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Technical Report explaining the scope of ICT tools in EES development and future market opportunities

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Building Up Next-Generation Smart Energy Services Offer and Market Up-take Valorising Energy Efficiency and Flexibility at Demand-Side.

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1. Introduction

The global landscape is witnessing an unprecedented transformation in the energy sector, driven by the urgent need to address climate change, reduce greenhouse gas emissions, and enhance energy security. In this context, the development of Energy Efficiency Services (EES) has emerged as a critical component of sustainable energy strategies. Energy efficiency, often considered the "first fuel" of economic growth, offers a cost-effective means to reduce energy consumption, lower operational costs, and mitigate environmental impacts.

In an era where global energy consumption continues to rise and the threat of climate change looms large, the development and deployment of EES have become crucial. These services are designed to reduce energy consumption, optimize energy usage, and contribute to the overall sustainability goals set by UN and governments, corporations, and international organizations. Central to the evolution of EES is the integration of Information and Communication Technology (ICT) tools. The confluence of ICT and energy efficiency represents a transformative force, driving innovation, enhancing efficiency, and unlocking new market opportunities. As the demand for energy-efficient solutions continues to rise, Information and Communication Technology (ICT) tools are playing an increasingly pivotal role in shaping the future of energy efficiency services.

This technical report aims to explore the scope of ICT tools in the development of EES and to analyse the future market opportunities that these tools present. This Chapter provides a brief overview to introduce the themes under the scope of this report. Chapter two will present details on the scope and role of ICT tools in the present and future EES market. Additionally this Chapter will provide information on the current landscape of energy efficiency services, highlighting the key drivers for their adoption and the challenges that need to be addressed. Finally, the Chapter will explore the market opportunities that arise from the integration of ICT in energy efficiency services, emphasizing the potential for growth and innovation in this burgeoning field. Chapter three will present details on the methodology used to develop this deliverable, as well as on the metric used to classify the ICT data collected during the elaboration of this technical report. Chapter four will present the information collected regarding the innovative and market proven ICT tools for energy efficiency in buildings. Chapter five analyses the collected data and classifies the ICT according to the criteria established in the methodology (Chapter three). Chapter six identifies the the EES market needs and opportunities related to ICT tools . Additionally this report has two annexes with the template used in the ICT tools online survey sent to Energy Service Provider Companies (ESPC) and a second annex with a list of the ICT collected during the elaboration of this deliverable.

In conclusion, ICT tools are at the forefront of revolutionizing energy efficiency services, offering unprecedented opportunities for optimization and innovation. The global energy landscape is undergoing a significant transformation, driven by the pressing need to address climate change, reduce greenhouse gas emissions, and enhance energy security. In this context, energy efficiency has emerged as a cornerstone of sustainable energy strategies. It offers a cost-effective means to reduce energy consumption, lower operational costs, and mitigate environmental impacts. With the growing emphasis on energy efficiency, Information and Communication Technology (ICT) tools are playing an increasingly pivotal role in shaping the development and future market opportunities of energy efficiency services The future market landscape for these services is promising, with substantial growth potential driven by regulatory pressures, corporate sustainability goals, consumer demand, and technological advancements. As these tools become more

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sophisticated and integrated, their role in achieving global energy efficiency and sustainability objectives will only become more critical.

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2. Scope and Role of ICT Tools in the Present and Future EES Market

Energy Efficiency Services encompass a wide range of technologies, systems, activities and solutions designed to collect, analyse, and manage data, aimed at reducing energy consumption while maintaining or improving service levels. These services include energy audits, energy management systems, retrofitting of buildings, deployment of energy-efficient appliances, and the implementation of renewable energy solutions, etc., that aim to optimizing energy use across various sectors, including residential, commercial, industrial, and public infrastructure. The importance of these services cannot be overstated, particularly in the context of global efforts to mitigate climate change and reduce carbon emissions.

Several factors are driving the adoption of energy efficiency services. Firstly, there is a growing awareness of the environmental impact of energy consumption, which has led to increased regulatory pressure on industries and businesses to reduce their carbon footprint. Governments around the world are introducing stricter energy efficiency standards and offering incentives for the adoption of energy-efficient technologies. Secondly, the rising cost of energy (caused by the most recent armed conflicts worldwide, namely in Ukraine and Israel) is prompting businesses and consumers alike to seek ways to reduce their energy bills. EES offer a cost-effective solution to this problem by reducing energy consumption and, consequently, energy costs. Lastly, advancements in technology are making it easier and more cost-effective to implement energy efficiency measures. The development of smart grids, the Internet of Things (IoT), and advanced data analytics are enabling more precise and effective energy management.

However, despite these drivers, the widespread adoption of EES faces several challenges. One of the primary challenges is the initial cost associated with implementing energy efficiency measures. Although these measures often lead to significant long-term savings, the upfront investment/cost can be a barrier for many businesses and consumers. Additionally, there is a lack of awareness and understanding of the benefits of EES, particularly among small and medium-sized enterprises (SMEs) and residential consumers. Finally, there are technical challenges related to the integration of new technologies with existing infrastructure, particularly in older buildings and industrial facilities due to the lack of standardisation of communication systems (e.g. very often each manufacturer uses specific communication protocols only compatible with own equipment) or Service Level Agreements (SLA).

Information and Communication Technology (ICT) tools play a critical role in overcoming many of the challenges associated with the development and deployment of EES. ICT tools facilitate the collection, analysis, and communication of data, which is essential for an effective energy management.

2.1 Categories of ICT Tools

In terms of scope, ICT tools can be broadly categorized into several key areas:

Big Data Analytics and Artificial Intelligence

Data analytics is at the heart of the modern energy efficiency services. The integration of big data and AI in energy management allows for the analysis of large datasets to identify trends, forecast energy demand, and

optimize energy supply chains. AI algorithms can provide predictive insights, automate energy-saving actions, and enhance the precision of energy management practices. For instance, Machine Learning models can predict peak energy demand periods and suggest load-shifting strategies to minimize costs. Additionally, AI-driven analytics can uncover hidden patterns in energy use, revealing opportunities for further efficiency gains. By collecting and analysing large volumes of data, organizations can gain valuable insights into their energy usage patterns, identify inefficiencies, and make informed decisions on how to optimize their energy consumption. Advanced data analytics tools can process data in real-time, allowing for immediate adjustments to be made in response to changing conditions (e.g. predictive analytics can forecast energy demand based on historical data and current trends, enabling organizations to adjust their operation accordingly in order to reduce energy waste). Moreover, data analytics tools are increasingly being integrated with Artificial Intelligence (AI) and Machine Learning (ML) algorithms, which can automate the process of energy optimization. Figure 1 presents the interaction between big data, IoT and AI.

