**iSERVcmb – a survey of the existing metering, data collection and handling protocols found across the EU across CIBSE EPG members**

# Technical report of findings to January 2014
# Report in support of the aims of iSERVcmb

By

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## Executive Summary

This report takes place in the context of iSERVcmb, a European project designed to look at end use of HVAC systems across Europe. The iSERV project provides an approach to achieving this in practice and allowing to be used across all building types in the EU Member States. The iSERV approach introduces an electronic method of using existing metering and sensors, along with information on buildings assets and activities, such that benchmarks, powerful in diagnostic work, can be derived from that data - and produced for individual building configurations and activities supported.

To ascertain to what extent metering is available and what are the specifics of the data collection & handling protocols most commonly used today across Europe, a survey was designed and distributed to members of the CIBSE EPG group.

The aim of this survey was:

to extract information regarding

- the extent of dedicated electrical sub metering with data collection on HVAC components,
- the time intervals preferred in recording and storing metered data,
- the predominant metered data sending protocols, and
- the existence of digital records of energy metering strategies, building asset portfolios, HVAC system components assets and energy consumption data,

to highlight

- possible differences between practices in NW and SE Europe
- possible differences between buildings using different approaches to metering
- which areas or HVAC components are usually metered

and

- to identify potential end users that were in a position to participate to the iSERV cmb project.

The results of this survey are used in iSERVcmb to underpin the assertion that the iSERVcmb approach is potentially applicable and that its specifics agree with what exists in the market.

Participants were recruited from the CIBSE Energy Performance Group in which more than 13,000 members from around the world are participating.

This report focuses on data collection conducted between 16/5/2013 and 13/01/2014.

The main findings are:

- ✓ Sub metering is more prevalent in office buildings, educational facilities and hotels.
- ✓ Fully metered buildings are more likely to record and store sub hourly data equally at 15' or 30' intervals, while partly metered buildings (sub metering on at least one HVAC component) are more likely to use 30' interval data.
- ✓ Metered buildings appear to usually record sub-hourly data for the main electrical or gas supply, with main water supply metered from a smaller percentage of the population.
- ✓ In ranking order, sub metering recording sub-hourly data is statistically more likely to be installed on either lighting, chillers, HVAC system as a whole, or small power. A smaller amount of buildings appear to record sub hourly data for fans, boilers, pumps or IT systems. IT systems and pumps are mostly recorded in educational facilities and offices, while metering catering is popular amongst participants in retail and education.
- ✓ It appears that in offices and educational facilities there is a greater variety with respect to what is metered.
- ✓ No obstacles were observed in metered buildings being in a position to directly send their data for analysis. Sending data manually to an email address is preferred over an automatic option.
- ✓ It appears that the majority of metered buildings have digital energy consumption data.
- ✓ Professionals based in NW Europe who are in charge of operating, managing and maintaining HVAC systems in their buildings, appear to have a wider variety of responsibilities compared to professionals based in SE Europe that touch upon duties regarding the enforcement of sustainability to building management and legislation compliance matters. Moreover, they tend to be managing larger floor areas compared to SE Europe.

To summarise, we can conclude there is great potential of an iSERV type approach being implemented across Europe. It appears that there is a significant population of buildings equipped with sub metering recording at sub hourly intervals, one which adheres to the prerequisites iSERV sets. Currently, such an approach is more likely to be easier to implement in offices, educational facilities and hotels, as there is strong evidence these sectors already have sub metering recording at sub hourly intervals, in a variety of areas and components inside their buildings, and are in position to manually send digital energy consumption data for analysis, if asked.

## Acknowledgements

We would like to thank the many people who have supported this project.

Firstly, we would like to thank Phil Jones, chairman of the CIBSE Energy Performance Group, who assisted in the collation and distribution of this questionnaire to the CIBSE EPG group.

We would also like to thank the participants who have agreed to take part in this study, and for giving up their time to fill out this questionnaire.

## Background of survey research

### iSERV cmb Project Overview

This is a report in support of the aims of the E.C. funded project "Inspection of HVAC Systems through continuous monitoring and benchmarking (iSERV cmb)".

The project shows the practical operation and benefits of an automatic monitoring and feedback system, as now allowed for in the recast EPBD, applied to Heating, Ventilation and Air-Conditioning systems in EU Member States. It is an important project as previous work has indicated real savings of up to 60% are achievable in individual HVAC systems through the iSERVcmb project approach. The project has recruited over 1000 operating HVAC systems from around Europe. It has the support of the two main professional bodies for HVAC systems in Europe – CIBSE and REHVA – eight universities, an HVAC Maintenance company and an Energy Database SME, as well as input and interest from HVAC component manufacturers and property developers.

Building on the results of its predecessor projects, AUDITAC (2005-2007) and HARMONAC (2007-2010), the iSERVcmb project seeks to understand how energy is used in HVAC systems and buildings through evidence based analysis of real-world energy performance data. The project demonstrates how significant electrical savings, ranging from 5% to 30% on average, can be achieved by understanding the details of energy usage at the level of individual components within buildings.

The specific objectives of EACI from this funding call, and iSERV's impact in response to these objectives, are:

- **Reduce energy consumption across the EU MS over the life of the project in line with the EU 2020 targets.**
- **To build strong foundations for further reductions after the project officially finishes.**
- **Projects to have a significant impact in terms of energy efficiency.**
- **Strong replicability across the EU MS.**
- **To create the right market conditions for their use**

## Introduction to the survey research

The iSERV project provides an approach to achieving this in practice which can be used across all building types in the EU Member States. Key to this approach is the establishment of statistically robust benchmarks of energy use at HVAC component level, derived from sub-hourly automatic monitoring data collected from over 1000 HVAC systems across the EU. The iSERV approach introduces an electronic method of using existing metering and sensors, along with information on buildings assets and activities, such that benchmarks, powerful in diagnostic work, can be derived from that data - and produced for individual building configurations and activities supported.

To ascertain to what extent metering is available and what are the specifics of the data collection & handling protocols most commonly used today across Europe, a survey was designed and distributed to members of the CIBSE EPG group.

## Identify research objectives

To ascertain to what extent metering is available and what are the specifics of the data collection & handling protocols most commonly used today across Europe, a survey was designed and distributed to members of the CIBSE EPG group.

This report presents data in relation to metering and data collection & handling practices across Europe. The survey was particularly concerned with identifying potential end users that were in a position to participate to the iSERV cmb project, extracting information regarding:

- the extent of dedicated electrical sub metering with data collection on HVAC components,
- the time intervals preferred in recording and storing metered data,
- the predominant metered data sending protocols, and
- the existence of digital records of energy metering strategies, building asset portfolios, HVAC system components assets and energy consumption data,

and highlighting

- possible differences between practices in NW and SE Europe
- possible differences between buildings using different approaches to metering
- which areas or HVAC components are usually metered.

Over 13,000 CIBSE EPG group members were asked to complete a short questionnaire set up online through the Survey Monkey platform. The survey targeted personnel responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in their buildings. A total of 162 individuals responded to this survey.

The survey ran during the period 16/5/2013 to 13/01/2014.

The results of this survey are used in iSERVcmb to underpin the assertion that the iSERVcmb approach is potentially applicable and that its specifics agree with what exists in the market.

## Methodology

The survey was designed using Survey Monkey, a web based survey platform. The link of the survey was then sent to over 13,000 13,000 CIBSE EPG group members by the group's chairman, Phil Jones., along with an introductory email asking members to contribute to the iSERV project's survey.

The Energy Performance Group (EPG) is CIBSE's largest Special Interest Group and has over 13,000 members from around the world. Its mission is to improve the energy performance of buildings by increasing awareness amongst all building professionals and supporting the implementation of relevant legislation aimed at reducing carbon emissions in buildings. The Energy Performance Group contributes in CIBSE's prime responsibility for effectively meeting the sustainability challenge head on. The group was deemed as the most appropriate channel through which the survey was to be circulated as, amongst other aims, it:

- helps building professionals become aware of the opportunities for energy saving within the buildings they are involved in - both new and existing,
- encourages best practice in the use of passive solutions, new and developing technologies to reduce carbon emissions,
- keeps building professionals aware of market conditions and government initiatives related to energy saving, provide a forum to explore the lessons that can be learned, and disseminate these, and
- provides a central source of links and information (including information about training and certification in energy inspection).

The survey link was also made available through social media, namely LinkedIn Groups and Twitter.

The design of the survey aimed primarily at identifying potential end users for the iSERVcmb project. The minimum requirements for participating in iSERV are:

- Ability to provide the power consumption data of your current HVAC system components
- Have dedicated electrical metering on at least one HVAC component, capable of recording data at sub-hourly, ideally 15 minute, intervals.
- Ability to send the HVAC consumption data to iSERV monthly, over a minimum period of one full year.

In accordance to the aims of the survey and the prerequisites for participating to iSERV, the survey was divided into two parts. The first part of the survey aimed to filter **respondents** by collecting information regarding their position in their work place, the sector they work for, the building area they are in charge of, and the level of metering installed in their buildings. The second part focused on the remaining **respondents**, referred to in this reports as survey **participants**, about the specifics of the metering, data collection and handling protocols operated in their buildings.

Being "**responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in your buildings"** 'was used as the survey's second question operating as a first participation criterion. Respondents meeting this criterion were allowed to progress to the next question. All rejected respondents were asked to provide the contact information of the personnel responsible. All rejected respondents were asked to provide the contact information of the personnel responsible for managing the HVAC systems in their building(s), to which only three responded.

The questionnaire then proceeded to a first set of questions aiming at identifying:

1. The sector that best describe where participants work
2. The roles and responsibilities participant hold
3. The number of buildings participants are responsible for
4. The total size of the buildings participants are responsible for

"**Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components"** 'was used as the survey's second question-criterion, allowing participants to choose between:

- Fully Metered Building
- Partly Metered – sub-metering on one of the HVAC components
- No Metering Installed but Planning to
- None of the above.

Participants who stated they had "No Metering Installed but Planning to" or "None of the above" were not allowed to proceed to the questions following, and were directed to the end of the survey. This ensured that questions regarding the specifics of metering, data collection & handling protocols most commonly used today across Europe were answered by end users that had at least some metering installed in their buildings.

The second set of questions consisted of separate questions used as additional consecutive criteria. The questions aimed at identifying:

1. The time interval at which participants' electrical metering is capable of recording and storing data
2. The building and HVAC components participants are recording sub hourly data for
3. The ability to send HVAC consumption data for analysis
4. The existence of digital records of energy metering strategies, building asset portfolios, HVAC system components assets and energy consumption data.

Participants were not allowed to proceed to the next question in order, and were directed to the end of the survey, if they fell in the categories shown in Table 1.

**Table 1 : Disqualifying Answers for questions Q10, Q11, Q12 and Q14**

| **Question** | **Disqualifying Answers** |
|---|---|
| Q10. Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals? | Daily, Monthly data, None of the above |
| Q11. Please tick all the following that apply. I am recording sub-hourly data for: | None of the above |
| Q12. Are you in a position to send your HVAC consumption data for analysis by any of the following means? | Unlikely |
| Q14. Please tick if you have any of the following already in electronic form: | None of the above |

Upon completion of the survey, participants were informed whether their Building and HVAC systems appear suitable for participation in iSERVcmb, and were prompted to provide their contact info in order to be contact by an iSERVcmb partner.

No rewards were sent upon receipt of the questionnaire.

The responses given in the questionnaire were exported to Excel and analysed using descriptive statistics. Findings are presented in tables which contain frequencies of responses. We also include percentages to help comparison of responses across questions.

Table 2 gives a summary of the survey questions. A copy of the questionnaire can be found in the Appendix.

**Table 2 : Summary of Survey Questions**

| No | Question | Qualifying Answers | Disqualifying Answers | If Qualified directed to: | If Disqualified directed to: | No. Answers | No. Skips |
|---|---|---|---|---|---|---|---|
| Q1 | Please select your country of residence. * | <List of Countries> | | Q2 | | 162 | 0 |
| Q2 | Are you responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in your buildings? * | Yes | No | | Q3 | 154 | 8 |
| Q3 | Do you know the personnel responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in your building? * | Yes | No | Q4 | End of Survey | 45 | 117 |
| Q4 | If yes, please put us in touch with them by filling in their e-mail address or pass the survey to them. If you provide an email address please include your name as a contact that we can refer to in our contact email otherwise the email will probably be ignored. * | <Contact Info> | | End of Survey | | 3 | 159 |
| Q5 | Please choose the sector that best describes where you work: * | <List of Sectors> | | Q6 | | 109 | 53 |
| Q6 | Please indicate all the roles and responsibilities you hold: ** | <List of roles > | | Q7 | | 107 | 55 |
| Q7 | Please indicate the number of buildings you are responsible for so we can best understand your potential for replication of iSERVcmb in your organisation: * | 1, 2-10, 11-100, 100+ | | Q8 | | 106 | 56 |
| Q8 | Approximately, what is the total size of the buildings you are responsible of? * | 0 - 1,000m$^2$, 1,001 - 10,000m$^2$, 10,001 – 100,000m$^2$, 100,000+ m$^2$ | | Q9 | | 106 | 56 |
| Q9 | Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components? * | Fully Metered Building, Partly Metered | No Metering Installed but Planning to, None of the above | Q10 | End of Survey | 102 | 60 |
| Q10 | Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals? ** | 15’ data, 30’ data, Hourly data | Daily, Monthly data, None of the above | Q11 | End of Survey | 85 | 77 |
| Q11 | Please tick all the following that apply. I am recording sub-hourly data for: ** | <List of Sub metered components/ systems> | None of the above | Q12 | End of Survey | 66 | 96 |
| Q12 | Are you in a position to send your HVAC consumption data for analysis by any of the following means? * | Automatically to an email address, Manually to an email address, Maybe but could require some help, Not sure | Unlikely | Q13 | End of Survey | 62 | 100 |
| Q13 | Would you be able to send us a sample of this data now or in the very near future? * | Yes, No | | Q14 | | 55 | 107 |
| Q14 | Please tick if you have any of the following already in electronic form: ** | Energy metering strategy, Building asset portfolio, HVAC system components asset, Energy consumption data | None of the above | End of Survey | End of Survey | 53 | 109 |

*Questions allowing one possible answer

**Questions allowing multiple answers

## Reporting strategy

We have presented the data in two sections:

- Sample demographics and representativeness - overviewing the sample at the beginning of the data collection, and drop-out as the survey proceeds
- Findings - overview of the findings which were collected through the survey monkey by those who qualified in terms of level of metering.

A number of tables are referred to throughout the report, some of which may be found in the appendix. The data is presented in terms of both numbers and percentages. As our sample numbers are low, the percentages should be interpreted cautiously, and numbers within individual cells of tables referred to at all times.

## Sample demographics and representativeness

**Project sample and population**

In this section, the survey sample is examined to see how representative it is of the population from which participants were recruited.

One important consideration is whether the sample of 102 participants we received responses from is representative.

Tables presenting the demographic data may be found in the appendix.

The survey was distributed through CIBSE's Energy Performance Group. The Energy Performance Group (EPG) is CIBSE's largest Special Interest Group and has over 13,000 members from around the world. Its mission is to improve the energy performance of buildings by increasing awareness amongst all building professionals and supporting the implementation of relevant legislation aimed at reducing carbon emissions in buildings. The Energy Performance Group contributes in CIBSE's prime responsibility for effectively meeting the sustainability challenge head on. The group was deemed as the most appropriate channel through which the survey was to be circulated as, amongst other aims, it:

- helps building professionals become aware of the opportunities for energy saving within the buildings they are involved in - both new and existing,
- encourages best practice in the use of passive solutions, new and developing technologies to reduce carbon emissions,
- keeps building professionals aware of market conditions and government initiatives related to energy saving, provide a forum to explore the lessons that can be learned, and disseminate these, and
- provides a central source of links and information (including information about training and certification in energy inspection).

A total of 162 individuals responded to this survey. However, 37 were deemed unsuitable to complete it as there were not responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in their buildings. All rejected respondents were asked to provide the contact information of the personnel responsible to which only three responded.

The small sample size must be taken into account when assessing the representativeness of our sample to the population. The following points are noted regarding the survey **respondents**:

1. The majority of the respondents are based in the UK (48.1%)
2. There is an underrepresentation of SE European countries (21.7%)
3. A small number of respondents are based outside the EU (16%)
4. The majority of respondents work either in offices (38.5%) or the education sector (23%).
5. There is a strong majority of respondents who are responsible of the energy management in their buildings (77.6%)
6. The majority of respondents are in charge of a small group of buildings (40.6%).
7. The majority of respondents are in responsible for a total area of 1,001 - 10,000 m2 (39.6%).
8. A strong majority of respondents had metering in their buildings (73.5%)

**Participant drop-out**

Participant drop-out is summarised as follows:

- 32.7% of initial survey respondents, including respondents who skipped the question, were disqualified from the survey as they were not responsible for

operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in their buildings.

- From Q5 to Q9 that are mostly concerned with gathering demographic data from the respondents, there is a steady dropout rate ranging from 0 to 3.8%.
- Out of the 85 participants stating they have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components in their buildings, 22.4% were recording data a Daily, Monthly or larger interval.
- Out of the 85 participants stating they have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components in their buildings, 27% stated they have no sub-hourly recorded data for their HVAC as a whole, HVAC component, main incomers, Lighting, Small power, Catering or IT systems.
- Out of the 85 participants stating they have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components in their buildings, 35.3% stated they were able to send their HVAC consumption data for analysis either automatically or manually.
- Out of the 85 participants stating they have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components in their buildings, 37.6% stated they don't have in electronic form their energy metering strategy, or Building asset portfolio, or HVAC system components asset, or Energy consumption data.

This information is summarised in the Table 3.

**Table 3: Responses for each question**

| No. | No. Answers | No. Skips | % of drop out compared to previous question | % of drop out compared to Q1 |
|---|---|---|---|---|
| **Q1** | 162 | 0 | 0% | 0% |
| **Q2** | 154 | 8 | 4.9% | 4.9% |
| **Q5** | 109 | 53 | 29.2% | 32.7% |
| **Q6** | 107 | 55 | 1.8% | 34.0% |
| **Q7** | 106 | 56 | 0.9% | 34.6% |
| **Q8** | 106 | 56 | 0% | 34.6% |
| **Q9** | 102 | 60 | 3.8% | 37.0% |
| **Q10** | 85 | 77 | 16.7% | 47.5% |
| **Q11** | 66 | 96 | 22.4% | 59.3% |
| **Q12** | 62 | 100 | 6.1% | 61.7% |
| **Q13** | 55 | 107 | 11.3% | 66.0% |
| **Q14** | 53 | 109 | 3.6% | 67.3% |

## Findings

**Q1: Please select your country of residence.**

Figure 1 shows that almost two thirds of the respondents were based in NW Europe, predominantly in the UK which gathers 77.2% of the respondents from NW Europe and 48% of the total respondents.

The rest of the respondents were based either in SE Europe (22%) or in a variety of countries outside Europe soil (16%) (Appendix, Table 6). The majority (80%) of the respondents, as depicted in Figure 2, were based in SE Europe were sourced from Italy (25.7%), Portugal (22.9%), Greece (17.1%) and Spain (14.3%).

