-112.75	74.09	763.71**	358.80	1168.62
-2	-31.69	-136.17	72.80	-73.54	-167.87	20.79	-40.14	-133.83	53.56	569.44**	180.15	958.73
-1												
0	-15.82	-138.80	107.17	30.87	-69.99	131.73	-39.43	-150.36	71.50	123.93	-305.70	553.57
1	143.08**	5.25	280.90	107.66	-8.30	223.62	-59.52	-188.87	69.84	34.14	-519.00	587.29
2	134.81**	4.28	265.35	178.29**	31.56	325.02	-26.24	-184.26	131.79	-575.75**	-1099.02	-52.48
3	371.95**	184.83	559.07	214.58**	24.58	404.59	-130.63	-300.98	39.71	-127.44	-839.89	585.02
4	287.61**	94.21	481.01	191.37	-59.96	442.70	-261.05**	-451.10	-71.00	-189.87	-969.10	589.36
5	187.25	-3.78	378.28				-372.46**	-602.82	-142.10	-820.04	-1665.24	25.17

[36] Results generated using CS model. In all cases, the dependent variable is grant amount per year per small area. The 2022 Pobal Deprivation Index is included as a covariate for all estimations with the SEC treatment indicators. Estimation is done using the doubly robust method provided in the DiD package which combines inverse probability weighting of observations with outcome regression.

Table TA.2.4 Results with subset of SEC areas only[37]

	Better Energy Homes			Solar PV			EV			Warmer Homes Scheme		
Dependent variable	*Grant Amount per Small Area per Year*											
	Point estimate	**Lower CI**	**Upper CI**	**Point estimate**	**Lower CI**	**Upper CI**	**Point estimate**	**Lower CI**	**Upper CI**	**Point estimate**	**Lower CI**	**Upper CI**
Time from SEC formation (years)												
-5	53.07	-59.86	166.00				-113.52	-234.28	7.24	468.11	-185.89	1122.10
-4	22.63	-100.50	145.77				-43.93	-160.23	72.36	485.45	-118.97	1089.87
-3	71.50	-47.34	190.35	74.27	-76.97	225.52	-65.68	-174.29	42.93	275.27	-229.69	780.23
-2	5.62	-108.61	119.85	4.01	-107.75	115.78	-61.46	-170.13	47.20	131.85	-332.04	595.74
-1												
0	-49.72	-194.74	95.30	24.75	-86.93	136.44	-53.63	-201.40	94.15	235.35	-359.12	829.82
1	77.83	-125.07	280.73	21.85	-130.16	173.86	-55.16	-229.19	118.86	842.80**	68.65	1616.94
2	-30.85	-257.19	195.48	60.90	-175.11	296.90	-35.87	-261.80	190.06	294.52	-464.00	1053.04
3	143.61	-159.04	446.26				-88.20	-344.97	168.56	253.96	-871.35	1379.28
4	112.37	-245.38	470.11				-404.93**	-724.79	-85.06	1181.11	-120.21	2482.43
5	-177.74	-615.13	259.64				-432.87**	-839.96	-25.78	1141.82	-513.50	2797.14

[37] Results generated using CS model. In all cases, the dependent variable is grant amount per year per small area. The removal of all small areas which never form a SEC reduces the number of observations in the dataset by roughly two thirds.

Table TA.2.5 Results with varying range of SEC influence[38]

	Better Energy Homes			Solar PV			EV		
	Baseline (10 SAs)	5 nearest SAs	15 nearest SAs	Baseline (10 SAs)	5 nearest SAs	15 nearest SAs	Baseline (10 SAs)	5 Nearest SAs	15 Nearest SAs
Time from SEC formation (years)									
-5	17.85	-23.86	60.03	-404.04**	-270.66	-265.68	-27.08	-102.98	9.14
-4	-25.76	-37.04	17.21	-216.75**	-199.08	-164.42	10.82	-48.57	28.54
-3	12.17	15.01	21.63	-91.99	-83.58	-58.50	-11.67	-91.19	5.44
-2	-24.44	-38.42	10.32	-65.11	-42.87	-60.10	-39.84	-143.18	-2.99
-1									
0	-12.79	-67.25	20.85	31.23	35.71	39.17	-43.94	-72.47	-36.36
1	144.05**	159.58	118.76	108.19	179.97**	93.29	-83.13	-165.21	-58.31
2	119.69**	120.04	157.87**	165.49**	154.45	146.24**	-48.60	-6.09	-24.75
3	368.49**	293.90**	327.84**	184.64	50.00	200.02**	-200.47**	-174.45	-223.92**
4	267.89**	182.35	239.42**	195.52	-32.80	273.96**	-333.54**	-413.88**	-340.62**
5	156.30	-44.44	194.85**	0.00			-505.93**	-340.85	-625.16**