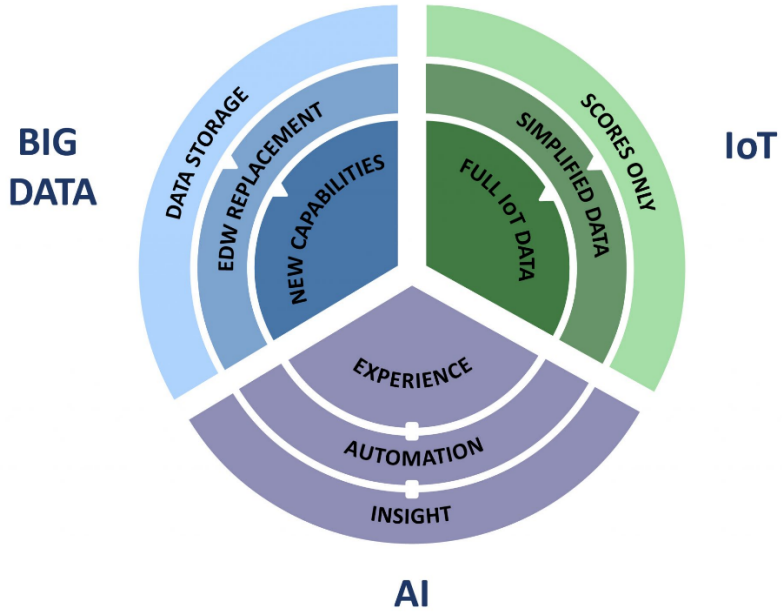

Figure 1 – Example of the different sources of information for Big data and AI systems[1]. Source: ISM guide[2]

These algorithms can continuously learn from data, improving their predictions and recommendations over time. This level of automation is particularly valuable in complex industrial environments and large building with multiple energy services (e.g. solar photovoltaics, battery storage, Electric Vehicle-EV charging, etc.) where energy consumption is influenced by a multitude of factors, and manual optimization would be time-consuming and prone to errors.

Internet of Things (IoT) Devices

The Internet of Things (IoT) is a network of interconnected devices that can communicate with each other and with central systems over the internet. In the context of energy efficiency, IoT devices include smart

[1] EDW – Enterpride Data Warehouse
[2] ISM guide - https://ismguide.com/how-big-data-and-ai-will-work-together/

thermostats, lighting systems, appliances, and all types of sensors that can monitor and control energy usage in real-time. These devices can be programmed to operate more efficiently based on data collected from their environment (e.g. temperature, humidity, climate forecast, luminance, motion, air quality, etc.), leading to significant energy savings.

Figure 2 – Example of different IoT devices. Source: Online Article[3]

For example, a smart thermostat can learn the habits of the occupants of a building and adjust the temperature, accordingly, reducing energy consumption when the building is unoccupied or pre-cool/heat in periods where the electricity tariff is lower. Similarly, smart lighting systems can adjust the brightness of lights based on the amount of natural light available, reducing the need for artificial lighting. IoT devices can also be integrated with other ICT tools, such as data analytics and cloud computing, to enable more sophisticated energy management solutions.

Cloud Computing

Cloud computing is another type of ICT tool that is playing an increasingly important role in energy efficiency services. Cloud computing allows the storage, processing, and analysis of large volumes of data on remote servers, rather than on local systems. This enables organizations to access advanced data analytics tools and other ICT resources without the need for significant investments in hardware and software infrastructure.

[3] The Role of IoT in Smart Cities by Sathiya Shree - https://www.linkedin.com/pulse/role-iot-smart-cities-sathiya-shree-fz4nc/

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Figure 3 – Cloud computing representation. Generated by AI technology

One of the key benefits of cloud computing in the context of energy efficiency is scalability. As an organization grows, the energy management also needs to grow. Cloud-based platforms facilitate the storage and processing of vast amounts of energy data. These platforms enable remote monitoring and management of energy systems, offering scalability and flexibility to energy efficiency service providers. By leveraging cloud computing, organizations can access advanced analytical tools without the need for significant on-premises infrastructure. This accessibility democratizes energy management capabilities, allowing organizations of all sizes to benefit from sophisticated energy efficiency solutions. Additionally, cloud-based systems allow for a greater collaboration and data sharing between different stakeholders, such as energy service providers, utilities, and customers. This can lead to more effective and coordinated energy efficiency efforts from a supply chain.

Smart Grid Technologies

The development of smart grid technologies is another important area where ICT tools are transforming EES. A smart grid is an electricity network that uses digital technology to monitor and manage the production, distribution, and consumption of electricity. Unlike traditional grids, which operate on a one-way flow of electricity, smart grids enable a two-way flow of electricity and data. This allows for a more efficient management of the grid, as well as greater integration of renewable energy sources.

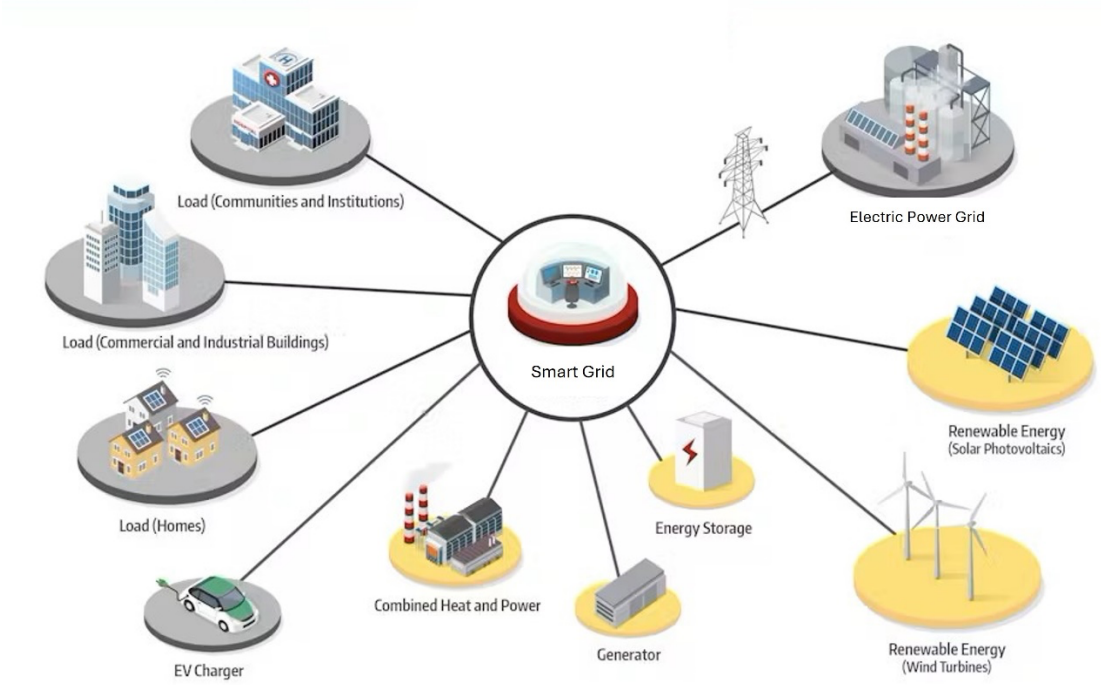

Figure 4 – Smart grid representation. Source: Microgrid Knowledge[4]