**Figure 1 : Geographic Distribution of Survey Respondents by region**

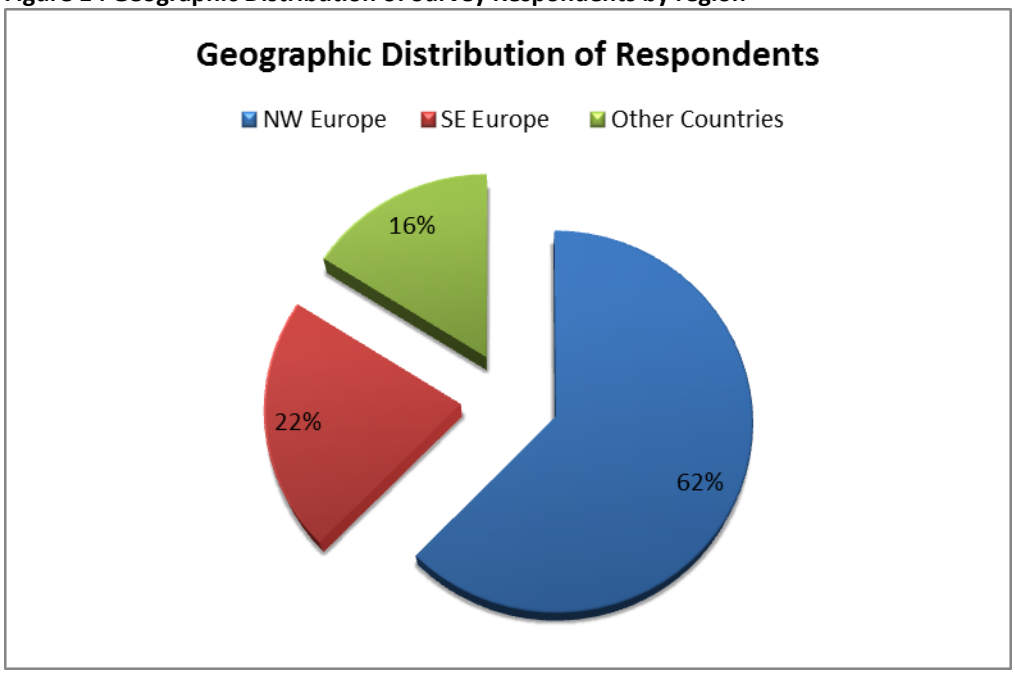
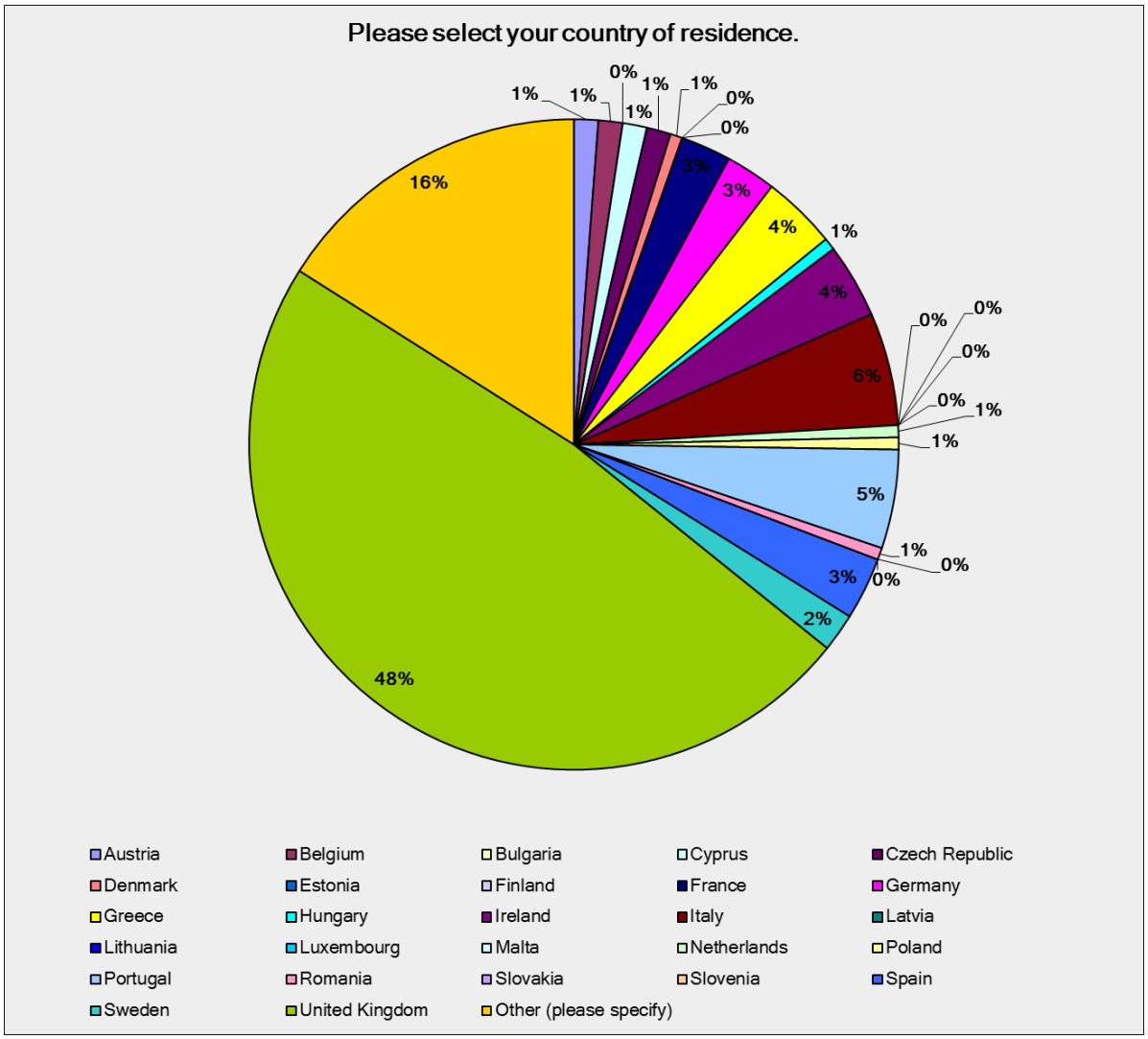



**Figure 2 : Geographic Distribution of Survey Respondents by country**




**Summary of Findings:**

- ✓ **The majority of the respondents were based in the UK (48.1%).**
- ✓ **There is an underrepresentation of SE European countries (21.7%).**
- ✓ **A small number of respondents are based outside the EU (16%).**

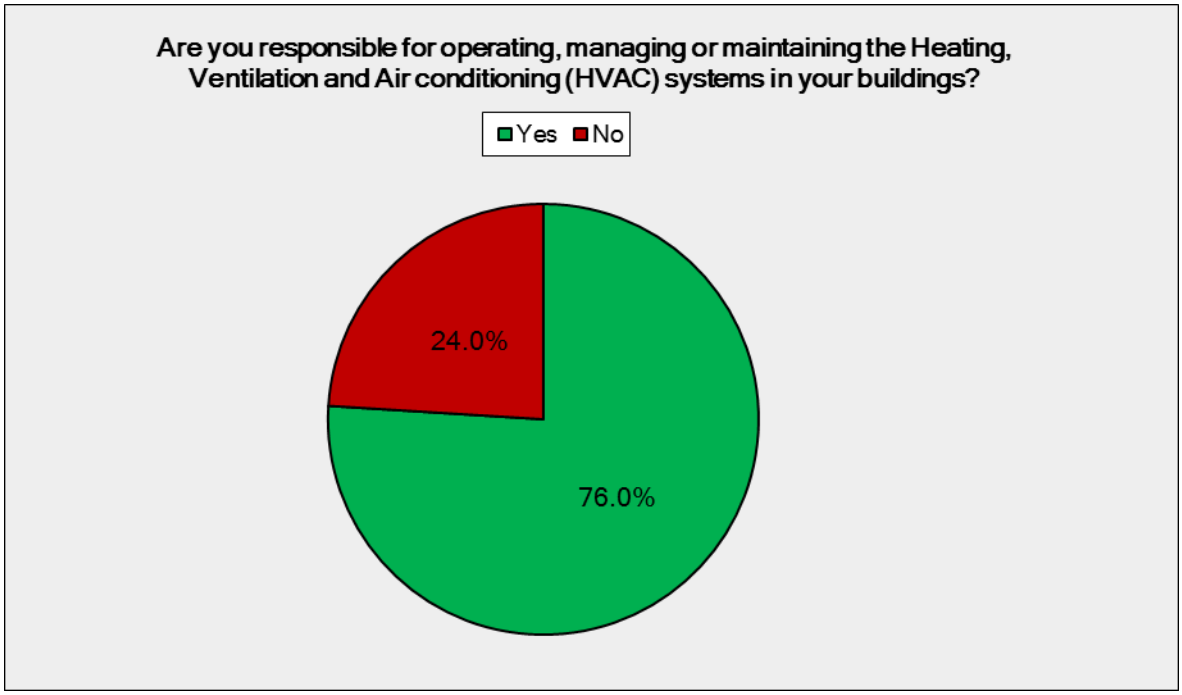
➢ Please refer to tables 6 and 7 in the appendix.

**Q2: Are you responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in your buildings?**

Being "**responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in your buildings"** 'was used as the survey's second question operating as a first participation criterion. Respondents meeting this criterion were allowed to progress to the next question. All rejected respondents were asked to provide the contact information of the personnel responsible.

Almost one fourth (24%) of the respondents who took this survey were not in charge of operating, managing or maintaining the HVAC systems in their buildings. All respondents who replied negatively were asked to provide the contact information of the personnel responsible for managing the HVAC systems in their building, to which only three responded.

**Figure 3 : Q2 - Are you responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in your buildings?**




If we were to distribute the negative answers by country, we could conclude that approximately one third of the respondents based in SE Europe replied negatively (32.3%), with the equivalent in NW Europe barely reaching 13%.

**Figure 4 : Answers to Q2 from respondents based in NW Europe**

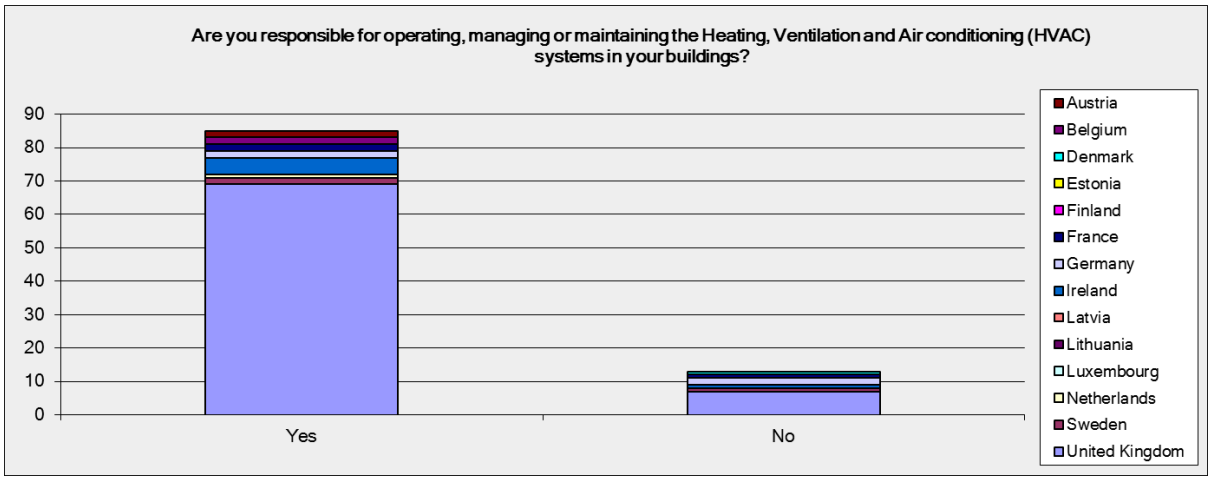
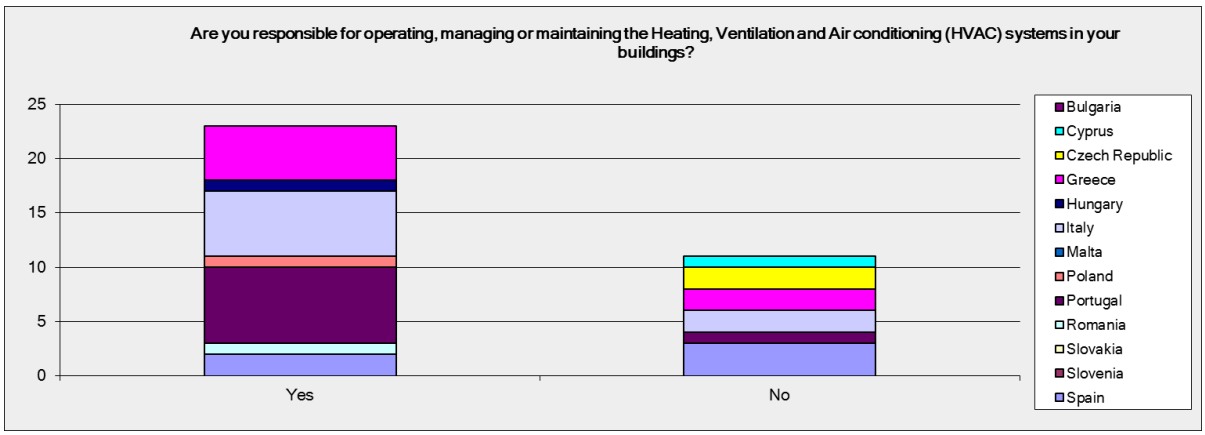



**Figure 5 : Answers to Q2 from respondents based in SE Europe**




**Summary of Findings:**

- ✓ **The majority of respondents who took this survey were in charge of operating, managing or maintaining the HVAC systems in their buildings (76%).**
- ✓ **Approximately one third of the respondents based in SE Europe replied they were not in charge of operating, managing or maintaining the HVAC systems in their buildings (32.3%), with the equivalent in NW Europe barely reaching 13%.**

➢ Please refer to tables 8 and 9 in the appendix.

**Q5: Please choose the sector that best describes where you work.**

A major characteristic of the survey sample is that the majority of respondents works in offices (38.5%) or the education sector (23%) consisting of primary, secondary and higher educational facilities (Figure 6, Table 4). In order of occurrence, other sectors included Hotels (9.2%), Dwellings (3.7%), Hospitals (2.8%) and Industrial Process Buildings (1.8%) (Appendix, Table 10)

**Figure 6 : Distribution of respondents according to sector they are employed in.**

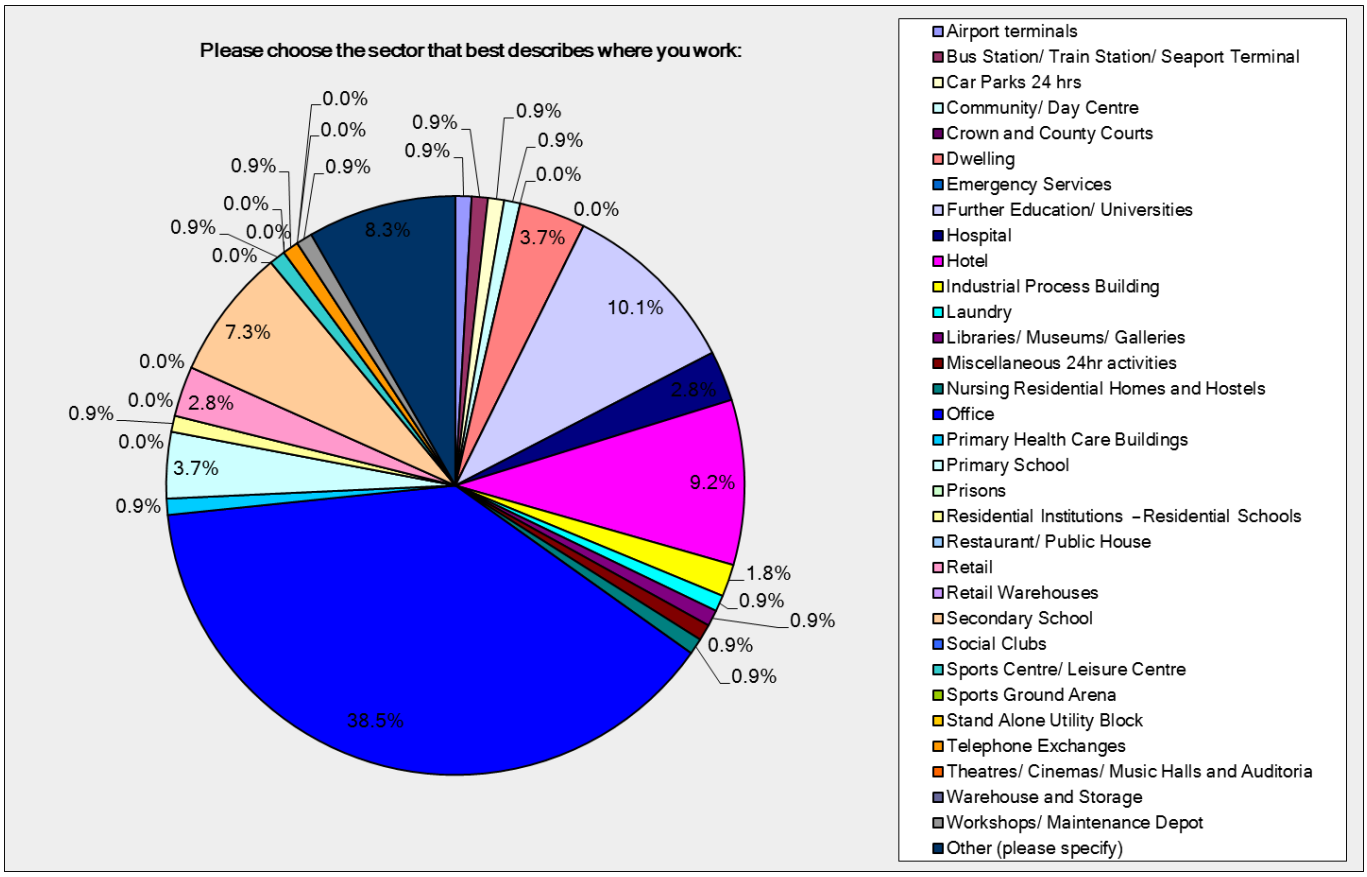



**Table 4 : Distribution of respondents employed in offices or educational facilities.**

| Answer | Total (N) | (%) to all respondents (N=109) | NW Europe (N) | (%) to all respondents (N=109) | SE Europe (N) | (%) to all respondents (N=109) |
|---|---|---|---|---|---|---|
| Further Education/ Universities | 11 | 10.1 % | 9 | 8% | 2 | 2% |
| Primary School | 4 | 3.7 % | 4 | 4% | 0 | 0% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Secondary School | 8 | 7.3 % | 8 | 7% | 0 | 0% |
| TOTAL | 23 | 21 % | 21 | 19 % | 2 | 2 % |

These traits are inherent to the majority of the respondents based in NW Europe (Figure 7) Respondents from SE Europe were found to be mostly employed in offices (29%) or hotels (24%) (Figure 8).

**Figure 7 : Distribution of respondents based in NW Europe according to sector they are employed in.**

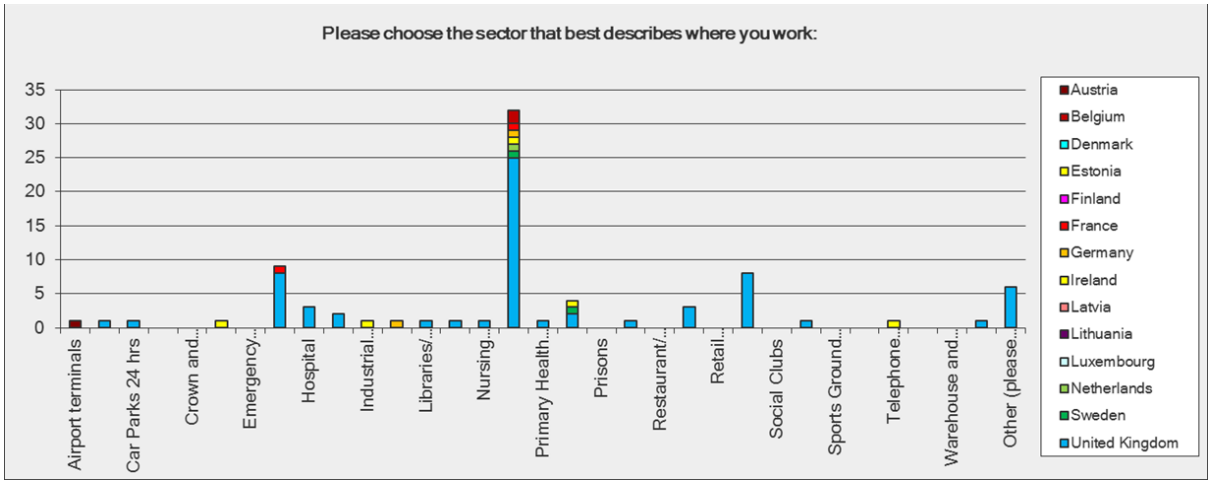
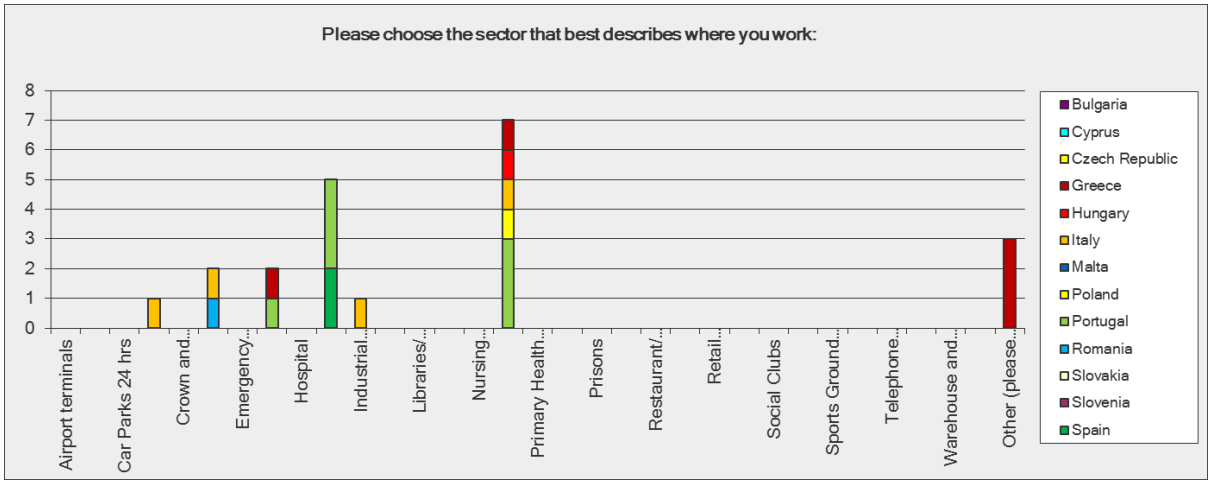



**Figure 8 : Distribution of respondents based in SE Europe according to sector they are employed in.**



Some of the **"other sectors"** reported such as Food manufacturing, Data Centres and an Ice Rink, could have been categorised under one of the listed sectors given , whereas few of the **"other sectors"** provided reveal that some of respondents might not have understood the question (Appendix, Table 10).