[38] Results generated using CS model. In all cases, the dependent variable is grant amount per year per small area. Results shown are the point estimates of the baseline model, as well as 2 further scenarios when the assumed range of influence of a SEC is the 5 nearest small areas and the 15 nearest small areas. Significant point estimates, based on the CS bootstrap procedure, are marked ** and highlighted.

Placebo test

For each grant scheme, a group of small areas the same size as the group of SEC small areas is randomly selected from the whole dataset. The year of SEC establishment is randomly assigned to this randomly selected subset of small areas. The models are then estimated 500 times on the falsified dataset. Figure TA.2.1 shows the results of the test.

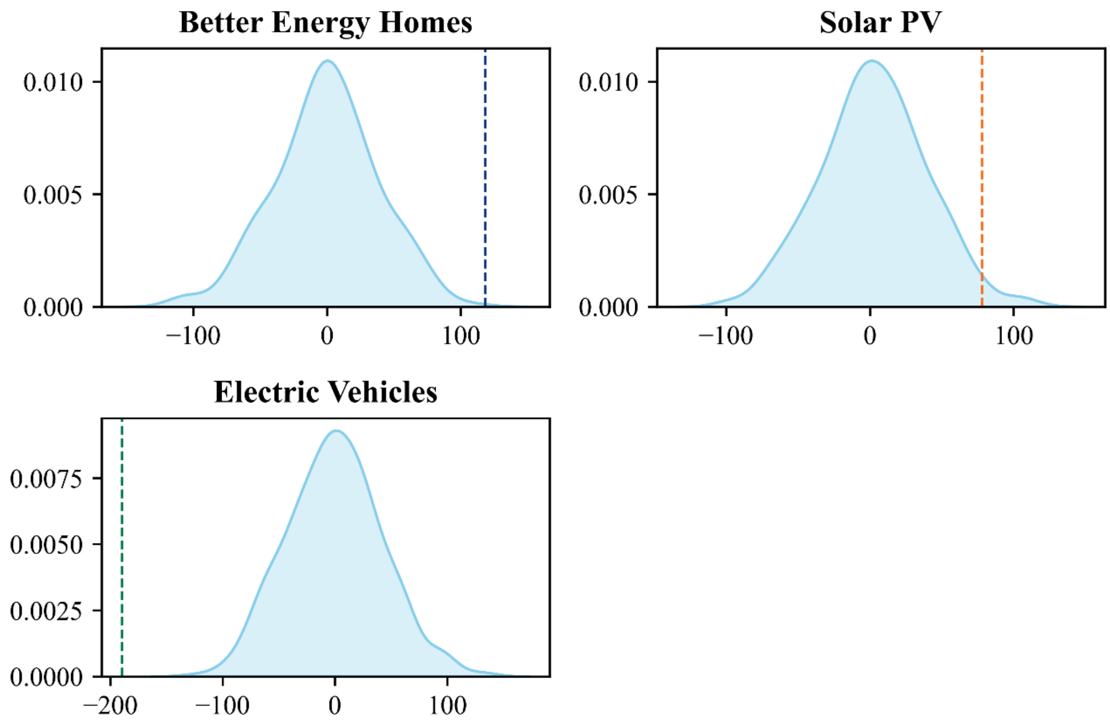

Figure TA.2.1: Placebo test results[39]

[39] The plots represent the probability distributions of the results of the placebo tests, described in the section on 'Causality and Range of SEC Influence' in chapter 6. The dashed lines in each subplot are the actual observed overall effect of SEC presence on grant uptake. The Individual Home Energy Upgrades dashed line appears to lie within the placebo range, but this is due to the smoothing of the KDE function and in reality, it is slightly larger than the maximum placebo estimate. The SPV estimate lies at the 97.5 percentile of the placebo results.

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