Smart grid technologies include Advanced Metering Infrastructure (AMI), which provides real-time data on energy consumption/production to both utilities and consumers. This data can be used to optimize energy usage patterns, reduce peak demand, create flexibility and improve the overall efficiency of the electricity network. Additionally, smart grids enable demand response programs, where consumers are incentivized to reduce their energy consumption during periods of high demand. These programs are made possible by using ICT tools that allow for the real-time communication and management of energy usage data.

Building Energy Management Systems (BEMS)

ICT tools act has support mechanisms of BEMS to monitor and control energy usage patterns in buildings. These systems can automatically adjust the operation of Heating, Ventilation, and Air Conditioning (HVAC) systems, lighting, heat pumps, and other electrical devices/systems. By optimizing the performance of these systems, BEMS can achieve significant energy savings. For instance, intelligent algorithms can adjust HVAC and heat pump settings based on occupancy patterns, weather conditions (present and forecasted), and energy prices, leading to reduced energy waste and lower utility bills.

[4] https://www.microgridknowledge.com/about-microgrids/article/11429017/what-is-a-microgrid

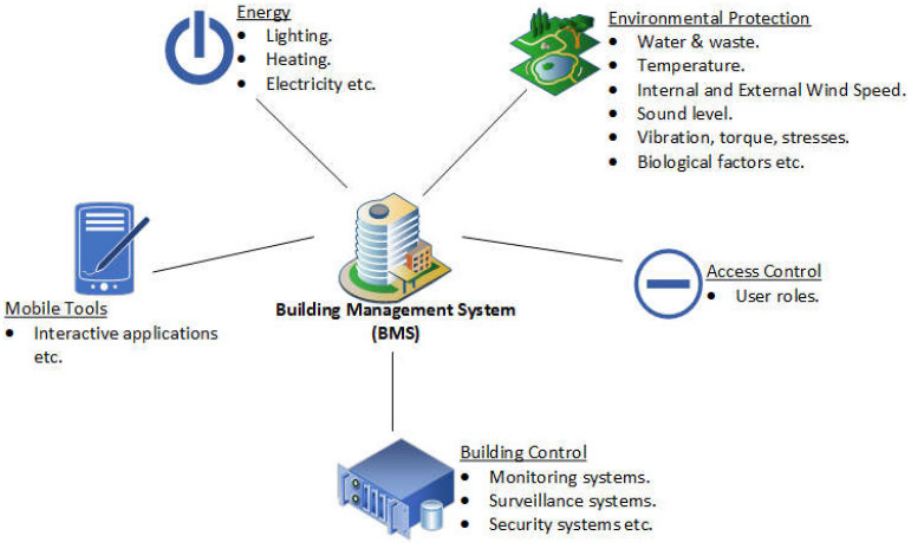

Figure 5 – Example of BEMS. Source: The Convergence of Blockchain, Internet of Things (IoT) and Building Information Modeling (BIM): The smart museum case[5]

Energy Management Software

Advanced Energy Management Software (AEMS) solutions analyse energy consumption patterns and identify opportunities for efficiency improvements. These tools can track energy usage across different time periods, benchmark performance against industry standards or other buildings, and generate detailed reports to guide decision-making processes. Such software is very valuable for organizations aiming to enhance their energy performance and achieve sustainability goals. By providing insights into energy usage, these tools help organizations to prioritize investments in energy-saving measures and monitor the effectiveness of the implemented strategies/measures.

Figure 6 – Representation of an AEMS. Wattsense[6]

[5] The Convergence of Blockchain, Internet of Things (IoT) and Building Information Modeling (BIM): The smart museum case - https://www.researchgate.net/publication/332786383_The_Convergence_of_Blockchain_Internet_of_Things_IoT_and_Building_Information_Modeling_BIM_The_smart_museum_case/figures?lo=1

[6] Wattsense online blog - https://www.wattsense.com/blog/building-management/understanding-energy-management-system-ems/

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2.2 ICT Tools are Transforming Energy Services

The use of AI and ML in the development of ICT tools is transforming and accelerating the development and adoption of energy efficiency services. Traditional approaches to energy management are being supplanted by innovative, data-driven solutions that offer greater precision and control. The development of these services is characterized by several key trends:

- **Enhanced Data Accuracy and Accessibility -** ICT tools provide accurate, real-time data on energy consumption/production patterns, enabling a more effective monitoring and management. This data is easily accessible through digital interfaces, empowering consumers and organizations to make more informed decisions about their energy use. Enhanced data accuracy ensures that energy-saving measures are based on reliable information and are in fact achieved, leading to more substantial and sustained improvements in energy efficiency;

- **Automation and Control -** Advanced ICT tools facilitate the automation of energy-saving measures, reducing the need for manual intervention. Automated systems can almost instantly adjust energy use based on real-time conditions, optimizing efficiency and reducing waste. For example, smart lighting systems can automatically dim or turn off lights in unoccupied areas, while smart thermostats can adjust temperatures and heat pump operation based on occupancy and external weather conditions;
- **Tailor-made or Customized Energy Solutions -** ICT tools enable the customization of energy efficiency services to meet the specific needs of different users. Personalized recommendations and tailored solutions enhance user engagement and drive higher adoption rates. By analysing individual consumption/production patterns and preferences, energy management systems can offer suitable advice and interventions that maximize energy savings, reduce energy demand from the grid and improve user satisfaction;

- **Scalability and Integration -** The modular nature of ICT tools allows for an easy integration with the existing energy systems/equipment and the scalability to accommodate future growth, as well as the interoperability of the different components. This flexibility is crucial for adapting to evolving energy landscapes and expanding service offerings. For instance, as renewable energy sources become more prevalent, ICT tools can integrate these sources into the energy management framework, ensuring seamless operation and optimization.