**Summary of Findings:**

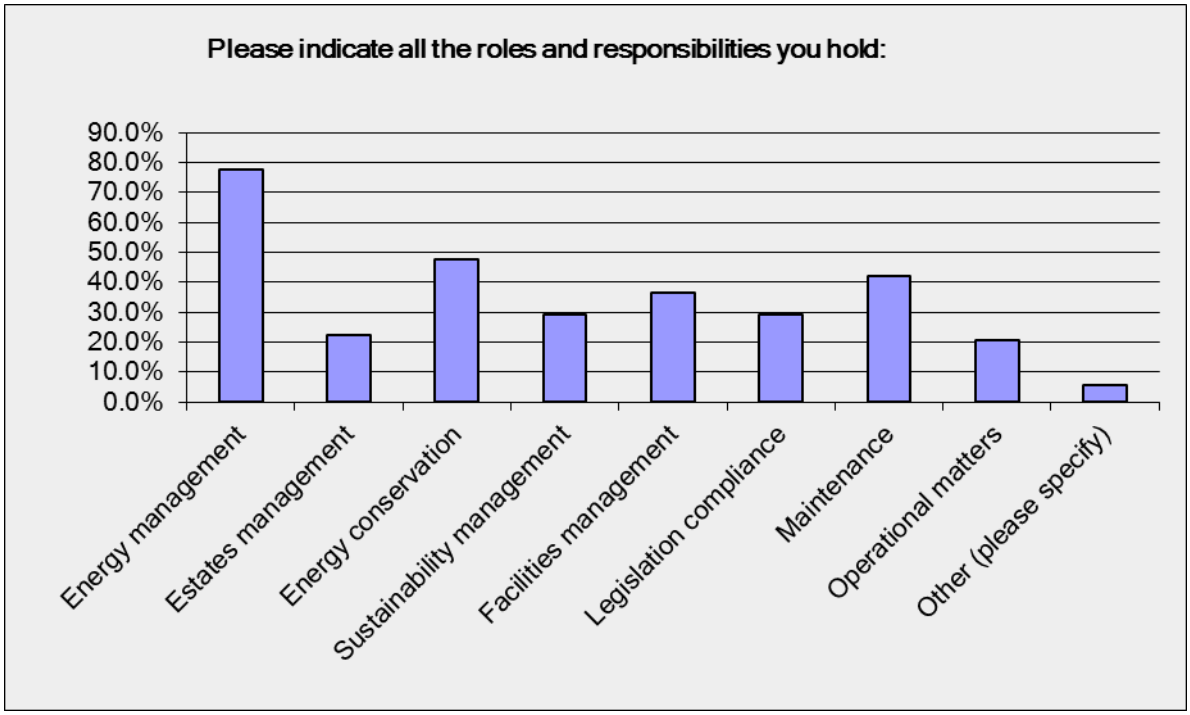
- ✓ **The majority of respondents work either in offices (38.5%) or the education sector (23%). These traits are inherent to the majority of the respondents based in NW Europe.**
- ✓ **The majority of respondents based in SE Europe are employed either in offices (29%) or hotels (24%).**

➢ Please refer to tables 10, 11 and 22 in the appendix.

**Q6. Please indicate all the roles and responsibilities you hold.**

It appears that the role of the majority of the respondents, who are in charge of operating, managing and maintaining HVAC system in their buildings, consists of energy management duties (77.6%) and Energy conservation duties (47.7%). Approximately one third of respondents included either sustainability management (29%), Facilities management (36.4%) or Legislation compliance (29%) in their duties. One fourth listed either Estates management (22.4%) or Operational matters (20.6%) as part of their role (Figure 9, Appendix, Table 12).

**Figure 9 : Please indicate all the roles and responsibilities you hold.**




These trends are also found in respondents based in NW Europe (Figure 10). Although, more than two thirds of the respondents based in SE Europe (70%) indicated that Energy management is part of their duties, more than one third (35%) stated that either Facilities management or Maintenance are equally part of their role, with the rest of the listed options scoring lower (Figure 11).

**Figure 10 : Roles and responsibilities held by respondents based in NW Europe.**

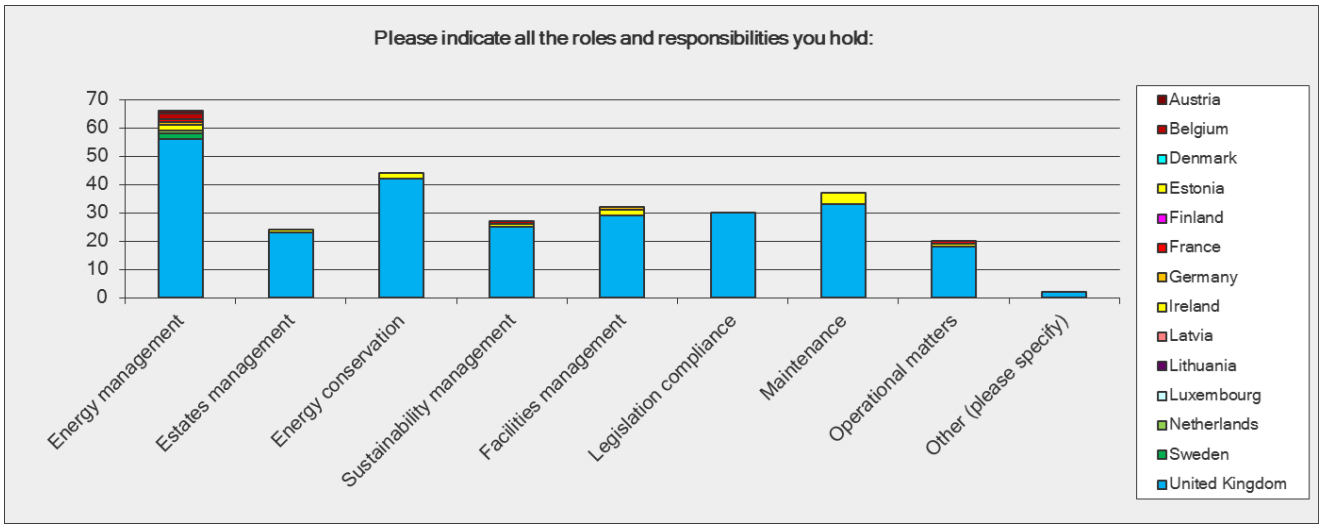
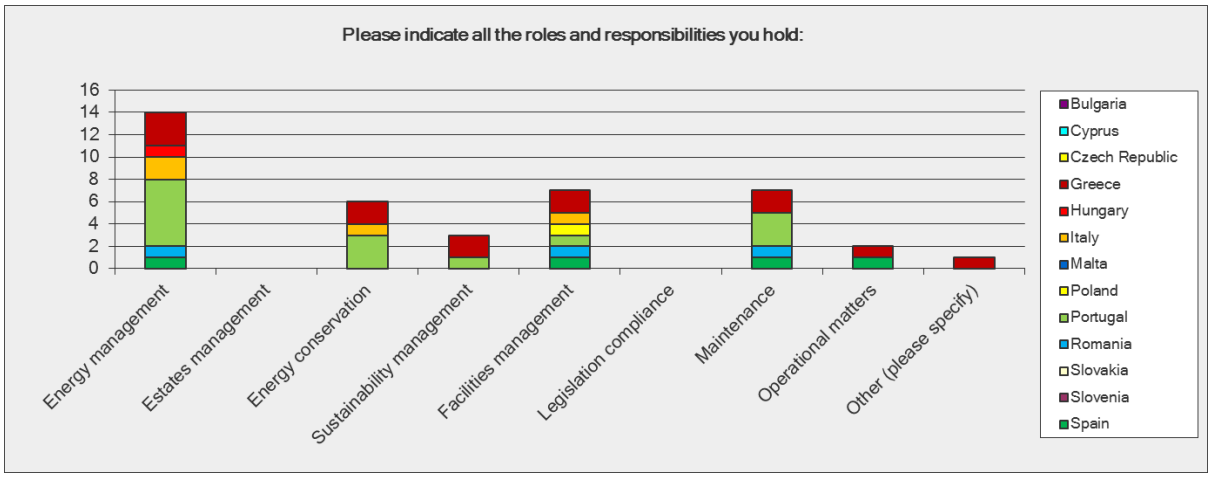



**Figure 11 : Roles and responsibilities held by respondents based in SE Europe.**




Some of the roles and responsibilities respondents thought they were not listed include Test and Commissioning, Health and Safety and Planning (Appendix, Table 13).

**Summary of Findings:**

- ✓ **There is a strong majority of respondents who are responsible of the energy management in their buildings (77.6%)**
- ✓ **Professionals based in NW Europe who are in charge of operating, managing and maintaining HVAC systems in their buildings, appear to have a wider variety of responsibilities that touch upon a role to enforce sustainability to building management as well as are involved in legislation compliance matters.**

- ➢ Please refer to tables 11 and 12 in the appendix.

**Q7. Please indicate the number of buildings you are responsible for so we can best understand your potential for replication of iSERVcmb in your organisation:**

**Q8. Approximately, what is the total size of the buildings you are responsible of?**

The majority of the respondents (64%) stated they either operate one building (24%) or a small group of buildings not exceeding a total of 10,000m2 floor area (40%)(Appendix - Tables 14 and 15, Figure 12 and 13).

**Figure 12 : Q7. Please indicate the number of buildings you are responsible for so we can best understand your potential for replication of iSERVcmb in your organisation.**

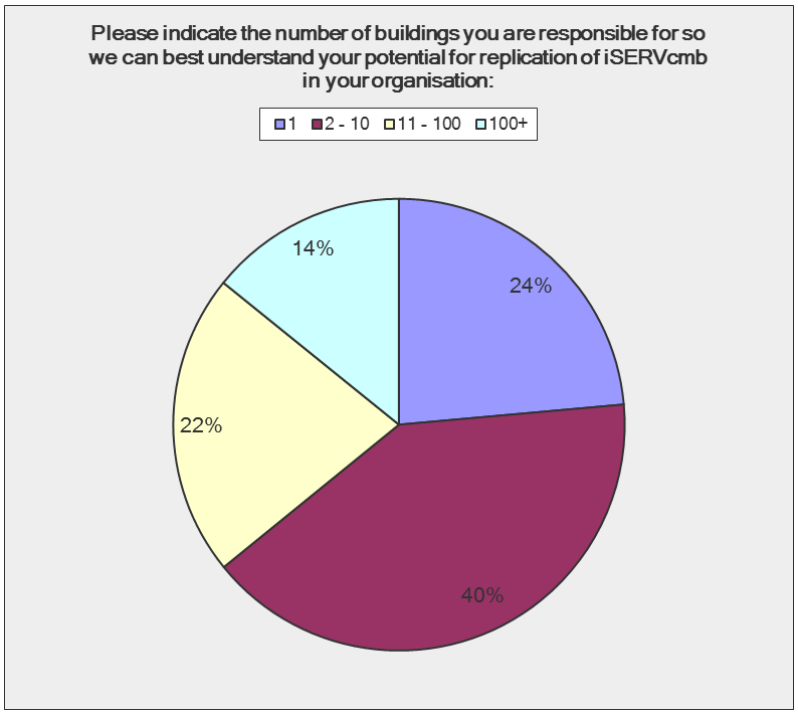



**Figure 13 : Q8. Approximately, what is the total size of the buildings you are responsible of?**

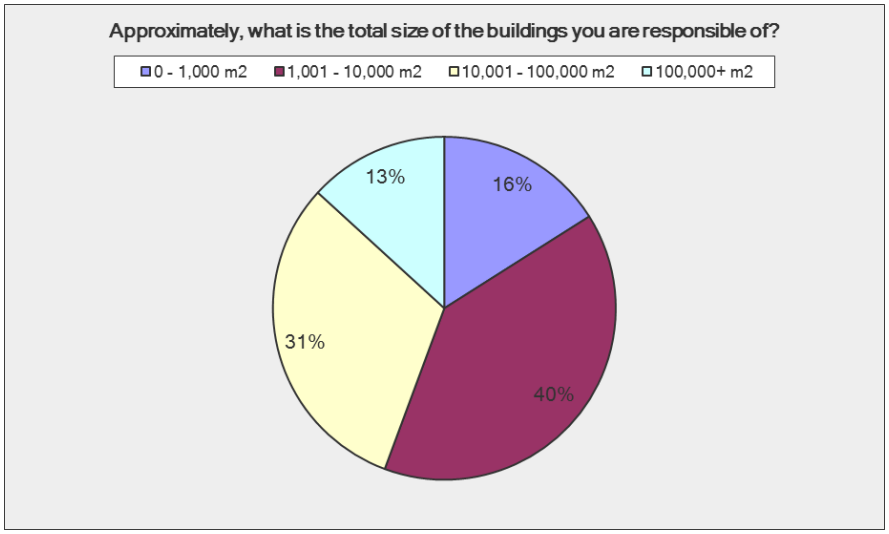



**Figure 14 : Q7. Please indicate the number of buildings you are responsible for so we can best understand your potential for replication of iSERVcmb in your organisation – NW Europe**

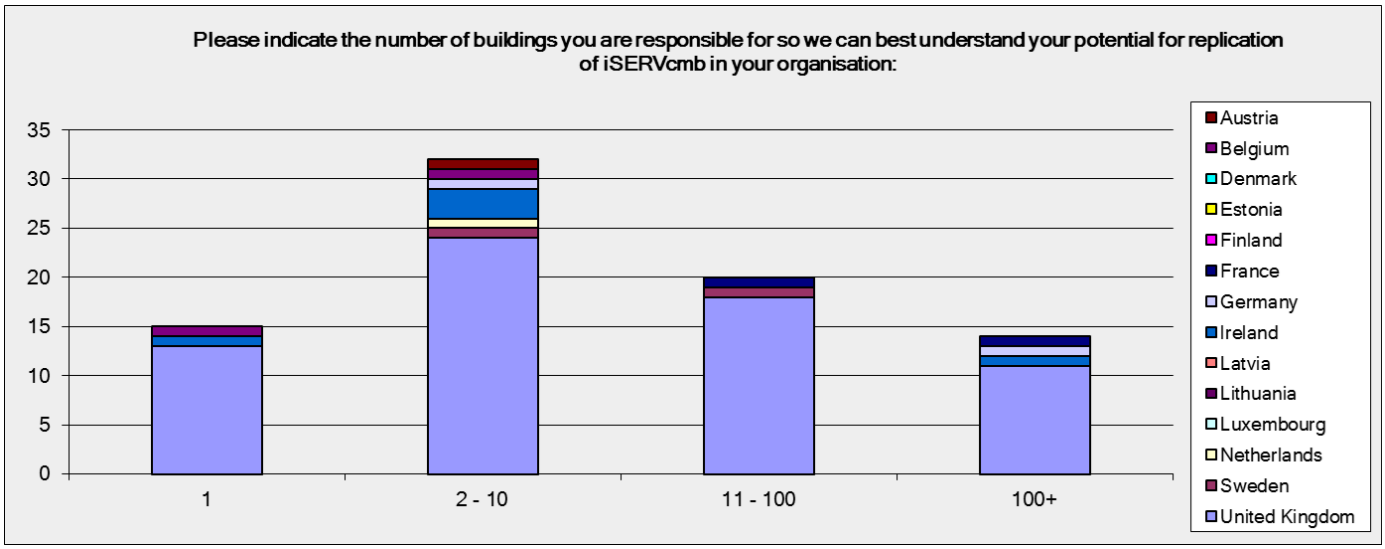
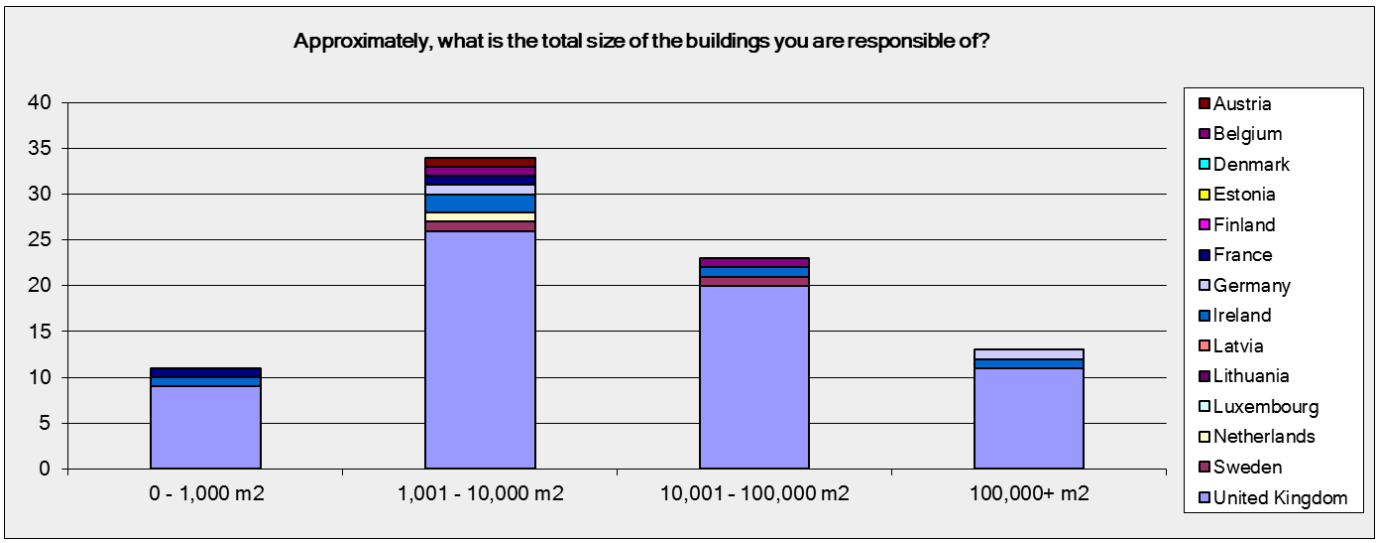



**Figure 15 : Q8. Approximately, what is the total size of the buildings you are responsible of? – NW Europe**




Mapping these results on the European map, most respondents from SE Europe (Figures 16 and 17) are either in charge of a single building (7.5%) or operating a small group of buildings (6.6%). In contrast, in NW Europe, those respondents operating a small group of Buildings (30.2%) are more than double than those who operate one single building (14.2%), with respondents operating a larger group of buildings (11 to 100) scoring second(18.9%)(Figures 14 and 15).

**Figure 16 : Q7. Please indicate the number of buildings you are responsible for so we can best understand your potential for replication of iSERVcmb in your organisation – SE Europe**

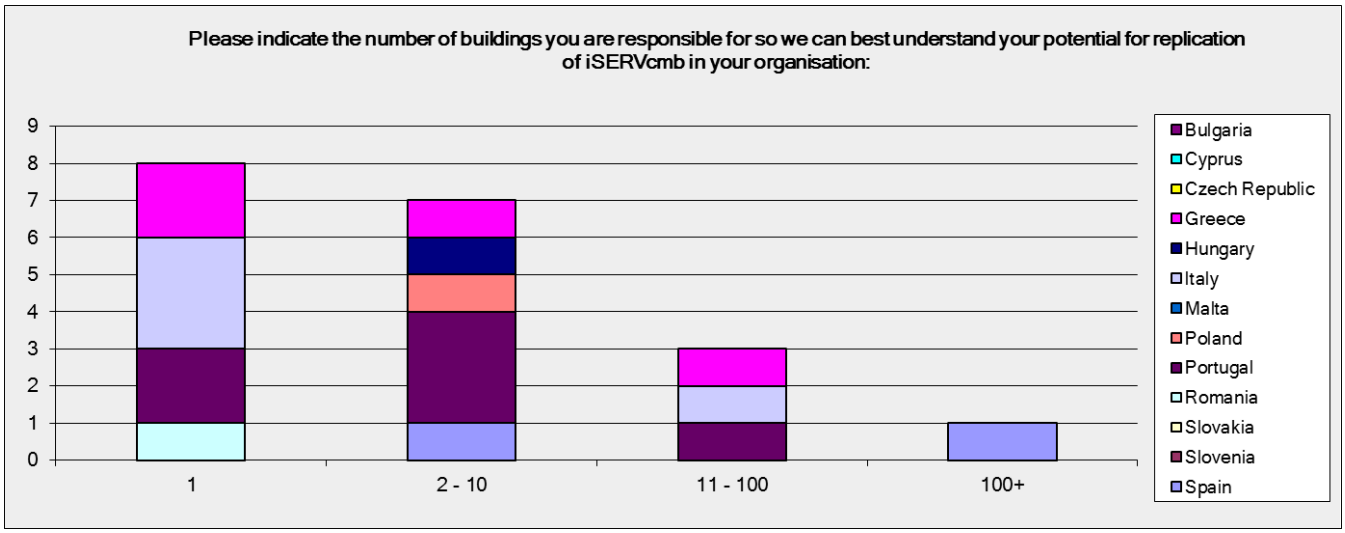
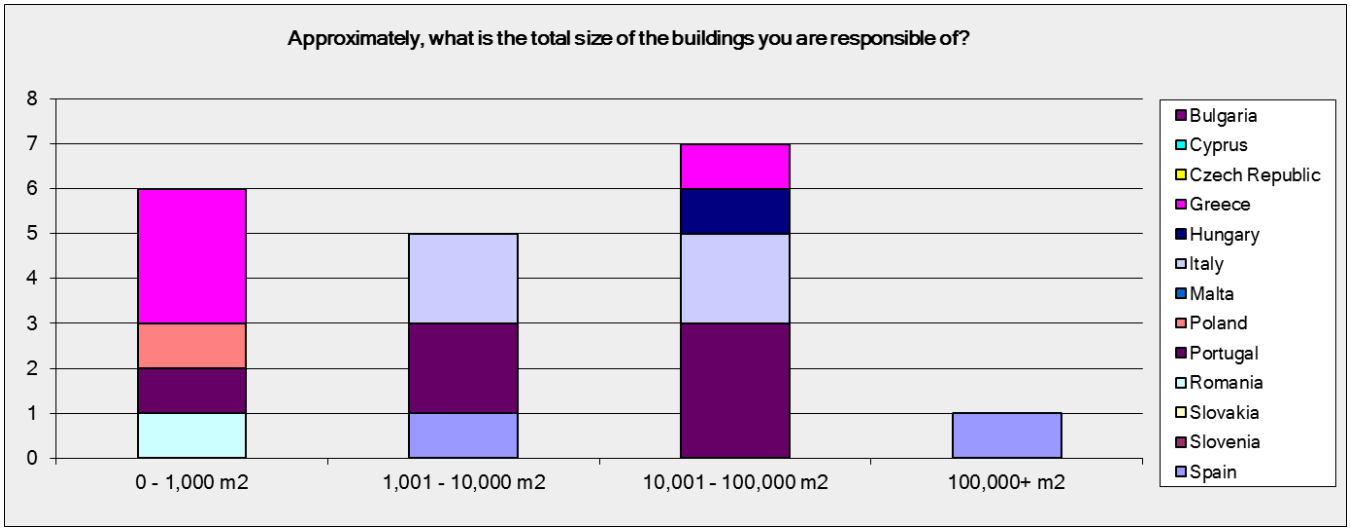



**Figure 17: Q8. Approximately, what is the total size of the buildings you are responsible of? – SE Europe**



**Summary of Findings:**

- ✓ **The majority of the respondents (64%) either operate one building (24%) or a small group of buildings not exceeding a total of 10,000m2 floor area (40%).**
- ✓ **It appears that building management professionals in SE Europe are in charge of a smaller number of buildings at a time, in comparison to NW Europe. This could be further supported by data regarding the size of building management companies prevailing in different parts of Europe.**

➢ Please refer to tables 14 and 15 in the appendix.

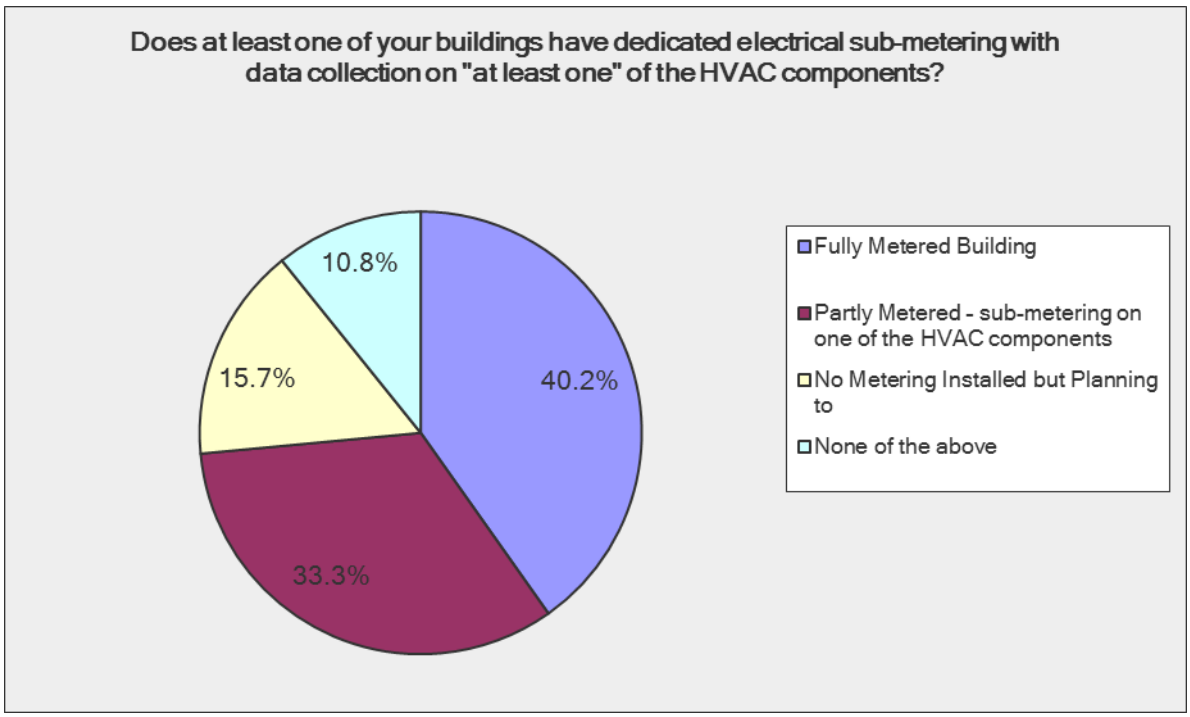
**Q9. Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components?**

"**Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components"** 'was used as the survey's second inclusion criterion.

Participants who stated they had "No Metering Installed but Planning to" or "None of the above" were not allowed to proceed to the questions following and were directed to the end of the survey. This ensured that questions regarding the specifics of metering, data collection & handling protocols most commonly used today across Europe, where end users that had at least some metering installed in their buildings.

Almost a third of the total respondents (27%) stated they either had no metering installed in at least one of the HVAC components, with more than half of those (15.7%) stating they were planning to (Appendix, Table 16)(Figure 18) . The same percentage was observed inside the population of the respondents based in NW Europe.

**Figure 18: Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components.**



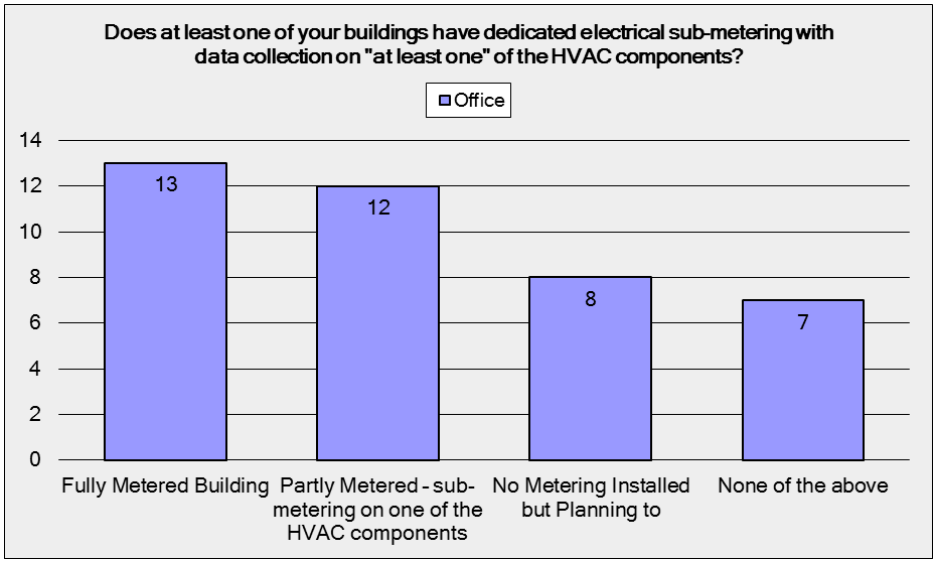
Overall, the majority of the respondents disqualified were based in NW Europe (78%) (Table 5). Out of all the respondents based in SE Europe, only 8% stated they did not have metering on at least one HVAC component.

**Table 5 : Respondents Disqualified based on Q9 - Geographic Distribution**

| | NW Europe (N) | (%) to all respondents (N=102) | (%) to all disqualified (N=27) | (%) to NW Europe (N=78) | (%) to SE Europe (N=78) |
|---|---|---|---|---|---|
| Disqualified Respondents based in NW Europe | 21 | 21% | 78% | 27% | |
| Disqualified Respondents based in SE Europe | 6 | 6% | 22% | | 8% |
| Total Disqualified Respondents | 27 | 27% | 100% | | |

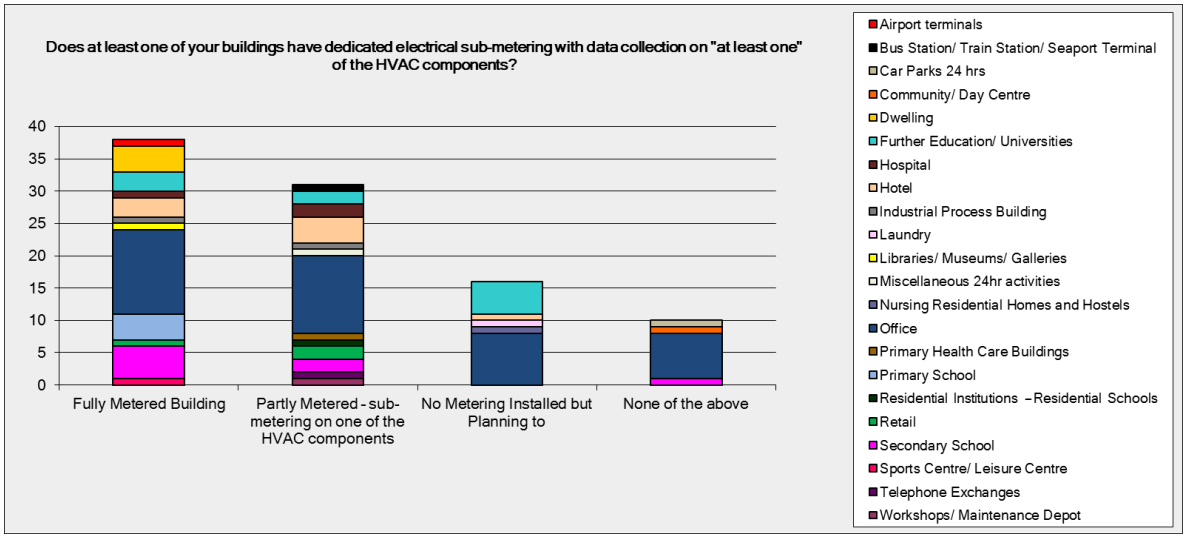
We can observe that offices have almost equal distribution between those who have full metering (33%) and part metering (30%); with 37% stating no metering is installed on at least one HVAC component (Figure 19).

**Figure 19: Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components – distribution in offices.**



Overlaying the reported sectors on the level of metering, it appears that there is an equal amount of respondents who are employed in Higher Education stating their building(s) had "no metering/ intending to install" in comparison to those who stated they had at least some metering. In contrast, the majority of respondents employed in hotels -predominantly based in SE Europe- and those employed in secondary school, reported they had at least some metering. All respondents employed in primary schools stated they had full metering (Figure 20). Since the survey sample is mostly populated by respondents employed in offices, educational facilities and hotels, we are not in a position to extrapolate conclusions regarding metering level by sector.

**Figure 20: Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components – distribution between sectors.**




***Sectors that scored no votes have been removed from this graph**

**Figure 21: Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components – Distribution in NW Europe**

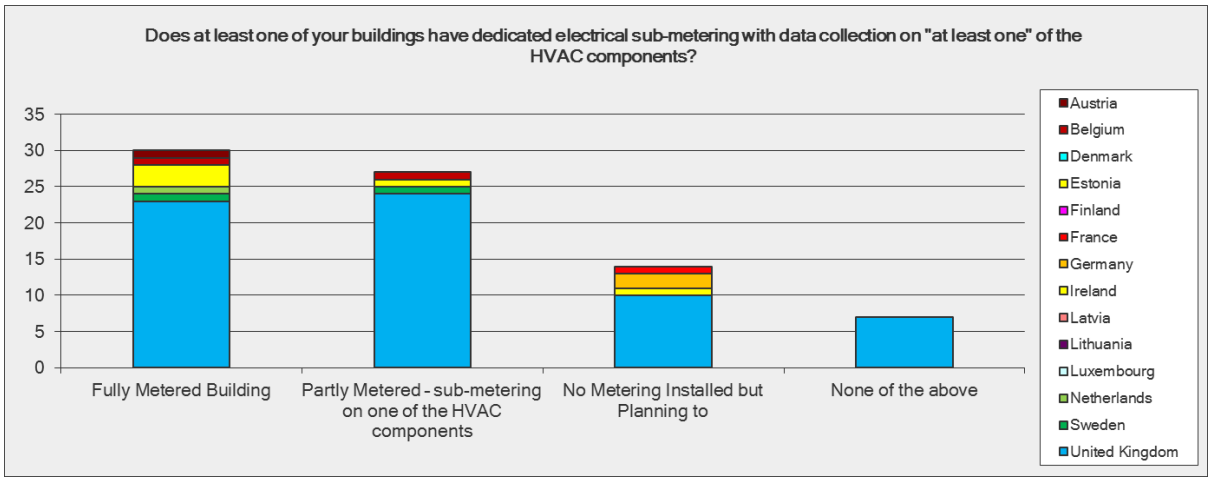
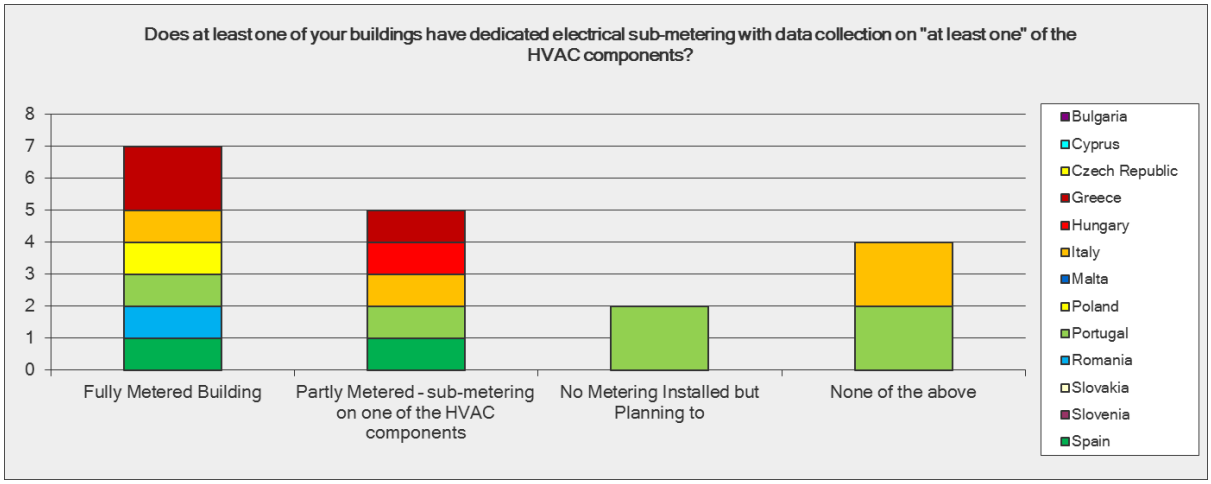



**Figure 22: Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components – Distribution in SE Europe**



**Summary of Findings:**

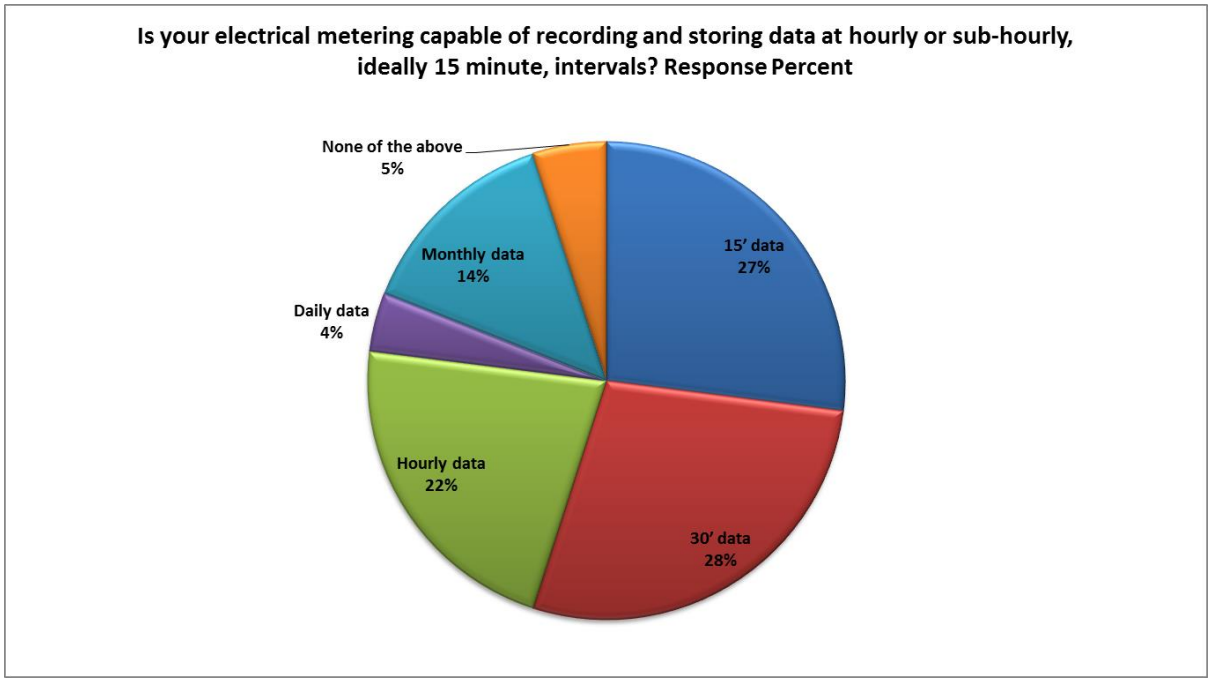
- ✓ **A strong majority of respondents had metering installed to at least one HVAC components (73.5%).**
- ✓ **The majority of the respondents who stated they had no metering in their building(s) were based in NW Europe (78%).**

➢ Please refer to table 16 in the appendix.