The convergence of ICT tools and energy efficiency services presents significant market opportunities. As the demand for energy is expected to grow over the next years, the global emphasis on sustainability intensifies. It is important to reduce carbon emissions in order to reduce global warming and mitigate climate change consequences. To this end, energy efficiency is a fundamental strategy to be used in the coming decades. The timely and goal-oriented adoption of cost-effective energy-efficient solutions can help to achieve the United Nation Sustainability Goals (UN-SDGs)[7] present in the figure bellow.

[7] United Nation Sustainability Goals - https://sdgs.un.org/goals

Figure 7 - United Nation Sustainable Development Goals. Source: United Nations[8]

2.3 Contribution to UNSDG

Considering all of the above, several factors can contribute to an increasing the role of energy efficiency and at the same time enhance the use of ICT tools in the road to achieve the sustainable development goals:

- ✓ **Regulatory Drivers -** Governments worldwide are implementing stringent energy efficiency regulations and incentives. Compliance with these regulations creates a substantial market for ICT-enabled energy efficiency services. Policies such as carbon pricing, energy efficiency standards, and renewable energy mandates drive the adoption of energy-saving technologies and practices;

- ✓ **Expansion of Energy Efficiency Services -** As organizations and consumers become more aware of the benefits of energy efficiency, the demand for energy efficiency services is expected to grow. This growth will be particularly strong in sectors that are traditionally energy-intensive, such as manufacturing, transportation, and construction. In these sectors, energy efficiency services can offer significant cost savings and help organizations meet mandatory regulatory requirements. The expansion of EES will also be driven by the increasing availability of advanced ICT tools. These tools are making it easier and more cost-effective for organizations to implement energy efficiency measures, which is reducing the barriers to entry for new service providers. Additionally, as ICT tools become more sophisticated, they are enabling the development of new and innovative energy efficiency solutions, which will further drive market growth;

[8] United Nation Sustainable Development Goals - https://sdgs.un.org/goals

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- ✓ **Organizations/Institutions Sustainability Goals -** Organizations are increasingly prioritizing sustainability as part of their corporate social responsibility initiatives. ICT tools can help companies achieve their energy efficiency targets, reducing operational costs and enhancing their environmental credentials. By demonstrating commitment to sustainability, organizations can also improve their brand image and attract environmentally conscious consumers and investors;

- ✓ **Consumer Awareness -** Rising consumer awareness on energy conservation and environmental impact is fuelling the demand for energy-efficient products and services. ICT tools empower consumers with the information and control needed to reduce their energy/environmental footprint. As consumers become more knowledgeable about the benefits of energy efficiency, they are more likely to invest in smart home technologies, energy-efficient appliances, storage systems and renewable energy solutions;

- ✓ **Technological Advancements -** Ongoing advancements in ICT, including AI, ML, IoT, and cloud computing, are continuously expanding the capabilities of energy efficiency services. These technologies will drive innovation and create new business models in the energy sector. For example, advancements in AI could lead to more sophisticated predictive analytics, while IoT developments could result in even more integrated and responsive energy management systems;

- ✓ **Smart Home Market –** This is an area where significant market opportunities are emerging. Smart homes are equipped with IoT devices that can monitor and control energy usage, leading to significant energy savings. The growing adoption of smart home technologies is being driven by several factors, including the increasing availability of affordable IoT devices, the rising cost of energy, and the growing awareness of the environmental impact of energy consumption, as well as the consumer awareness on how to reduce consumption. The smart home market is expected to continue to grow rapidly in the coming years, creating opportunities for companies that provide energy efficiency services. These companies can offer solutions that integrate IoT devices with advanced data analytics and cloud-based tools, enabling homeowners to optimize their energy usage and reduce their energy bills;

- ✓ **Expansion into Emerging Markets -** Emerging markets represent a significant growth opportunity for energy efficiency services. Many emerging markets are experiencing rapid economic and/or population growth, which is leading to an increase in the energy consumption. At the same time, these markets are facing significant challenges related to energy access and sustainability. Energy efficiency services can help address these challenges by reducing energy consumption, improving energy access, and supporting the development of renewable energy sources. The expansion into emerging markets will be facilitated by the increasing availability of ICT tools, which are making it easier and more cost-effective to deploy energy efficiency solutions in these regions. Additionally, as governments in emerging markets (as well as in some developing countries) are introducing more stringent energy efficiency standards, the demand for energy efficiency services is expected to grow over the next decades;

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- ✓ **Development of New Business Models -** The integration of ICT tools in energy efficiency services is also leading to the development of new business models. One of these models is the "Energy as a Service" (EaaS) model, where customers pay for energy efficiency services on a subscription basis, rather than making a one-time investment in energy-efficient technologies. This model is particularly attractive to organizations that may not have the capital to invest in energy efficiency upfront but still want to benefit from reduced energy costs. Another emerging business model is the use of performance-based contracts, where the payment for energy efficiency services is tied to the actual energy savings achieved. This model aligns the interests of the service provider and the customer, as both parties have a financial incentive to maximize energy savings. Performance-based contracts are made possible by using ICT tools that can accurately measure and verify energy savings in real-time. More recently another business model is emerging in the market, called “X-as a Service” (XaaS) or “Anything as a Service”. This model is data-driven and combines innovative transaction and service accounting models. It allows consumers to choose tailored energy services under different payment schemes. The model aims to deliver final energy services to end-consumers in a new and improved manner, with a strong emphasis on engaging consumers in the energy service value chain, creating flexibility to consumers and at the same contributing to the decarbonization of energy;

- ✓ **Integration with Renewable Energy -** The integration of ICT tools in energy efficiency services is also creating new opportunities to increase the level of integration of renewable energy sources. By optimizing energy usage, organizations and consumers can reduce their reliance on non-renewable energy sources, electric grid (if available) and increase their use of renewable energy. Additionally, ICT tools can enable more effective management of renewable energy systems, such as solar panels, battery storage systems and wind turbines, by providing real-time data on energy production and consumption. The integration of renewable energy with energy efficiency services is particularly important in the context of the global transition to a low-carbon economy. As governments around the world set ambitious targets for reducing carbon emissions, the demand for integrated energy efficiency and renewable energy solutions is expected to grow. This will create significant market opportunities for companies that can provide these integrated solutions.

The integration of ICT tools in energy efficiency services represents a transformative force in the energy sector. These tools are enabling more effective and efficient energy management, reducing the barriers to the adoption of energy efficiency measures, renewable energy systems and unlocking new market opportunities. As the demand for energy efficiency services continues to grow, driven by increasing energy costs, regulatory requirements, and technological advancements, the role of ICT tools will become even more critical.

Looking ahead, the future of energy efficiency services is bright. The expansion of these services into new sectors and emerging markets, the development of new business models, and the integration with renewable energy sources all represent significant growth opportunities. For organizations and investors looking to capitalize on these opportunities, the key will be to stay at the forefront of technological advancements and to develop innovative solutions that meet the evolving needs of the market. The scope of ICT tools in energy efficiency service development is quite vast, and the potential for future market opportunities is enormous. By leveraging these tools, organizations can not only improve their energy

efficiency and reduce their operational costs but also contribute to the global efforts to combat climate change and build a more sustainable economic structure. In conclusion, ICT tools are an important enabler for revolutionizing energy efficiency services, offering unprecedented opportunities for optimization and innovation. The future market landscape for these services is promising, with substantial growth potential driven by regulatory pressures, organizations sustainability goals, consumer demand, and technological advancements. As these tools become more sophisticated and integrated, their role in achieving global energy efficiency and sustainability objectives will only become more critical.

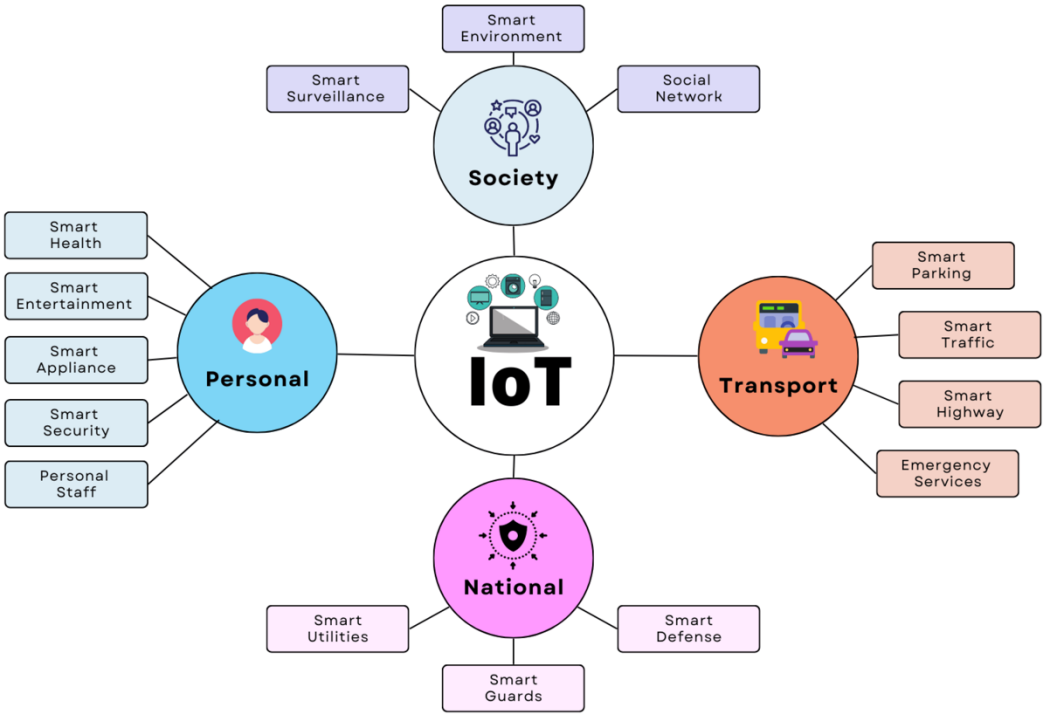

Figure 8 - Representation of the uses of ICT tools in a smart city. Source: MDPI[9]

[9] https://www.mdpi.com/sensors/sensors-22-09271/article_deploy/html/images/sensors-22-09271-g002.png

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3. Methodology

The methodology used by the BungEES project team is based in the combination of two types of actions, an online survey in some cases complemented with informal bilateral interviews targeting the Energy Service Provider Companies (ESPCs) or Energy Service companies (ESCOs) and market research that in some case included bilateral contacts with some companies to obtain the necessary information (not available online) on their ICT tools.

The main objective of this Chapter is to outline in a comprhensive way the methodology used either for conducting the online survey, and for the extensive market research performed, inorder to identify the most innovative and market-proven ICT tools used for energy efficiency in buildings. The outcome of this methodology allowed to prepare this Deliverable 3.4 within the scope of BungEES.

The goal of this Delliverable is to combine the collected information into a study that uncovers current trends, assess the penetration of ICT tools in the market, and classifies the ICT tools according to previously defined criteria.

Preceding the methodology, it is important to define the key objectives of the methodology:

- Identification of market proven ICT tools currently used by ESCOs and new innovative ICT tools entering the market, used to improve energy efficiency in buildings;
- Evaluate and grade the identified ICT tools according to specific criteria (see Chapter 5) defined by the BungEES team such as innovation level, number of clients, market positioning, customers, type of interface, etc.;
- Design of an online survey that reaches ESCOs and gets them comfortable to share details on their business. This survey is usually more attractive for stakeholders because it is less time consuming than an interview, and can be done at a time of their choice;
- The market research allows to improve the quality and robustness of the collected data and provides additional feedback from other sources (ICT tools developers, suppliers and retailers);
- The combination of data collected in the online surveys and in the market research (e.g. literature review, direct consultation with ICT Tools developers and suppliers and desk research) allows to deliver
- Assemble a representative picture of the current market situation, trends and innovation level. Additionally, it may allow to identify the largest players, as well as the most companies with the highest potential.

The first step was to design a comprehensive and low time-consuming survey targeting ESPCs/ESCOs that could drive them to share details of their business model, namely ICT tools used. The BungEES team anticipated that this could be a significant challenge and included in this methodology the market research.

The survey was divided into three parts. Part one includes personal details and organization/company details (contact, location of the company, etc.). Part two requests inputs, namely name and purpose of the ICT tools used in their projects. Part three need information regarding the use of automated measurement & verification techniques and user engagement. This survey also included some questions related to the use of

automated measurement and verification techniques, the feedback from stakeholders will be used in Deliverable 3.5. For more details on the template used for the online survey please see Annex A.

The online survey was disseminated through differente channels. First, with the collaboration of all project partners, who know their country-specific markets in detail, the target companies for the surveys were identified. The survey was then circulated through networking using partners contact networks and directly to relevant people in ESPCs/ESCOs in each BungEES partner country. Third, the most relevant business associations, namely ESCO associations in each country within the BungEES consortium were contacted to disseminate the online survey. Additionally, in some cases, specific stakeholders were contacted to clarify or obtained specific information related to The ICT tools used or developed by those stakeholders. Moreover, this direct contact were also used to obtain information, needed to respond to the grading criteria.