**Q10. Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals?**

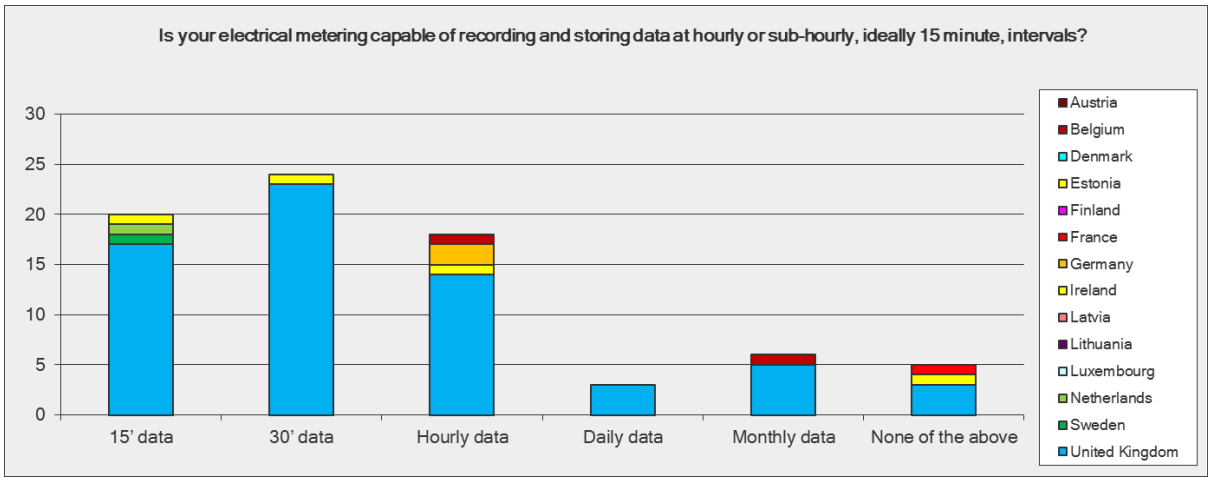
Almost two thirds (64.7%) of the total participants stated they record and store data at sub hourly intervals, equally distributed between 15' data (31.8%) and 30' data (32.9%). Approximately one quarter of the total participants stated they record and store hourly data. The remaining (27.1%) indicated that they either record and store data at larger interval or do not record data at any of the listed options (Appendix, Table 17) (Figure 23).

**Figure 23: Q10. Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals?**



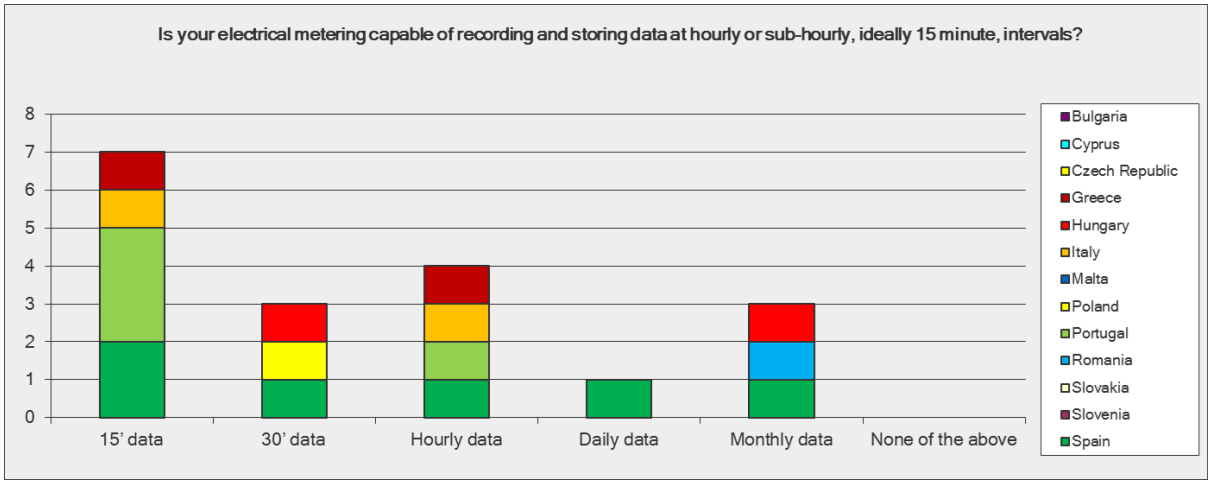

The same percentage was observed inside the population of the respondents based in NW Europe.

**Figure 24: Q10. Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals – Distribution in NW Europe**



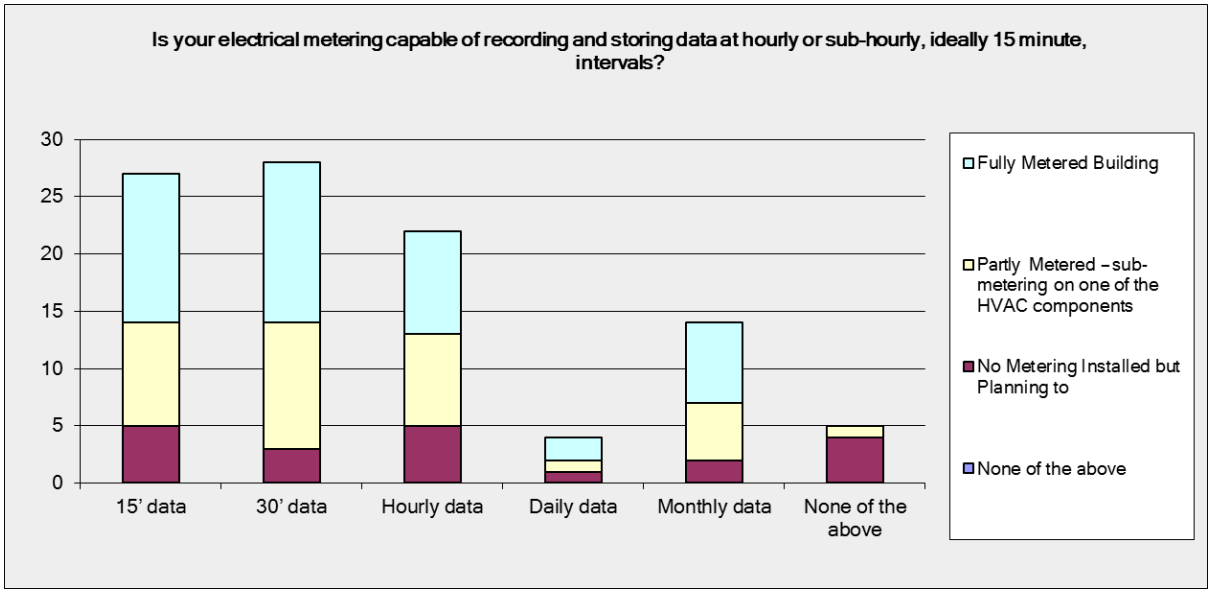

Overall the majority of the respondents disqualified were based in NW Europe (78%). Out of all the respondents based in SE Europe, only 8% stated they did not have metering on at least one HVAC component. Similar trends can be observed in the responses of the participants based both in NW and SE Europe. However, unlike responses from SE Europe that indicate 15' data (54%) are used in metered buildings with hourly (31%) and 30' (23%) data following respectively, responses from participants based in NW Europe indicate that 30' data (36%) are preferred over the listed options with 15' (30%) and hourly (27%) data following. Daily data appear to be unpopular between participants (Appendix, Table 17)(Figures 24 and 25).

**Figure 25: Q10. Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals – Distribution in NW Europe**



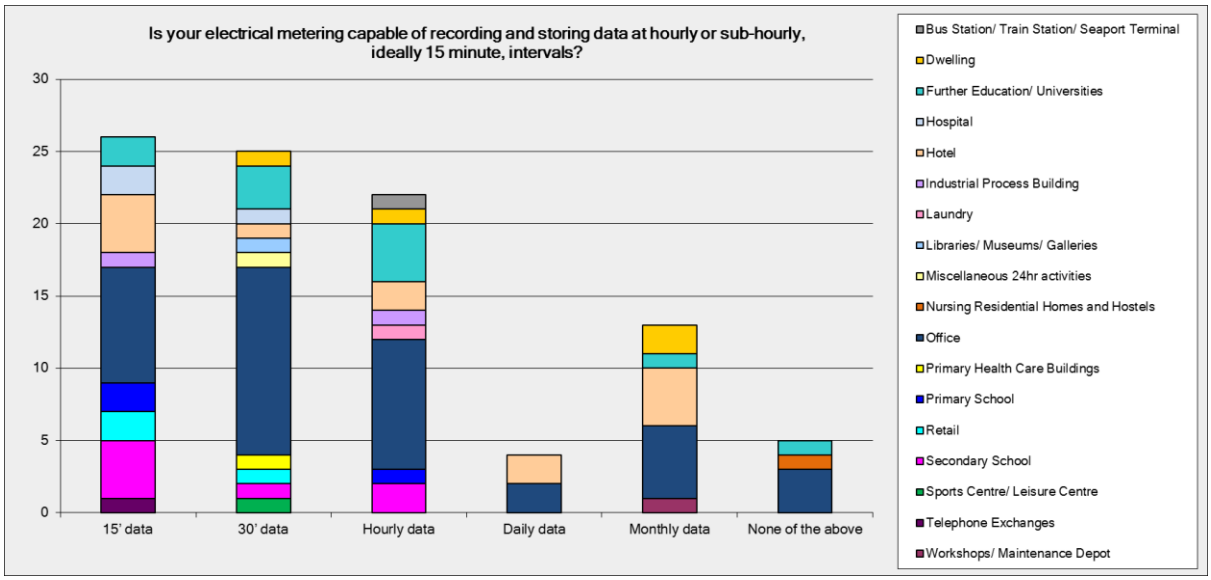
The majority of fully metered buildings appear to record and store data equally at 15' and 30' intervals, whereas partly metered buildings appear to be more likely to record and store data at 30' intervals with 15' and hourly data following (Figure 26).

**Figure 26: Q10. Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals – Distribution by metering level**




Most participants employed in offices and education facilities stated they are recording sub hourly data, with hourly data being the second most popular option, while hotels and dwellings appear to record and store data in intervals larger than 30' (Figure 27).

**Figure 27: Q10. Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals – Distribution by sector**




***Sectors that scored no votes have been removed from this graph**

**Summary of Findings:**

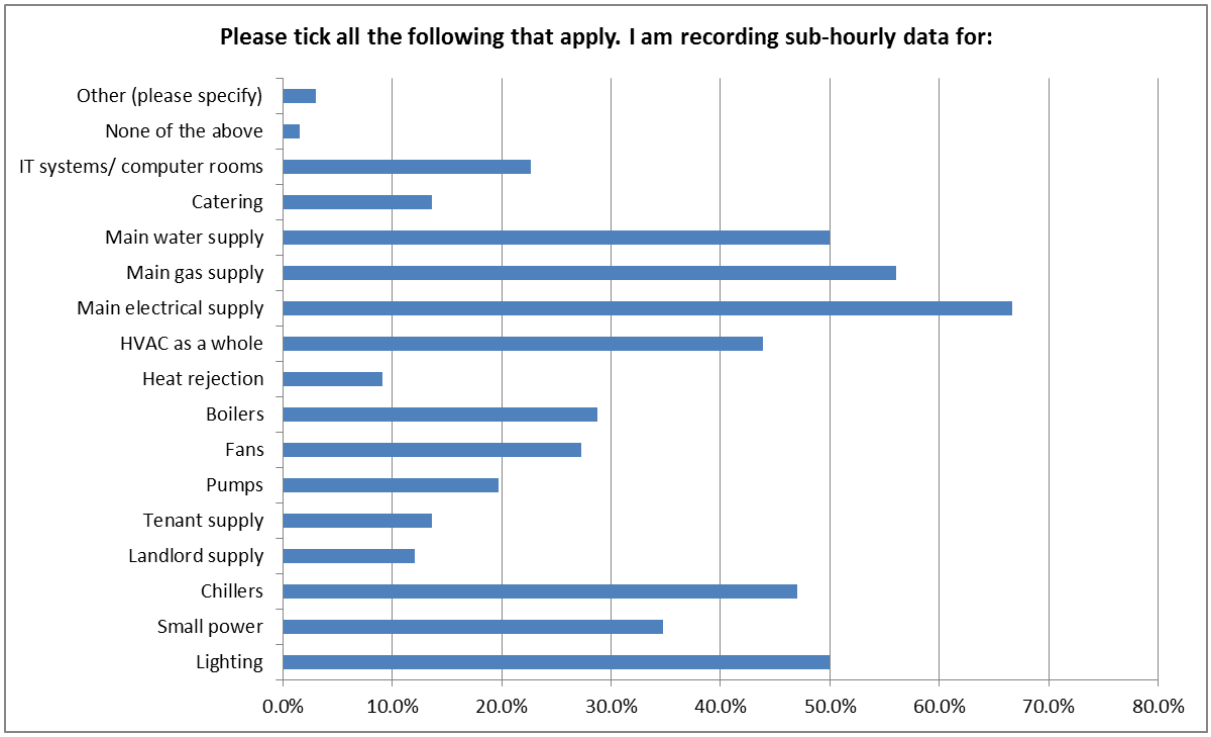
- ✓ **Almost two thirds (64.7%) of the total participants stated they record and store data at sub hourly intervals, equally distributed between 15' data (31.8%) and 30' data (32.9%).**
- ✓ **Approximately one quarter of the total participants stated they record and store hourly data.**
- ✓ **Less than one third (27.1%) indicated that they either record and store data at larger interval or do not record data at any of the listed options.**
- ✓ **The majority of fully metered buildings appear to record and store data equally at 15' or 30' intervals.**
- ✓ **Partly metered buildings appear to be more likely to record and store data at 30' intervals with 15' and hourly data following.**
- ✓ **In practice, hourly data appear to be almost as popular as 15' interval or 30' interval data.**

➢ Please refer to table 17 in the appendix.

**Q11. Please tick all the following that apply. I am recording sub-hourly data for.**

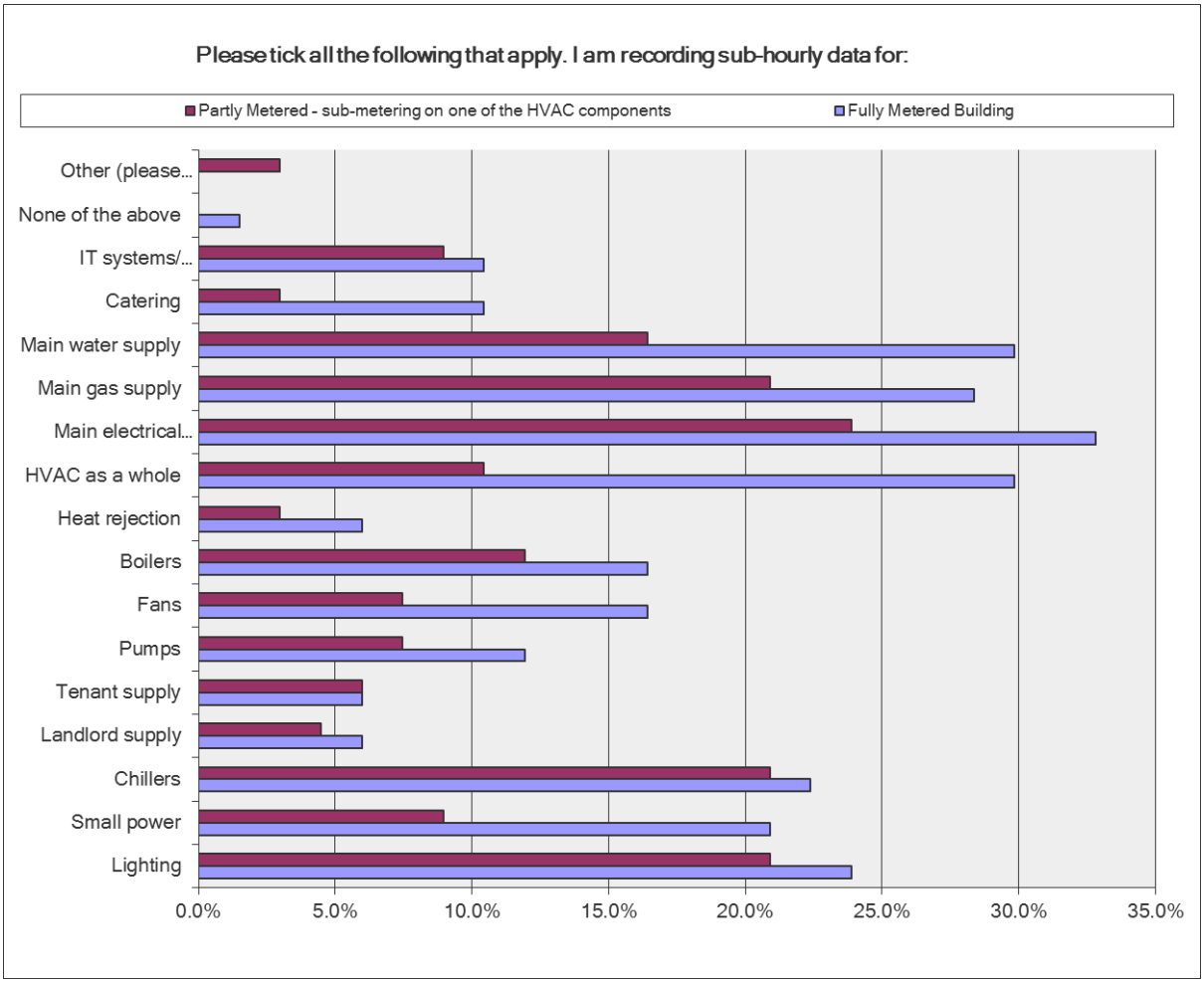
As presented in Table 18 and Figure 28, more than half of the survey participants (66.7%) stated they are recording sub-hourly data for the main electrical or gas supply. Lighting or main water supply are recorded at sub hourly intervals by half of the total participants (50%), whereas approximately the same amount of participants record sub hourly data for Chillers (47%) or the HVAC system as a whole (43.9%). More than a third, record sub hourly data for small power (34.8%), and a little over than a quarter record sub hourly data for fans (27.3%) or boilers (28.8%). Approximately a fifth of the total participants stated they record sub hourly data for either pumps (19.7%) or IT systems (22.7%).

**Figure 28: Q11. Please tick all the following that apply. I am recording sub-hourly data for.**




One of the major differences between fully metered and partly metered buildings, is that additionally to recording sub hourly data for the main incomers, sub hourly metering for the HVAC system as a whole is preferred at equal level to main water and main gas supply metering (Figure 29). Fully metered buildings also appear more likely to be equipped with sub hourly metering on catering, heat rejection, fans and small power.

**Figure 29: Q11. Please tick all the following that apply. I am recording sub-hourly data for – Distribution by metering level**




Compared to NW Europe, it appears that in SE Europe sub hourly metering on chillers is more likely to take place (Figures 30 and 31).