The market research is formed by a combination of actions drawing on the consortium experience to present overall high quality results. These actions include literature review (from an academic perspective), direct consultation of ICT tools developers and/or suppliers and desk reseach. This method allowed to identify a large number of ICT tools (see Annex B) which in combination with the establish grading criteria (see Table 1) allows to deliver a robust set of information that clearly show the market trends in terms of ICT tools for energy effiency in buildings.

The methodology used can be summarized by the next figure.

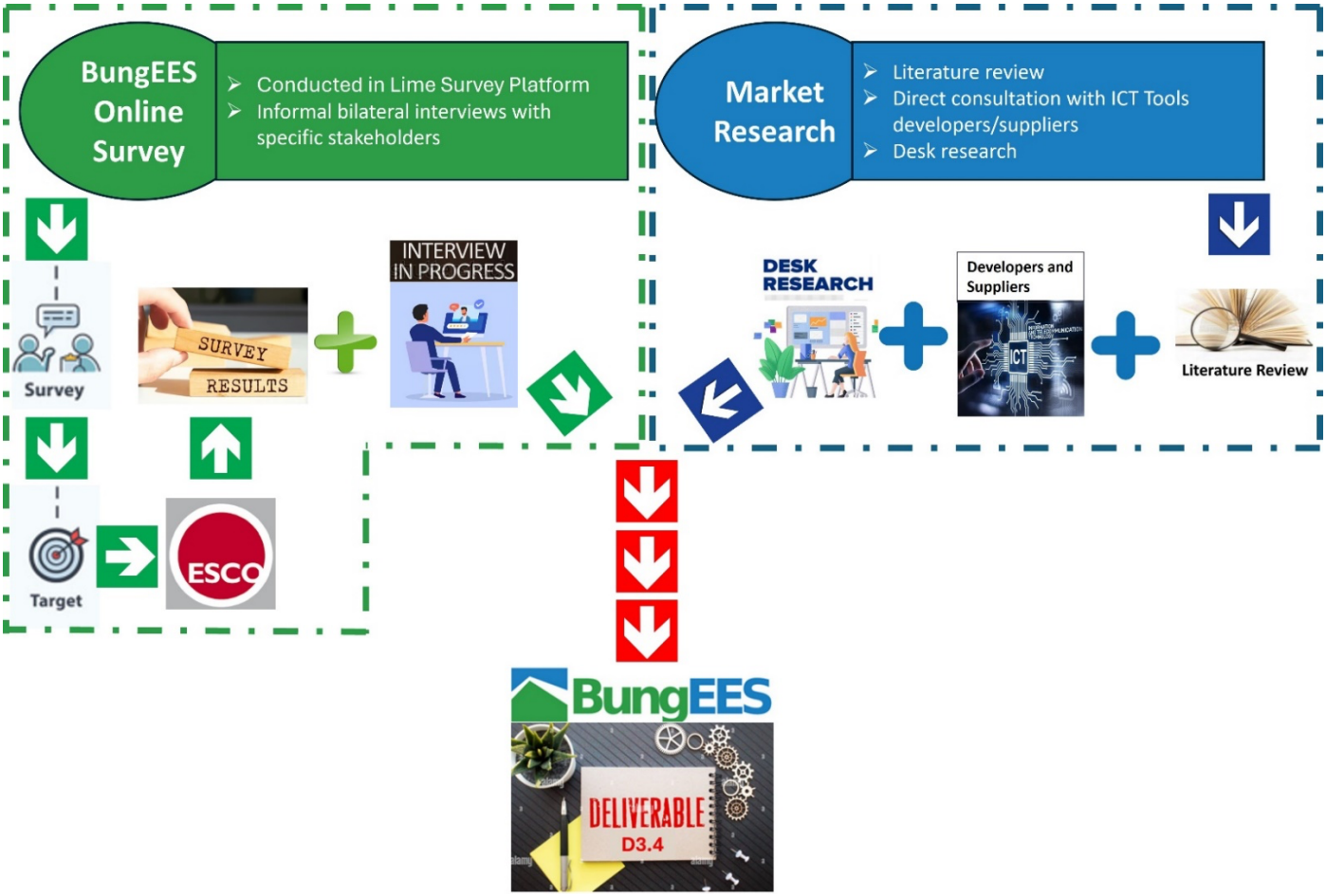

Figure 9 - Methodology used in the development of this deliverable. Source: ISR-UC

4. Collected Data

The results of the collected data (online survey, informal interviews and market research) are presented in an aggregated way to guarantee data anonymity according to European Regulations, namely GDPR[10].

During the collection process that includes online survey, informal interviews and market research more than 90 ICT tools were identified as having a strong presence on the market (market proven ICT tool) and present high levels of Innovation, potential for widespread dissemination in the market, etc. The identification of these used was based on a set of assumptions created by the BungEES team and used to create a set of criteria for grading the ICT Tools (for grading criteria see Chapter 5).

4.1 Reaching out to energy service companies, online survey

The choice for an online survey instead of a traditional questionnaire sent by email or a phone interview was made due to the fact that the target of this survey are ESPCs/ESCOs spread across the BungEES partners home countries. The use of traditional contact techniques takes take and usually the success rate is much smaller. This type of surveys is better to reach out companies in different countries and time zones. Additionally, the online survey offers other key advantages, such as:

- **Time and cost effectiveness** - Compared to traditional survey methods such as phone calls or in-person interviews, online surveys have a high time and cost-effectiveness. They reduce logistical costs such as travel, printing, or staffing, making it a more budge and environmentally friendly way to gather valuable data;

- **Convenience and Flexibility**: Energy service professionals are often busy, and an online survey allows them to respond at a time that suits them best. Participants can complete the survey at their convenience (can even make it step by step in different periods of time), which tends to increase participation rates;

- **Faster Data Collection and Analysis**: Responses are collected instantly and stored digitally in GDPR compliant platform[11], making it easier to analyse data in real-time. This speeds up the process of gathering insights, allowing for quicker decision-making and reporting;

- **Anonymity and Honesty**: Many respondents feel more comfortable providing honest feedback when they can do so anonymously online. This can lead to more candid insights that might be withheld in face-to-face interactions;

- **Customization and Flexibility**: Online surveys allow for easy customization. Questions can tailored and customized based on the type of energy service company, size, or market focus. The survey can

[10] GDPR - General Data Protection Regulation - https://gdpr.eu/what-is-gdpr/

[11] The survey was disseminated through the university of Coimbra online platform called Lime survey at: https://ls.uc.pt/index.php/379821?lang=en

also incorporate a variety of question types, such as multiple-choice, ranking, or open-ended, making it adaptable to your research needs;

- **Environmentally Friendly**: In keeping with the ethos of sustainability that many energy service companies prioritize, using an online survey eliminates paper waste and aligns with eco-friendly practices.