**Figure 30: Q11. Please tick all the following that apply. I am recording sub-hourly data for – Distribution in NW Europe**

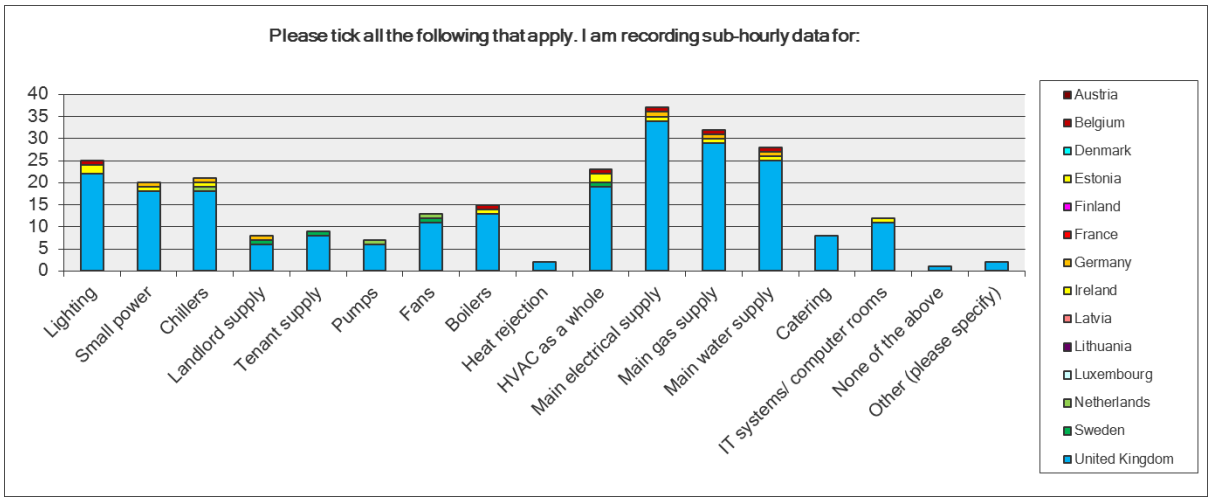
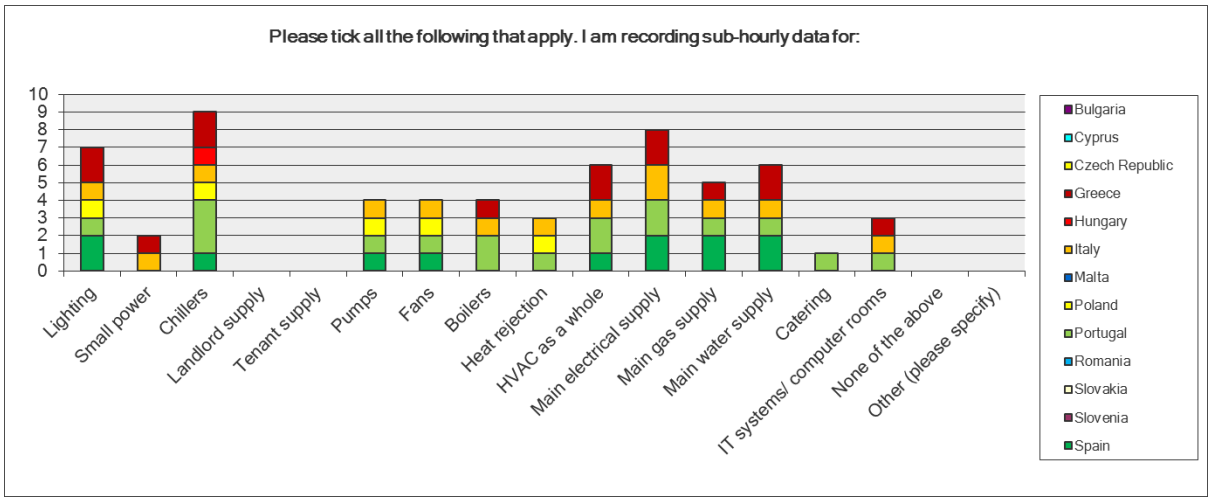


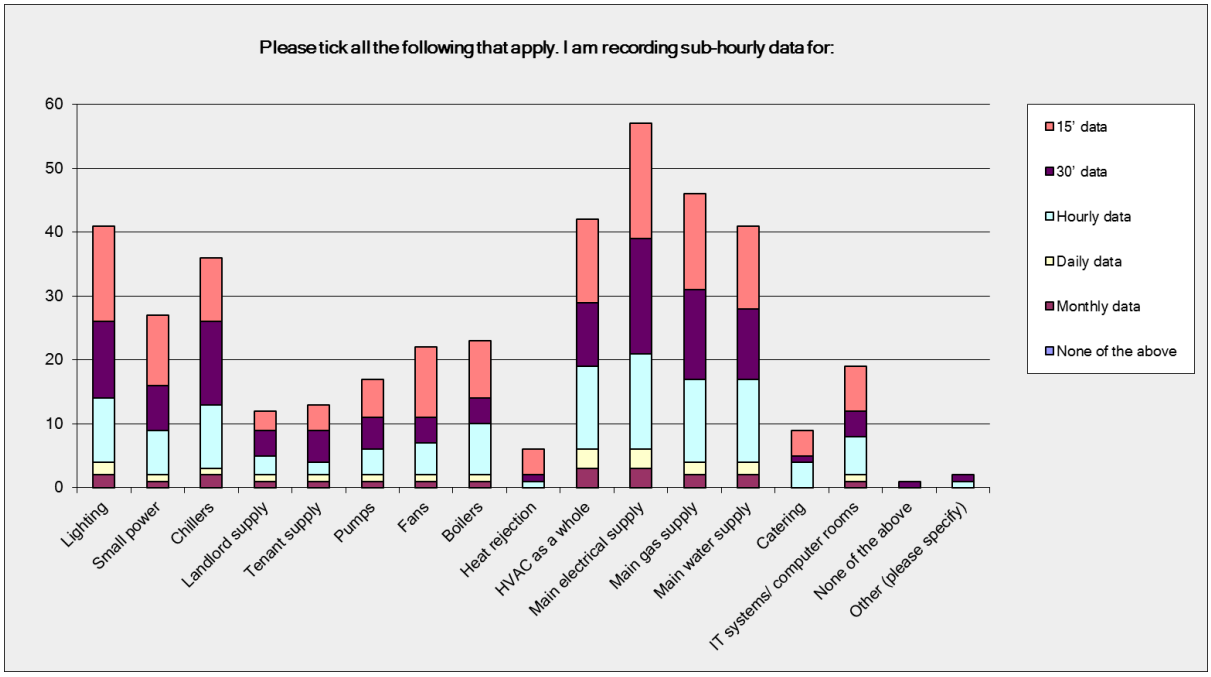

**Figure 31: Q11. Please tick all the following that apply. I am recording sub-hourly data for – Distribution in SE Europe**




Apart from sub hourly metering on the main incomers, the majority of participants recording at 15' intervals, acquire sub hourly data for lighting, small power, the HVAC as a whole and fans, whereas participants recording at 30' intervals appear to follow the same trends with chillers preferred over small power systems (Figure 32). Similarly, those recording at hourly intervals are moving along the same lines as participants recording at 15' intervals, with the exception that boilers score higher than small power metering. Those recording daily data appear to mostly acquire them from the main incomers, the HVAC as a

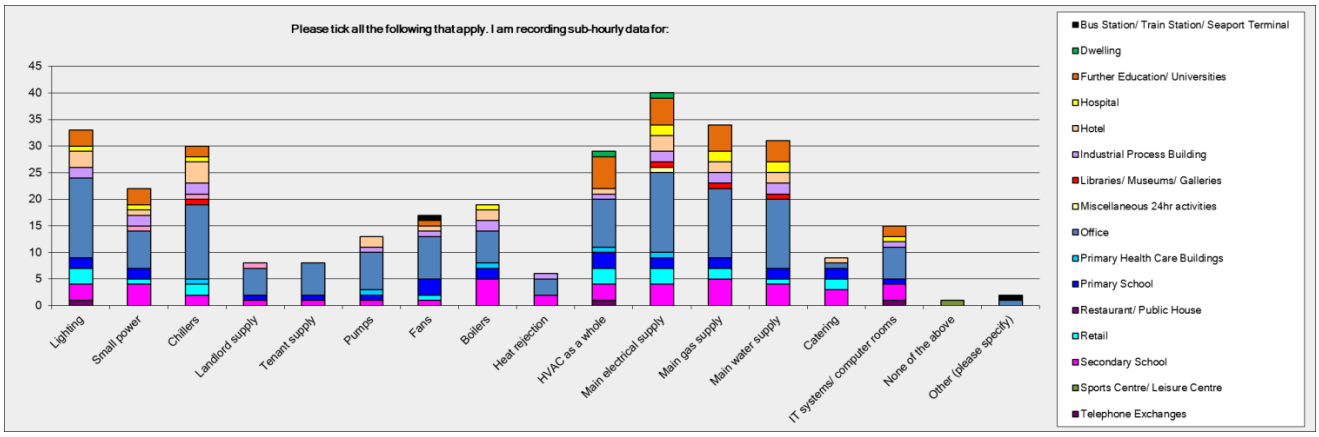
whole and lighting. Similarly, participants recording monthly data appear to usually meter the same categories as those recording daily data in addition to chillers.

**Figure 32: Q11. Please tick all the following that apply. I am recording sub-hourly data for – Distribution by metering data frequency**




IT systems and pumps are mostly recorded by participants in educational facilities and offices, while metering catering is popular amongst participants in retail and education (figure 33). Landlord and tenant supply appear to be more often recorded by participants employed by in office buildings. Participants employed in hotels tend to prefer to record the main incomers, lighting, chillers, boilers pumps and catering. From the participants' responses, it would appear that in offices and educational facilities there is a greater variety with respect to what is metered.

**Figure 33: Q11. Please tick all the following that apply. I am recording sub-hourly data for – Distribution by sector**




***Sectors that scored no votes have been removed from this graph**

****Results averaged to total participants for this question**

**Summary of Findings:**

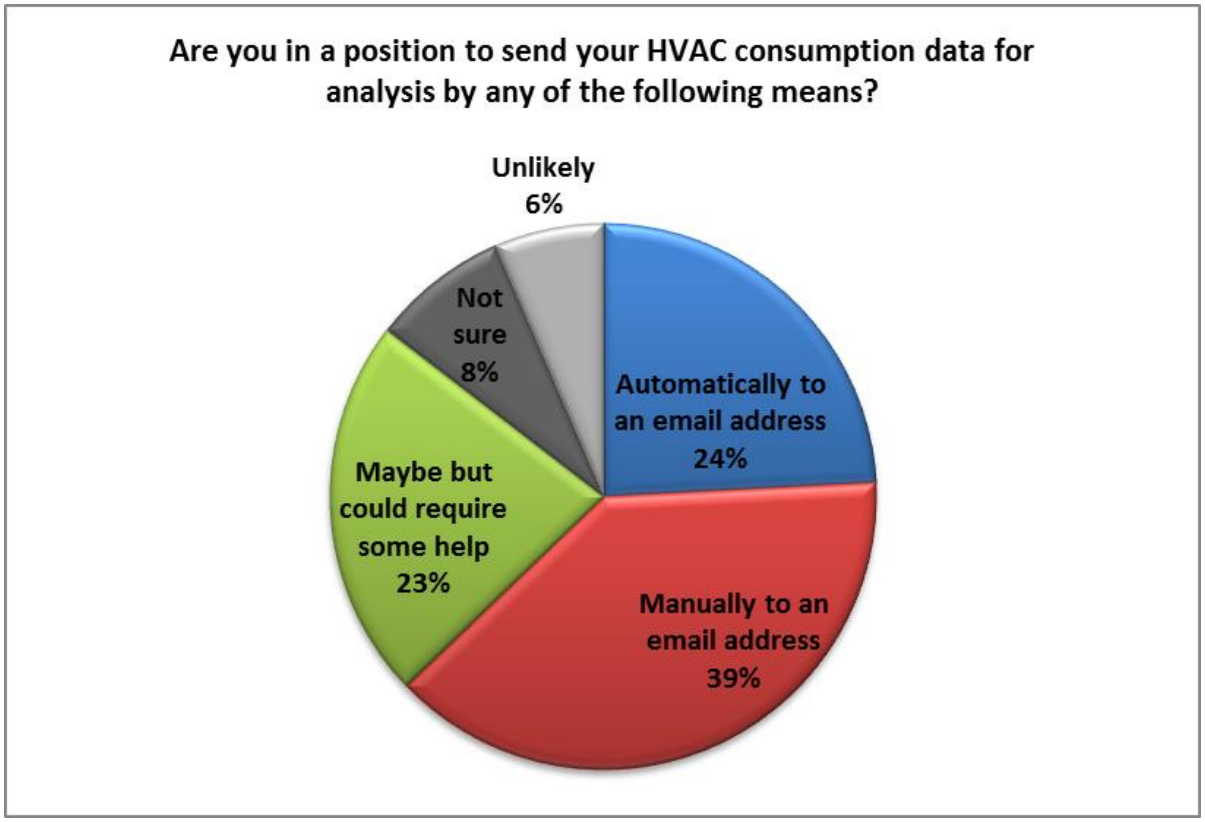
- ✓ **Over half of the survey participants are recording sub-hourly data for the main electrical or gas supply.**
- ✓ **Approximately half of the total participants record either lighting, main water supply, Chillers or HVAC system as a whole at sub hourly intervals.**
- ✓ **More than a third of survey participants, record sub hourly data for small power.**
- ✓ **A little over than a quarter record sub hourly data for fans or boilers.**
- ✓ **Approximately a fifth of the total participants stated they record sub hourly data for either pumps or IT systems.**
- ✓ **Additionally to recording sub hourly data for the main incomers, sub hourly metering for the HVAC system as a whole, which prevails in fully metered buildings, in part metered buildings is preferred at equal level to main water and main gas supply metering.**
- ✓ **Fully metered buildings also appear more likely to be equipped with sub hourly metering on catering, heat rejection, fans and small power.**
- ✓ **Compared to NW Europe, it appears that in SE Europe sub hourly metering on chillers is more likely to take place.**
- ✓ **IT systems and pumps are mostly recorded by participants in educational facilities and offices, while metering catering is popular amongst participants in retail and education.**
- ✓ **Landlord and tenant supply appear to be more often recorded by participants employed by in office buildings.**
- ✓ **Participants employed in hotels tend to prefer to record the main incomers, lighting, chillers, boilers pumps and catering.**
- ✓ **From the participants' responses, it would appear that in offices and educational facilities there is a greater variety with respect to what is metered.**

➢ Please refer to tables 18 and 19 in the appendix.

**Q12 Are you in a position to send your HVAC consumption data for analysis by any of the following means.**

Overall, a strong majority (62.9%) stated they were in a position to send their data for analysis (Appendix, Table 20). More than a third of the participants (38.7%) stated they would be in position to manually send data to an email address whereas over a quarter of the participants though stated they could either send their automatically (24.2%) or that they were not sure and would require help to do so (22.6%) (Figure 34).

**Figure 34: Q12 Are you in a position to send your HVAC consumption data for analysis by any of the following means.**




Participants based in SE Europe appear to prefer automatic sending over other listed options but the sample is too small to extrapolate conclusions (Figures 35 and 36).

**Figure 35: Q12 Are you in a position to send your HVAC consumption data for analysis by any of the following means – Distribution in NW Europe**

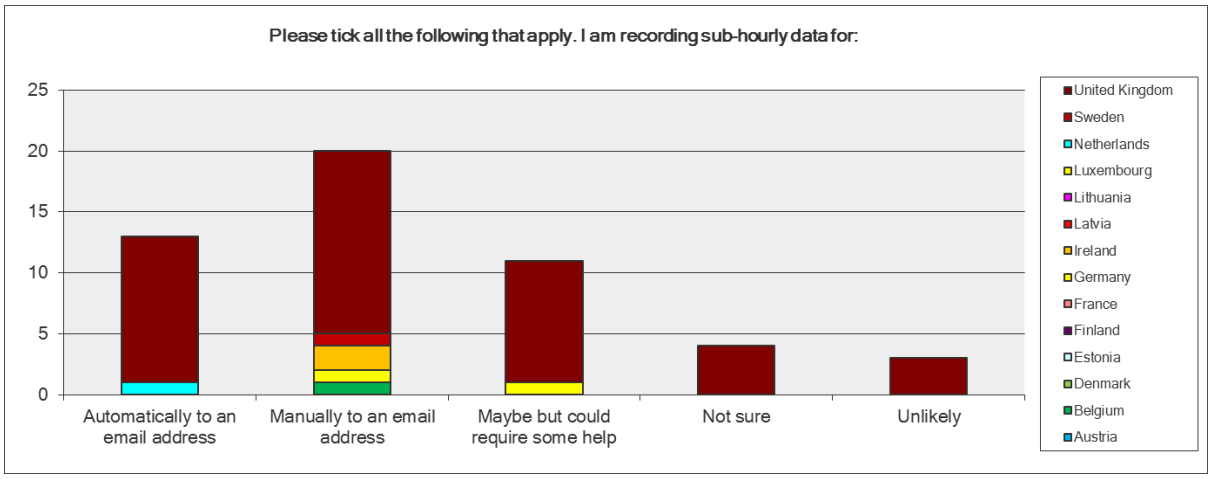
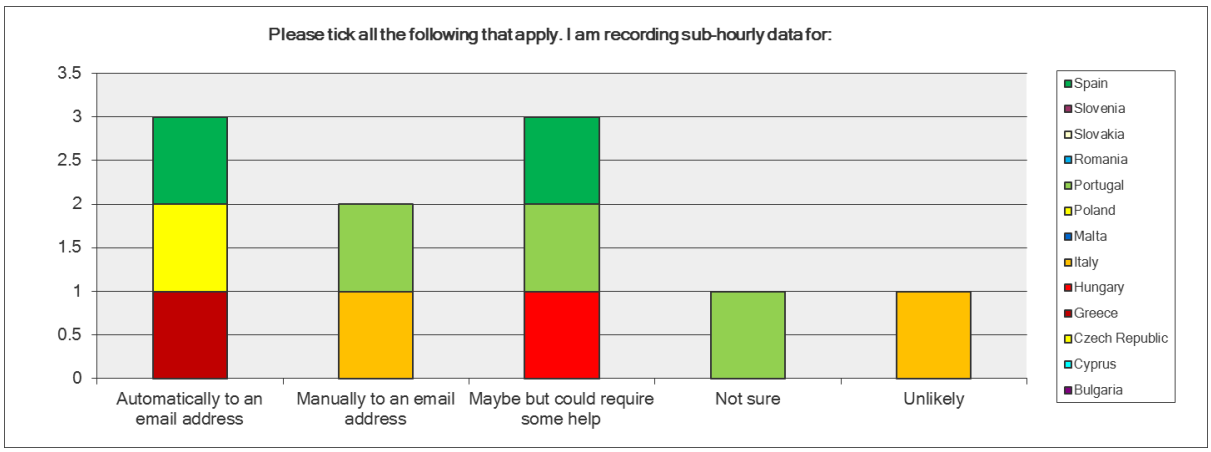
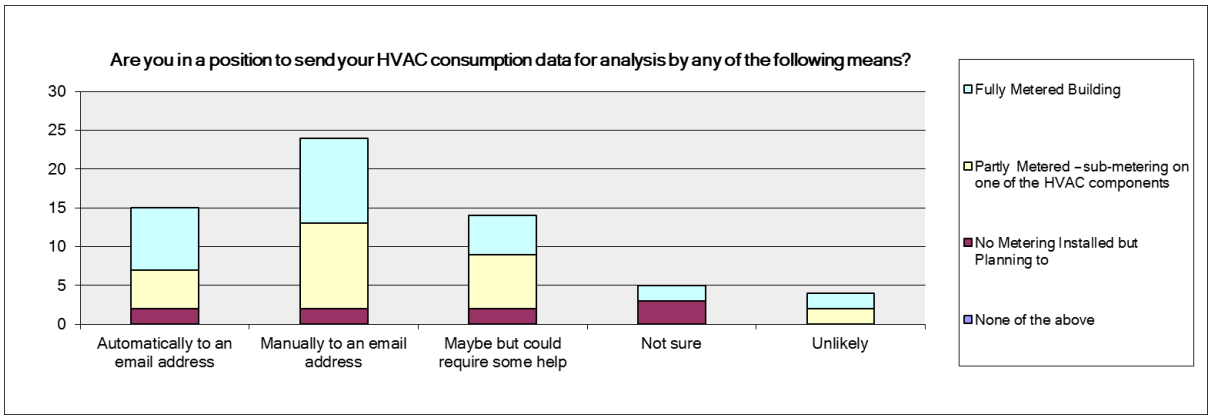



**Figure 36: Q12 Are you in a position to send your HVAC consumption data for analysis by any of the following means – Distribution in SE Europe**



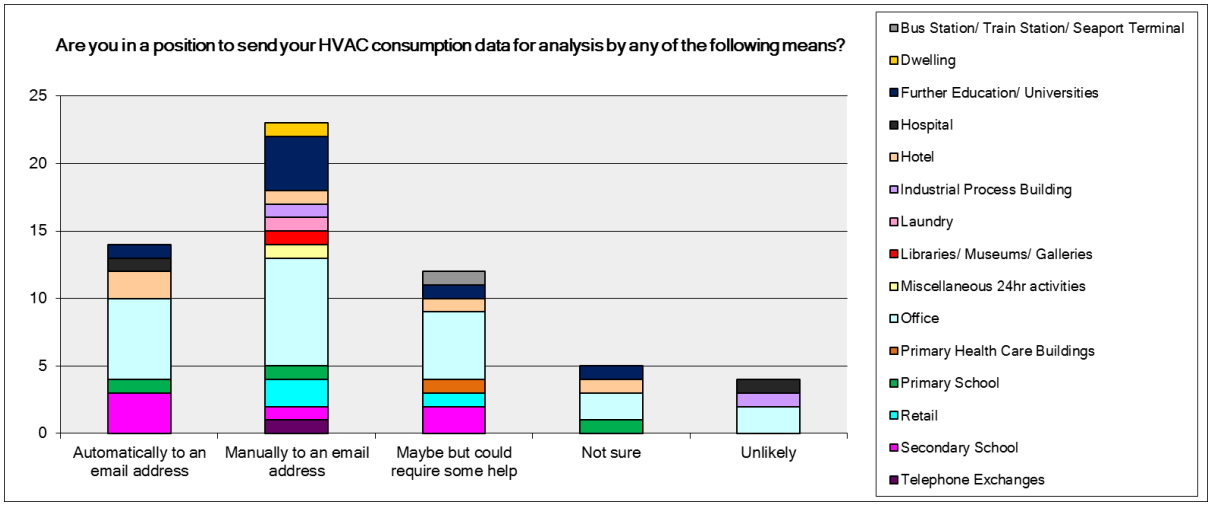

Fully metered buildings appear to be far more likely to send their data automatically (Figure 37).