By using an online survey, it is possible to efficiently gather valuable data, minimize costs, and tap into the collective expertise of energy service companies to better understand industry trends and challenges.

Taking a closer look at the online survey the main objective of this survey is to collect inside information and details on the ICT tools and Automated Mesaurement and Verification Techniques - AMVT (for Deliverable 3.5) used by the ESPCs/ESCOs, as well as to identify what they consider to be purpose of these tools. Additionally, the BungEES online survey intended to collect data on what ESPCs/ESCOs consider to be the multiple benefits in the use of ICT tools, as well as the future of ICT tools and AMVT for the years.

The ICT tools grading criteria and the tools score board (top 5 of tools with the highest score) is presented in Chapter 5 off this Deliverable. More details and grading of the remaining ICT can be found in Annex B.

As previsously mentioned the outcomes from online survey and informal interviews to ESPCs/ESCOs is presented in an aggregated way (see Annex B) to guarantee data anonymity according to European Regulations, namely GDPR[12].

4.2 Market research

Conducting market research on available ICT (Information and Communication Technology) tools for energy efficiency in buildings requires a well-structured approach to ensure that the information is collected using a standardized, comprehensive and accurate method. To guarantee the standardization of the data gathered, a template was created (see table used in Annex B) to assure that all ICT tools are analysed in a structured, balanced and equivalent way.

To ensures the quality of the data gathered in the market research, a robust strategy was defined and the following procedure was used:

- ✓ **Definition of the research objectives**
  - ➢ Start by clearly outlining the objectives of your research. Some key questions might include:
    - What are the most commonly used ICT tools for energy efficiency in buildings?
    - What are the features and functionalities of these tools?
    - Which companies or providers dominate the market?

[12] GDPR - General Data Protection Regulation - https://gdpr.eu/what-is-gdpr/

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- What is the innovation level of these tools (e.g. use of Artificial intelligence and/or machine learning algorithms)?
- Market positioning of the company, product or service?
- What are the technical specifications of the ICT tools (e.g. allows remote installation or operation, real-time control/operation, type of interface, etc.)?
- What are the commercial specifications of the ICT Tools (e.g. type of users (residential, SMEs or industrial), number of customers, etc.)?
- How are ICT tools contributing to improvements in energy efficiency in buildings?

➢ A clear understanding of what you need to achieve will help in focusing the research.

✓ **Identification of the key market players, startups and innovative products entering the market**

➢ Conducting comprehensive research is the foundation of identifying key players and innovative companies in the market;

➢ To do this the team consulted industry forums, websites, reports, publications, press releases and news outlets to checks which companies are being highlighted in the market due to innovative products or research advancements in ICT tools for energy efficiency in buildings;

➢ The BungEES partners have a strong knowledge of the energy efficiency market, which allowed to identify a large number of companies developing work in the field of ICT tools for buildings.

✓ **Review of existing literature, reports and product data sheets**

➢ A thorough review of existing literature, reports, and case studies was made to understand the current state of ICT tools for energy efficiency in buildings;

➢ For this literature review several sources of information was used, some examples are: white papers and reports from industry and organizations like the International Energy Agency (IEA) or the U.S. Department of Energy, academic articles (from conferences, journals or technology reviews) on smart building technologies, namely ICT Tools for improving energy efficiency in buildings;

➢ Reports from other research and or consultancy companies/institutions that focus on energy efficiency and digitalization of energy services in buildings were consulted for this literature review;

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- This step was very important to build a foundational understanding of the ICT tools and technologies that they will be managing (monitoring or controlling) and their application in a real-world environment.

✓ **Conduct a Competitive Landscape Analysis**

- An extensive market research was performed. This research includes major players in ICT tools available for energy efficiency in buildings. As already mentioned, startups and other companies with innovative ICT tools entering the market were also included in this market research. The key players and the companies entering in this market, develop ICT tools for:

  - Buildings Energy Management Systems – BEMS;
  - Smart sensors, meters, smart thermostats, Electric Vehicle charging, Energy storage systems and other IoT devices;
  - Smart appliances;
  - AI/ML-based energy optimization software and automated data analytics platforms
  - Cloud-based monitoring and automation tools;
  - Etc.

- Creation of a detailed comparison matrix (table used in Annex B) to compare these tools. The information gathered in this matrix in combination with a well-defined set of grading criteria (see Chapter 5) will allow to obtain a good overview of potential of the available ICT tools in the market. Additionally, it will be essential to identify innovative ICT tools entering the market, presenting high energy savings potential;

- This analysis helps to identify the strengths and weaknesses of the different solutions.

✓ **Landscape Analysis of the market trends and future innovations**

- While researching, it is crucial to stay aware of emerging trends and innovations in the ICT and energy efficiency space. During the research a special attention was paid to:

  - The increasing role of AI and ML algorithms in energy efficiency;
  - The rise of smart grids and smart buildings and their interaction with building energy management systems;
  - Increasing focus on interoperability between different energy assets, or the ability of ICT tools to incorporate different energy services/assets

- Predicting future trends can help in understanding where the market is headed and what new technologies may emerge over the next years.

✓ **Synthesize and Report Findings**

- Once all data has been collected, synthesize the information into a comprehensive report (Deliverable D3.4). This report should cover:
  - The ICT tools portfolio of the largest market players;

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- Innovative ICT tools from startups or other companies entering the market or with significant potential;
- A competitive analysis of and grading of the collected ICT Tools;
- An overview of available ICT tools (top 5 or top 10 ICT tools) for energy efficiency in buildings;
- ICT tools market trends and future outlook;
- Identification of potential EES market needs and opportunities for ICT tools
- Finally, ensure that the report is accessible and adequate for your audience and highlights the most critical findings and presents them in a clear and concise format.

By following these steps, the BungEES team created a thorough market research strategy that provides detailed insights into the current ICT tools available for energy efficiency in buildings, as well as an overview on the future trends in the ICT tools development industry. This research can guide decision-makers in choosing the right tools to optimize energy use, reduce costs, and meet sustainability goals.

5. Data Analysis

This analysis includes all the data types, which were aggregated, sorted and prioritized by the researchers based on the defined criteria before the grading process and described below. By presenting results through this method the anonymity of the collected data is guaranteed.