**Figure 37: Q12 Are you in a position to send your HVAC consumption data for analysis by any of the following means – Distribution by metering level**




Participants employed in hotels, offices and secondary schools appeared to be more likely to send their data automatically (Figure 38).

**Figure 38: Q12 Are you in a position to send your HVAC consumption data for analysis by any of the following means – Distribution by sector**




***Sectors that scored no votes have been removed from this graph**

**Summary of Findings:**

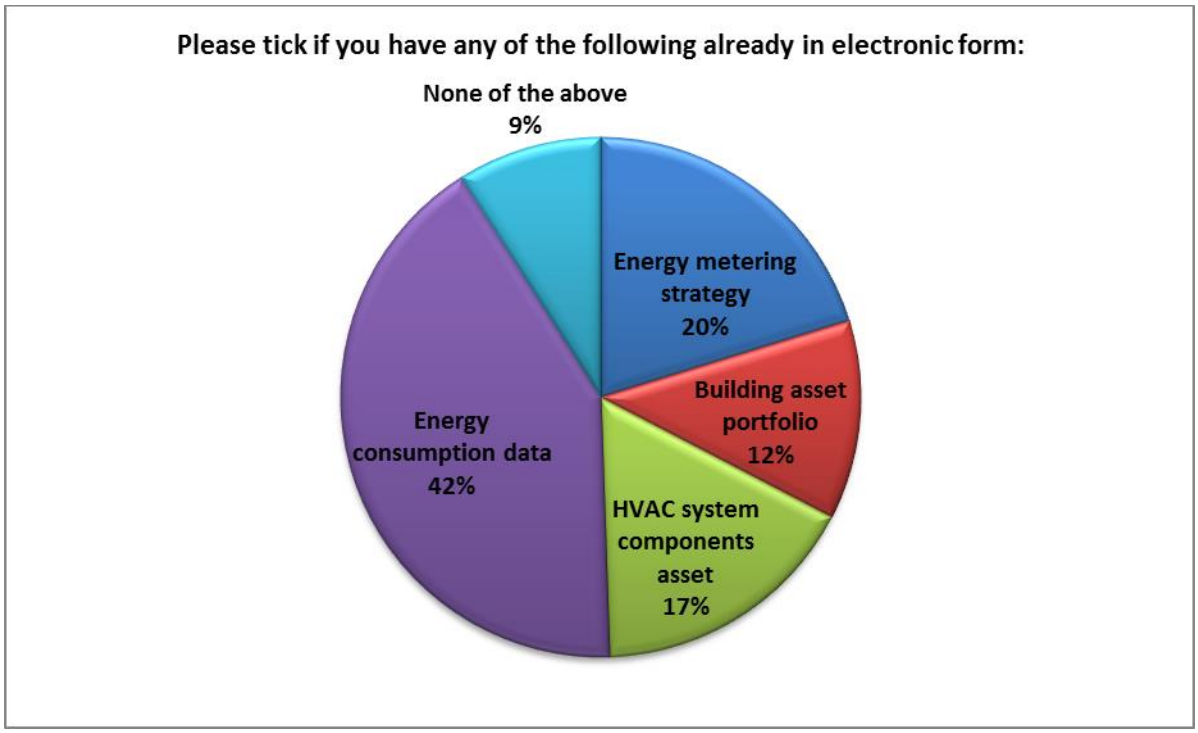
- ✓ **A strong majority of participants were in a position to send their data for analysis.**
- ✓ **More than a third of the participants were in position to manually send data to an email address.**
- ✓ **Over a quarter of the participants though stated they could either send their automatically or that they were not sure and would require help to do so.**
- ✓ **Fully metered buildings appear to be far more likely to send their data automatically.**
- ✓ **Participants employed in hotels, offices and secondary schools appeared to be more likely to send their data automatically.**

➢ Please refer to table 20 in the appendix.

### Q14. Please tick if you have any of the following already in electronic form

Over two thirds of the participants stated they have digital energy consumption data (69.8%) (Appendix, Table 21), whereas more than one third indicated they had an energy metering strategy in electronic form (34%) (Figure 39). According to the participants, building asset portfolios (20.8%) and HVAC components assets (28.3%) appear to be less likely to be in electronic form, with 15.1% stating they had none of the listed items in digital form.

**Figure 39: Q14. Please tick if you have any of the following already in electronic form**




The same trends appear to prevail amongst participants based in NW Europe (Figures 40 and 41). The sample for SE Europe is considered too small to extrapolate results.

**Figure 40: Q14. Please tick if you have any of the following already in electronic form – Distribution in NW Europe**

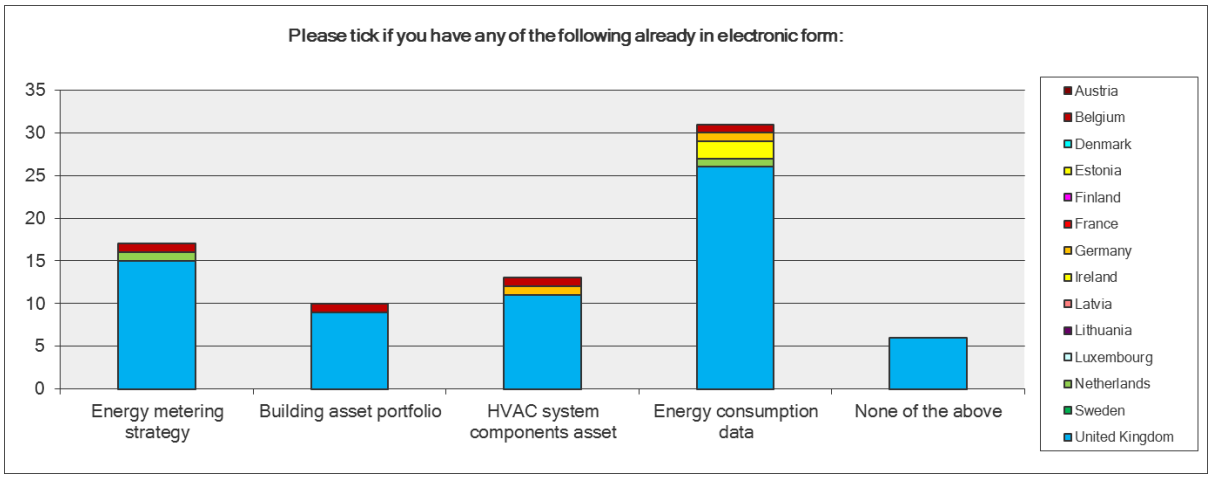
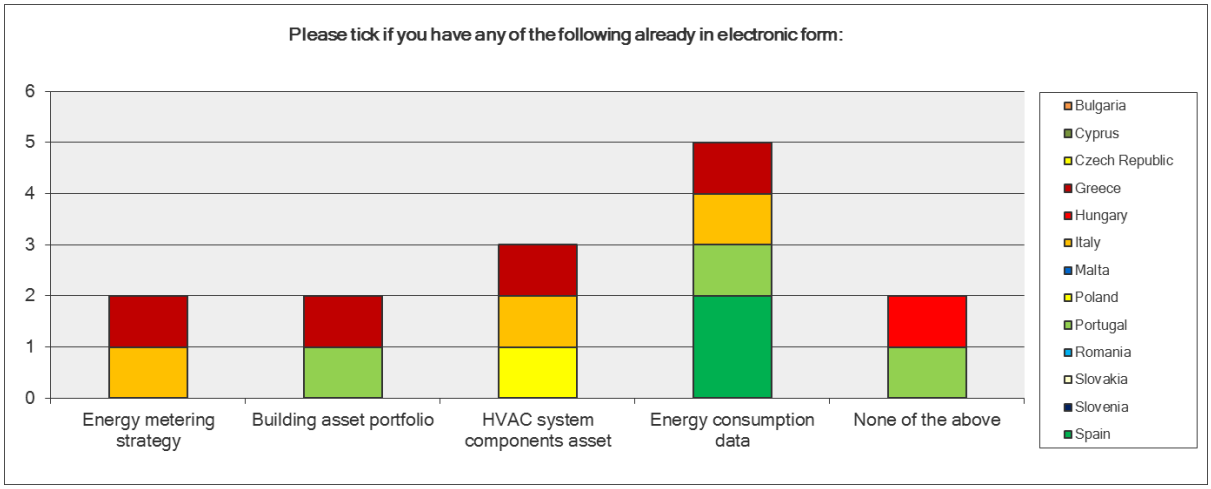
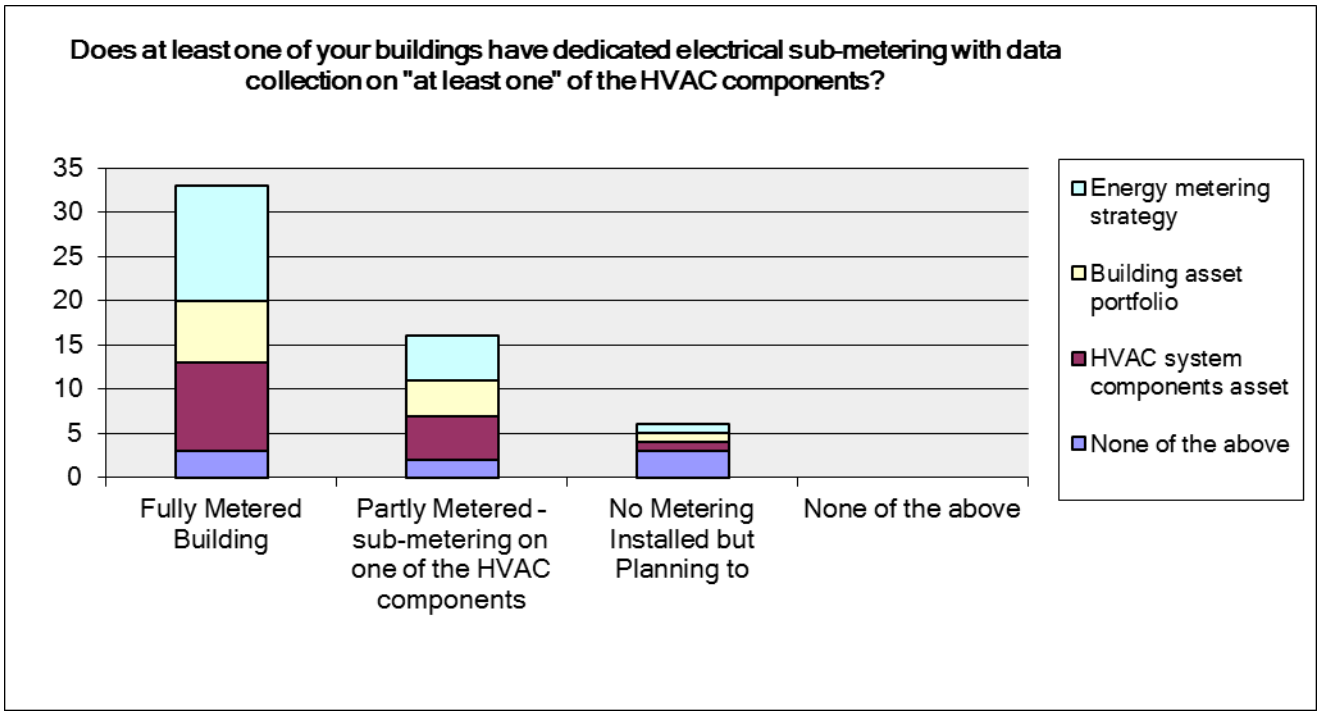



**Figure 41: Q14. Please tick if you have any of the following already in electronic form – Distribution in SE Europe**



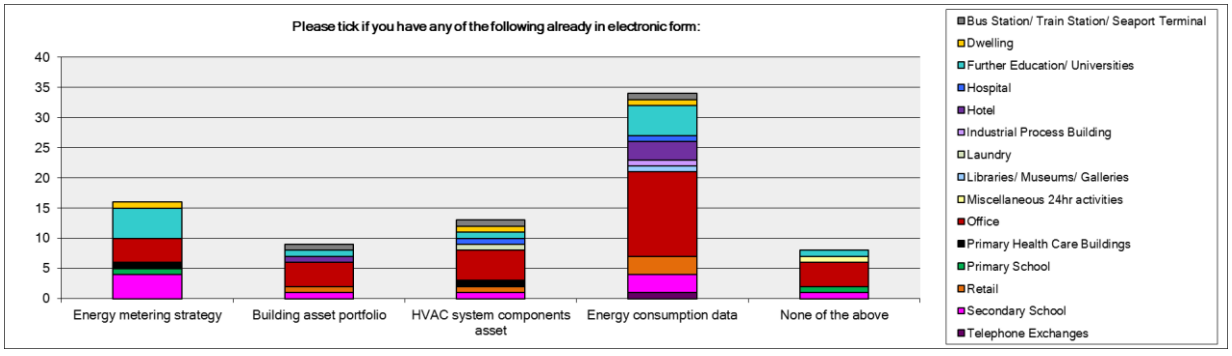

It appears that participants with no metering installed are more likely to have none of the listed items in electronic form compered those who are equipped at least with some metering (Figure 42).

**Figure 42: Q14. Please tick if you have any of the following already in electronic form – Distribution by metering level.**




Overlaying the sectors stated in Q5 over the responses given in Q14 (Figure 42), we can observe that digital energy metering strategies are popular amongst educational facilities. Moreover, it appears that there is approximately an equal amount of offices that either have digital building assets portfolios, digital HVAC system components assets list or none of the listed items.

**Figure 43: Q14. Please tick if you have any of the following already in electronic form – Distribution by sector**




***Sectors that scored no votes have been removed from this graph**

**Summary of Findings:**

- ✓ **Over two thirds of the participants have digital energy consumption data.**
- ✓ **More than one third indicated they had an energy metering strategy in electronic form.**
- ✓ **It appears that participants with no metering installed are more likely to have none of the listed items in electronic form compered those who are equipped at least with some metering.**
- ✓ **Digital energy metering strategies are popular amongst educational facilities.**
- ✓ **Equal amount of offices either have digital building assets portfolios, digital HVAC system components assets list or none of the listed items.**

➢ Please refer to table 21 in the appendix.

## Conclusions and Recommendations

This report takes place in the context of iSERVcmb, a European project designed to look at end use of HVAC systems across Europe. The iSERV project provides an approach to achieving this in practice and allowing to be used across all building types in the EU Member States. The iSERV approach introduces an electronic method of using existing metering and sensors, along with information on buildings assets and activities, such that benchmarks, powerful in diagnostic work, can be derived from that data - and produced for individual building configurations and activities supported.

To ascertain to what extent metering is available and what are the specifics of the data collection & handling protocols most commonly used today across Europe, a survey was designed and distributed to 13,000 CIBSE EPG group members.
The design of the survey aimed primarily at identifying potential end users for the iSERVcmb project. The minimum requirements for participating in iSERV are:

- Ability to provide the power consumption data of your current HVAC system components
- Have dedicated electrical metering on at least one HVAC component, capable of recording data at sub-hourly, ideally 15 minute, intervals.
- Ability to send the HVAC consumption data to iSERV monthly, over a minimum period of one full year.

According to the survey results, we can summarize the following:

- ✓ Sub metering is more prevalent in office buildings, educational facilities and hotels.
- ✓ Fully metered buildings are more likely to record and store sub hourly data equally at 15’ or 30’ intervals, while partly metered buildings (sub metering on at least one HVAC component) are more likely to use 30’ interval data.
- ✓ Metered buildings appear to usually record sub-hourly data for the main electrical or gas supply, with main water supply metered from a smaller percentage of the population.
- ✓ In ranking order, sub metering recording sub-hourly data is statistically more likely to be installed on either lighting, chillers, HVAC system as a whole, or small power. A smaller amount of buildings appear to record sub hourly data for fans, boilers, pumps or IT systems. IT systems and pumps are mostly recorded in educational facilities and offices, while metering catering is popular amongst participants in retail and education.
- ✓ It appears that in offices and educational facilities there is a greater variety with respect to what is metered.
- ✓ No obstacles were observed in metered buildings being in a position to directly send their data for analysis. Sending data manually to an email address is preferred over an automatic option.
- ✓ It appears that the majority of metered buildings have digital energy consumption data.

- ✓ Professionals based in NW Europe who are in charge of operating, managing and maintaining HVAC systems in their buildings, appear to have a wider variety of responsibilities compared to professionals based in SE Europe that touch upon duties regarding the enforcement of sustainability to building management and legislation compliance matters. Moreover, they tend to be managing larger floor areas compared to SE Europe.

To conclude there is great potential of an iSERV type approach being implemented across Europe. It appears that there is a significant population of buildings equipped with sub metering recording at sub hourly intervals, one which adheres to the prerequisites iSERV sets. Currently, such an approach is more likely to be easier to implement in offices, educational facilities and hotels, as there is strong evidence these sectors already have sub metering recording at sub hourly intervals, in a variety of areas and components inside their buildings, and are in position to manually send digital energy consumption data for analysis, if asked.

## Appendix of Tables

**Table 6 : Q1 - Please select your country of residence.**

| Country | (N) | (%) to all respondents (N=162) | (%) to NW Europe (N=101) | (%) to SE Europe (N=35) |
|---|---|---|---|---|
| Austria | 2 | 1.2 % | 2.0% | |
| Belgium | 2 | 1.2 % | 2.0% | |
| Bulgaria | 0 | 0.0 % | | 0.0% |
| Cyprus | 2 | 1.2 % | | 5.7% |
| Czech Republic | 2 | 1.2 % | | 5.7% |
| Denmark | 1 | 0.6 % | 1.0% | |
| Estonia | 0 | 0.0 % | 0.0% | |
| Finland | 0 | 0.0 % | 0.0% | |
| France | 4 | 2.5 % | 4.0% | |
| Germany | 4 | 2.5 % | 4.0% | |
| Greece | 6 | 3.7 % | | 17.1% |
| Hungary | 1 | 0.6 % | | 2.9% |
| Ireland | 6 | 3.7 % | 5.9% | |
| Italy | 9 | 5.6 % | | 25.7% |
| Latvia | 0 | 0.0 % | 0.0% | |
| Lithuania | 0 | 0.0 % | 0.0% | |
| Luxembourg | 0 | 0.0 % | 0.0% | |
| Malta | 0 | 0.0 % | | 0.0% |
| Netherlands | 1 | 0.6 % | 1.0% | |
| Poland | 1 | 0.6 % | | 2.9% |
| Portugal | 8 | 4.9 % | | 22.9% |
| Romania | 1 | 0.6 % | | 2.9% |
| Slovakia | 0 | 0.0 % | | 0.0% |
| Slovenia | 0 | 0.0 % | | 0.0% |
| Spain | 5 | 3.1 % | | 14.3% |
| Sweden | 3 | 1.9 % | 3.0% | |
| United Kingdom | 78 | 48.1 % | 77.2% | |
| Other | 26 | 16.0 % | | |
| TOTAL | 162 | 100% | 100% | 100% |
| No. skips | 0 | | | |

**Table 7 : Q1 - List of non EU participants.**

| Country | (N) | (%) to respondents from other Countries (N=26) | (%) to all respondents (N=162) |
|---|---|---|---|
| Australia | 3 | 11.5% | 1.9% |
| Bosnia | 1 | 3.8% | 0.6% |
| Canada | 2 | 7.7% | 1.2% |
| Chile | 1 | 3.8% | 0.6% |
| China | 2 | 7.7% | 1.2% |
| Costa Rica | 1 | 3.8% | 0.6% |
| Croatia | 1 | 3.8% | 0.6% |
| FYROM | 1 | 3.8% | 0.6% |
| Hong Kong | 1 | 3.8% | 0.6% |
| Israel | 1 | 3.8% | 0.6% |
| Japan | 1 | 3.8% | 0.6% |
| Kenya | 1 | 3.8% | 0.6% |
| Malaysia | 1 | 3.8% | 0.6% |
| Mauritius | 1 | 3.8% | 0.6% |
| Moldova | 1 | 3.8% | 0.6% |
| Nigeria | 1 | 3.8% | 0.6% |
| Qatar | 1 | 3.8% | 0.6% |
| Singapore | 1 | 3.8% | 0.6% |
| Saudi Arabia | 2 | 7.7% | 1.2% |
| Turkey | 1 | 3.8% | 0.6% |
| United States | 1 | 3.8% | 0.6% |
| TOTAL | 26 | 100% | 16.0% |

**Table 8 : Q2 - Are you responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in your buildings?**

| Answer | Total (N) | (%) to all respondents (N=154) | NW Europe (N) | (%) to all respondents (N=154) | SE Europe (N) | (%) to all respondents (N=154) |
|---|---|---|---|---|---|---|
| Yes | 117 | 76 % | 85 | 55% | 23 | 15 % |
| No | 37 | 24 % | 13 | 8 % | 11 | 7 % |

| | | | | | | |
|---|---|---|---|---|---|---|
| TOTAL | 154 | 100% | 98 | 64% | 34 | 22% |
| No. skips | 8 | | 3 | | 2 | |

**Table 9 : Q3 - Do you know the personnel responsible for operating, managing or maintaining the Heating, Ventilation and Air conditioning (HVAC) systems in your building?**

| Answer | (N) | (%) to all respondents (N=154) |
|---|---|---|
| Yes | 34 | 75.6 % |
| No | 11 | 24.4 % |
| TOTAL | 45 | 100% |

**Table 10 : Q5 - Please choose the sector that best describes where you work.**

| Answer | Total (N) | (%) to all respondents (N=109) | NW Europe (N) | (%) to all respondents (N=109) | SE Europe (N) | (%) to all respondents (N=109) |
|---|---|---|---|---|---|---|
| Airport terminals | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Bus Station/ Train Station/ Seaport Terminal | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Car Parks 24 hrs | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Community/ Day Centre | 1 | 0.9 % | 0 | 0% | 1 | 1% |
| Crown and County Courts | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Dwelling | 4 | 3.7 % | 1 | 1% | 2 | 2% |
| Emergency Services | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Further Education/ Universities | 11 | 10.1 % | 9 | 8% | 2 | 2% |
| Hospital | 3 | 2.8 % | 3 | 3% | 0 | 0% |
| Hotel | 10 | 9.2 % | 2 | 2% | 5 | 5% |
| Industrial Process Building | 2 | 1.8 % | 1 | 1% | 1 | 1% |
| Laundry | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Libraries/ Museums/ Galleries | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Miscellaneous 24hr activities | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Nursing Residential Homes and Hostels | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Office | 42 | 38.5 % | 32 | 29% | 7 | 6% |
| Primary Health Care Buildings | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Primary School | 4 | 3.7 % | 4 | 4% | 0 | 0% |
| Prisons | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Residential Institutions – Residential Schools | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Restaurant/ Public House | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Retail | 3 | 2.8 % | 3 | 3% | 0 | 0% |
| Retail Warehouses | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Secondary School | 8 | 7.3 % | 8 | 7% | 0 | 0% |
| Social Clubs | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Sports Centre/ Leisure Centre | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Sports Ground Arena | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Stand Alone Utility Block | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Telephone Exchanges | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Theatres/ Cinemas/ Music Halls and Auditoria | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Warehouse and Storage | 0 | 0.0 % | 0 | 0% | 0 | 0% |
| Workshops/ Maintenance Depot | 1 | 0.9 % | 1 | 1% | 0 | 0% |
| Other (please specify) | 9 | 8.3 % | 6 | 6% | 3 | 3% |
| TOTAL | 109 | 100% | 81 | 74% | 21 | 19% |
| No. skips | 53 | 5% | 20 | | 15 | |

**Table 11 : Q5 - Other Sectors reported by repondents**

| Other Sector | (N) | (%) to all respondents (N=109) |
|---|---|---|
| Data Centres | 1 | 0.9% |
| Production Engineer | 1 | 0.9% |
| Research laboratories | 1 | 0.9% |
| 5000 standing arena + seating & ice skating rink | 1 | 0.9% |
| Food manufacturing | 1 | 0.9% |
| Research | 1 | 0.9% |
| service provider operating across a wide range of sectors | 1 | 0.9% |
| Non domestic buildings in general | 1 | 0.9% |
| Engineer | 1 | 0.9% |
| TOTAL | 9 | 8.3% |

**Table 12 : Q6 - Please indicate all the roles and responsibilities you hold.**

| Answer | Total (N) | (%) to all respondents (N=107) | NW Europe (N) | (%) to all respondents (N=107) | SE Europe (N) | (%) to all respondents (N=107) |
|---|---|---|---|---|---|---|
| Energy management | 83 | 77.6 % | 66 | 61.7% | 14 | 13.1% |
| Estates management | 24 | 22.4 % | 24 | 22.4% | 0 | 0.0% |
| Energy conservation | 51 | 47.7 % | 44 | 41.1% | 6 | 5.6% |
| Sustainability management | 31 | 29.0 % | 27 | 25.2% | 3 | 2.8% |
| Facilities management | 39 | 36.4 % | 32 | 29.9% | 7 | 6.5% |
| Legislation compliance | 31 | 29.0 % | 30 | 28.0% | 0 | 0.0% |
| Maintenance | 45 | 42.1 % | 37 | 34.6% | 7 | 6.5% |
| Operational matters | 22 | 20.6 % | 20 | 18.7% | 2 | 1.9% |
| Other | 6 | 5.6 % | 2 | 1.9% | 1 | 0.9% |
| TOTAL | 107 | 100% | 81 | 75.7% | 20 | 18.7% |
| No. skips | 55 | | 20 | | 16 | |

**Table 13 : Q6 - Other roles and responsibilities held by respondents.**

| Other roles and responsibilities | (N) | (%) to all respondents (N=107) |
|---|---|---|
| Test and Commissioning | 1 | 1% |
| Execution and Commissioning | 1 | 1% |
| Project Consultant | 1 | 1% |
| Building Services manager | 1 | 1% |
| Health and Safety | 1 | 1% |
| Planning | 1 | 1% |
| TOTAL | 9 | 6% |

**Table 14 : Q7 - Please indicate the number of buildings you are responsible for so we can best understand your potential for replication of iSERVcmb in your organisation.**

| Answer | Total (N) | (%) to all respondents (N=106) | NW Europe (N) | (%) to all respondents (N=106) | SE Europe (N) | (%) to all respondents (N=106) |
|---|---|---|---|---|---|---|
| 1 | 25 | 23.6 % | 15 | 14.2% | 8 | 7.5% |
| 2 to 10 | 43 | 40.6 % | 32 | 30.2% | 7 | 6.6% |
| 11 to 100 | 23 | 21.7 % | 20 | 18.9% | 3 | 2.8% |
| 100+ | 15 | 14.2 % | 14 | 13.2% | 1 | 0.9% |
| TOTAL | 106 | 100 % | 81 | 76.4% | 19 | 17.9% |
| No. skips | 56 | | 20 | | 17 | |

**Table 15 : Q8 - Approximately, what is the total size of the buildings you are responsible of?**

| Answer | Total (N) | (%) to all respondents (N=106) | NW Europe (N) | (%) to all respondents (N=106) | SE Europe (N) | (%) to all respondents (N=106) |
|---|---|---|---|---|---|---|
| 0 - 1,000 m2 | 17 | 16.0 % | 11 | 10.4% | 6 | 5.7% |
| 1,001 - 10,000 m2 | 42 | 39.6 % | 34 | 32.1% | 5 | 4.7% |
| 10,001 – 100,000 m2 | 33 | 31.1 % | 23 | 21.7% | 7 | 6.6% |
| 100,000+ m2 | 14 | 13.2 % | 13 | 12.3% | 1 | 0.9% |

| | | | | | | |
|---|---|---|---|---|---|---|
| TOTAL | 106 | 100% | 81 | 76.4% | 19 | 17.9% |
| No. skips | 56 | | 20 | | 17 | |

**Table 16 : Q9 - Does at least one of your buildings have dedicated electrical sub-metering with data collection on "at least one" of the HVAC components?**

| Answer | Total (N) | (%) to all respondents (N=102) | NW Europe (N) | (%) to all respondents (N=102) | SE Europe (N) | (%) to all respondents (N=102) |
|---|---|---|---|---|---|---|
| Fully Metered Building | 41 | 40.2 % | 30 | 29.4% | 7 | 6.9% |
| Partly Metered – sub-metering on one of the HVAC components | 34 | 33.3 % | 27 | 26.5% | 5 | 4.9% |
| No Metering Installed but Planning to | 16 | 15.7 % | 14 | 13.7% | 2 | 2.0% |
| None of the above | 11 | 10.8 % | 7 | 6.9% | 4 | 3.9% |
| TOTAL | 102 | 100 % | 78 | 76.5% | 18 | 17.6% |
| No. skips | 60 | | 23 | | 18 | |

**Table 17 : Q10 - Is your electrical metering capable of recording and storing data at hourly or sub-hourly, ideally 15 minute, intervals?**

| Answer | Total (N) | (%) to all respondents (N=85) | NW Europe (N) | (%) to all respondents (N=85) | SE Europe (N) | (%) to all respondents (N=85) |
|---|---|---|---|---|---|---|
| 15’ data | 27 | 31.8 % | 20 | 23.5% | 7 | 8.2% |
| 30’ data | 28 | 32.9 % | 24 | 28.2% | 3 | 3.5% |
| Hourly data | 22 | 25.9 % | 18 | 21.2% | 4 | 4.7% |
| Daily data | 4 | 4.7 % | 3 | 3.5% | 1 | 1.2% |
| Monthly data | 14 | 16.5 % | 6 | 7.1% | 3 | 3.5% |
| None of the above | 5 | 5.9 % | 5 | 5.9% | 0 | 0.0% |
| TOTAL | 85 | 100 % | 66 | 77.6% | 13 | 15.3% |
| No. skips | 77 | | 35 | | 23 | |

**Table 18 : Q11 - Please tick all the following that apply. I am recording sub-hourly data for.**

| Answer | Total (N) | (%) to all respondents (N=66) | NW Europe (N) | (%) to all respondents (N=66) | SE Europe (N) | (%) to all respondents (N=66) |
|---|---|---|---|---|---|---|
| Lighting | 33 | 50.0 % | 25 | 37.9% | 7 | 10.6% |
| Small power | 23 | 34.8 % | 20 | 30.3% | 2 | 3.0% |
| Chillers | 31 | 47.0 % | 21 | 31.8% | 9 | 13.6% |
| Landlord supply | 8 | 12.1 % | 8 | 12.1% | 0 | 0.0% |
| Tenant supply | 9 | 13.6 % | 9 | 13.6% | 0 | 0.0% |
| Pumps | 13 | 19.7 % | 7 | 10.6% | 4 | 6.1% |
| Fans | 18 | 27.3 % | 13 | 19.7% | 4 | 6.1% |
| Boilers | 19 | 28.8 % | 15 | 22.7% | 4 | 6.1% |
| Heat rejection | 6 | 9.1 % | 2 | 3.0% | 3 | 4.5% |
| HVAC as a whole | 29 | 43.9 % | 23 | 34.8% | 6 | 9.1% |
| Main electrical supply | 44 | 66.7 % | 37 | 56.1% | 8 | 12.1% |
| Main gas supply | 37 | 56.1 % | 32 | 48.5% | 5 | 7.6% |
| Main water supply | 33 | 50.0 % | 28 | 42.4% | 6 | 9.1% |
| Catering | 9 | 13.6 % | 8 | 12.1% | 1 | 1.5% |
| IT systems/ computer rooms | 15 | 22.7 % | 12 | 18.2% | 3 | 4.5% |
| None of the above | 1 | 1.5 % | 1 | 1.5% | 0 | 0.0% |
| Other (please specify) | 2 | 3.0 % | 2 | 3.0% | 0 | 0.0% |
| TOTAL | 66 | 100 % | 53 | | 12 | |
| No. skips | 96 | | 48 | | 24 | |

**Table 19 : Q11 - Other Responses**

| Other responses | (N) | (%) to all respondents (N=107) |
|---|---|---|
| We are possibly getting more data hooked up in the next few months. | 1 | 1.5% |
| Sub-metering at DB level, detail dependent on configuration | 1 | 1.5% |
| TOTAL | 2 | 3% |

**Table 20 : Q12 - Are you in a position to send your HVAC consumption data for analysis by any of the following means?**

| Answer | Total (N) | (%) to all respondents (N=62) | NW Europe (N) | (%) to all respondents (N=62) | SE Europe (N) | (%) to all respondents (N=62) |
|---|---|---|---|---|---|---|
| Automatically to an email address | 15 | 24.2% | 13 | 21.0% | 3 | 4.8% |
| Manually to an email address | 24 | 38.7% | 20 | 32.3% | 2 | 3.2% |
| Maybe but could require some help | 14 | 22.6% | 11 | 17.7% | 3 | 4.8% |
| Not sure | 5 | 8.1% | 4 | 6.5% | 1 | 1.6% |
| Unlikely | 4 | 6.5% | 3 | 4.8% | 1 | 1.6% |
| TOTAL | 62 | 100 % | 51 | 82.3% | 10 | 16.1% |
| No. skips | 100 | | 50 | | 26 | |

**Table 21 : Q14 - Please tick if you have any of the following already in electronic form**

| Answer | Total (N) | (%) to all respondents (N=53) | NW Europe (N) | (%) to all respondents (N=53) | SE Europe (N) | (%) to all respondents (N=53) |
|---|---|---|---|---|---|---|
| Energy metering strategy | 18 | 34.0 % | 17 | 32.1% | 2 | 3.8% |
| Building asset portfolio | 11 | 20.8 % | 10 | 18.9% | 2 | 3.8% |
| HVAC system components asset | 15 | 28.3 % | 13 | 24.5% | 3 | 5.7% |
| Energy consumption data | 37 | 69.8 % | 31 | 58.5% | 5 | 9.4% |
| None of the above | 8 | 15.1 % | 6 | 11.3% | 2 | 3.8% |
| TOTAL | 53 | 100 % | 44 | 83.0% | 8 | 15.1% |
| No. skips | 109 | | 57 | | 28 | |

**Table 22 : Distribution of Sectors by Question**

| Answer | (%) to all respondents in Q5 (N=109) | (%) to all respondents in Q6 (N=98) | (%) to all respondents in Q7 (N=97) | (%) to all respondents in Q8(N=97) | (%) to all respondents in Q9 (N=95) | (%) to all respondents in Q10 (N=80) | (%) to all respondents in Q11(N=62) | (%) to all respondents in Q12 (N=58) | (%) to all respondents in Q14 (N=80) |
|---|---|---|---|---|---|---|---|---|---|
| **Airport terminals** | 0.9 % | 1.0% | 1.0% | 1.0% | 1.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Bus Station/ Train Station/ Seaport Terminal** | 0.9 % | 4.1% | 1.0% | 1.0% | 1.1% | 1.3% | 3.2% | 1.7% | 6.1% |
| **Car Parks 24 hrs** | 0.9 % | 8.2% | 1.0% | 1.0% | 1.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Community/ Day Centre** | 0.9 % | 1.0% | 1.0% | 1.0% | 1.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Crown and County Courts** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Dwelling** | 3.7 % | 9.2% | 4.1% | 4.1% | 4.2% | 5.0% | 3.2% | 1.7% | 6.1% |
| **Emergency Services** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Further Education/ Universities** | 10.1 % | 39.8% | 10.3% | 10.3% | 10.5% | 13.8% | 50.0% | 12.1% | 26.5% |
| **Hospital** | 2.8 % | 16.3% | 3.1% | 3.1% | 3.2% | 3.8% | 17.7% | 3.4% | 4.1% |
| **Hotel** | 9.2 % | 20.4% | 8.2% | 8.2% | 8.4% | 16.3% | 35.5% | 8.6% | 8.2% |
| **Industrial Process Building** | 1.8 % | 7.1% | 2.1% | 2.1% | 2.1% | 2.5% | 30.6% | 3.4% | 2.0% |
| **Laundry** | 0.9 % | 1.0% | 1.0% | 1.0% | 1.1% | 1.3% | 4.8% | 1.7% | 2.0% |
| **Libraries/ Museums/ Galleries** | 0.9 % | 3.1% | 1.0% | 1.0% | 1.1% | 1.3% | 6.5% | 1.7% | 2.0% |
| **Miscellaneous 24hr activities** | 0.9 % | 6.1% | 1.0% | 1.0% | 1.1% | 1.3% | 1.6% | 1.7% | 2.0% |
| **Nursing Residential Homes and Hostels** | 0.9 % | 1.0% | 1.0% | 1.0% | 1.1% | 1.3% | 0.0% | 0.0% | 0.0% |
| **Office** | 38.5 % | 123.5% | 43.3% | 43.3% | 42.1% | 50.0% | 208.1% | 39.7% | 63.3% |
| **Primary Health Care Buildings** | 0.9 % | 1.0% | 1.0% | 1.0% | 1.1% | 1.3% | 8.1% | 1.7% | 4.1% |
| **Primary School** | 3.7 % | 12.2% | 4.1% | 4.1% | 4.2% | 3.8% | 38.7% | 5.2% | 4.1% |
| **Prisons** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Residential Institutions – Residential Schools** | 0.9 % | 1.0% | 1.0% | 1.0% | 1.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Restaurant/ Public House** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Retail** | 2.8 % | 15.3% | 3.1% | 3.1% | 3.2% | 3.8% | 29.0% | 5.2% | 10.2% |
| **Retail Warehouses** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Secondary School** | 7.3 % | 24.5% | 8.2% | 8.2% | 8.4% | 8.8% | 67.7% | 10.3% | 20.4% |
| **Social Clubs** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Sports Centre/ Leisure Centre** | 0.9 % | 3.1% | 1.0% | 1.0% | 1.1% | 1.3% | 1.6% | 0.0% | 0.0% |
| **Sports Ground Arena** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Stand Alone Utility Block** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Telephone Exchanges** | 0.9 % | 2.0% | 1.0% | 1.0% | 1.1% | 1.3% | 4.8% | 1.7% | 2.0% |
| **Theatres/ Cinemas/ Music Halls and Auditoria** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Warehouse and Storage** | 0.0 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Workshops/ Maintenance Depot** | 0.9 % | 1.0% | 1.0% | 1.0% | 1.1% | 1.3% | 0.0% | 0.0% | 0.0% |
| **Other (please specify)** | 8.3 % | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **TOTAL** | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **No. skips** | 5% | 2.0% | 3.7% | 3.7% | 5.3% | 25% | 61.3% | 72.4% | 104.1% |