5.1 Set of Criteria Used to Compare and Grade the ICT Tools

With the data collection gathered within the scope of Chapter 4 the BungEES obtained a good overwiew of ICT tools available in the market. However, it is important to group the tools and compare them to better understand each ICT tools specificities, advantages, disavantages or its market profile in term of innovation (e.g. disruptive, transformative, etc.). For these reasons the following set criteria were choosen. These criteria allows to compare all the ICT tools and the respective developer company/business in a balanced and even way in order to extract the conclusions relevant to the reseach questions.

Table 1 - Grading criteria

Nº	Criteria Name	Scoring options and grading			
1	**Uses Machine Learning (ML) and/or Artificial Intelligence (AI) algorithms?**	NO – 0 points	N/A[13]		YES - 3 Points
2	**Market positioning of the company, product or service.**	Unknown – 0 Points	Mature well-established – 1 Point	Start-up – 2 Points	Innovative - 3 Points
3	**Number of users and/or customers.**	Unknown – 0 Points	Less than 50 – 1 Point	Between 50 and 100 – 2 Points	More than 100 - 3 Points
4	**Type of users and/or customers (residential/SME/Industrial)**	Unknown – 0 Points	At least one type of user - 1 Point	N/A	All types of users - 3 Points
5	**Number of services and/or assets that can be managed**	Unknown– 0 Points	Less than 5 – 1 Point	Between 5 and 10 - 2 Points	More than 10 – 3 Points
6	**Type of product or service (monitoring, management and control)**	Unknown – 0 Points	Only monitoring - 1 Point	Monitoring and management - 2 Points	Monitoring, management and control - 3 Points
7	**Product availability**	N/A	Only outside Europe - 1 Points	In some European contries- 2 Points	In all European countries - 3 Points
8	**Requires phisical installation of hardware at end-user facilities?**	Unknown - 0 Points	YES – 1 Point	N/A	NO – 3 Points
9	**Does it allow remote action/use/operation?**	Unknown - 0 Points	NO – 1 point	N/A	YES – 3 Points
10	**Does it allow control actions in real time (e.g. each 5 minutes, 10 minutes, etc.)?**	Unknown - 0 Points	NO – 1 point	N/A	YES – 3 Points

[13] N/A – Not Aplicable to this criteria

11	**Type of interface (API, Web portal)?**	Unknown - 0 Points	NO[14] – 1 point	N/A	YES – 3 Points
12	**Supports energy flexibility ?**	Unknown - 0 Points	NO – 1 point	N/A	YES – 3 Points

5.2 Scoring the ICT Tools

Applying the above mentioned set of criteria to all the ICT tools gathered within the scope of Chapter 4 the following outcomes are obtained:

Table 2 - Top 10 ICT Tools

TOP 10 - ICT Tools (all criteria)		
Position	**ICT Tool Name**	**Company Name - Developer**
#1	Building X	Siemens
#2	Cleanwatts™ OS	Cleanwatts Energy S.A.
#3	Desigo CC / Design Optic Management Software	Siemens
#4	É.visor	Limón
#5	Inavitas EMS Platform	Inavitas
#6	Kiome® / Kiplo® / Kisense®	Cleanwatts Energy S.A.
#7	MyVoltalis / Voltalis Pro /Voltalis H	Voltalis
#8	DABBEL	Dabbel Software Solutions
#9	Delta System Controllers - DSC	Delta Controls
#10	EcoStruxure (Building Advisor / Power Monitoring Expert 9.0 / Facility Expert / Power Advisor / SCADA Operation / Security Expert)	Schneider Electric

It is apparent that large companies (e.g. Siemens and Schneider Electric) have a strong presence in this market, with tools that have some overlap in terms of scope but seem to target different end users and differ in terms of complexity and user interface. More recent companies like Cleanwatts Energy S.A. and Limón or Inavita are already presenting market differentiation solutions, perhaps due the used of ML, AI, high interoperability and user friendly interfaces this companies may have a significant role in the market over the next years.

The next figure presents screenshots from some of the ICT tools presented in Table 2.

[14] Only possible with manufacturer software, platform or APP

Figure 10 - Screenshots extracted from ICT presented in Table 2

The next table presents an analysis were the criteria are used to evaluate the degree of innovation (criterium 1), the company or product positioning in the market (criterium 2) and the range of users/customers of these ICT tools.

Table 3 - Top 5 Innovation

TOP 5 - Innovation (Criteria #1, #2 and #4)		
Position	**ICT Tool Name**	**Company Name - Developer**
#1	Cleanwatts™ OS / FleXunity APP	Cleanwatts Energy S.A.
#2	MyVoltalis / Voltalis Pro /Voltalis H	Voltalis
#3	Energis	Energis S.A.
#4	EnergyElephant	Energy Elephant
#5	EnergyLogix Tools & Services	EnergyLogix

The most relevant criterium in this analysis is criterium 1 (use of ML and/or AI algorithms) because that has a direct impact in terms of the product beeing innovative (criterium 2). Criterium 4 was used to differenciate the tools by giving more score to the ones that can be used by a higher range (type) of

users/customers. It should also be noted that in this analysis another aspect considered for Innovation grading was the purpose of the tool. Most of the tools in Table 3, the purpose is to generated energy-savings for end-users, but the tools developed by Voltalis in addition to energy-savings they are also creating flexibilty (especially in pead demand periods) for the energy grid. This creates flexibility-as-a-service wich is an innovative business model.

A special mention needs to be done made into an ICT tool which is still under development in a pilot stage. This tool is not market available which does not allow to apply the set of criteria mentioned in Section 5.1. Due to this it was not possible to score this tool. Althrough, its apparent high level of innovation justifies this special mention.

Special mention – ICT Tools	
ICT Tool Name	**Company Name - Developer**
Name not defined - Product still under development	E.ON Ubirch

Ubirch is a German cyber security company that is buildiung a digital infrastructure for developing neighbourhood-specific electricity tariffs. The company is developing this new innovative product that offers customers, for the first time the benefit of knowing when and by whom each individual kilowatt hour is produced and consumed.In the future, this new cyber security technology, can be integrated with smart grids and meters, and may provide customers more attractive tariffs more accurate to the individual kWh and can help citizens to create energy communities.

A consortium formed by Ubirch and E.ON launched in Germany a nationwide pilot project to develop a “plug and play” solution with around 100 households. After the successful development phase, the teams are now integrating the innovative energy certificate into E.ON products supplying energy communities with decentralised, locally generated energy. This ICT tool used in thsi project uses blockchain and cryptography which represents a technological breakthrough for collaborative and sustainable energy use, smart meter applications and smart grids. The real-time capability of this solution enables customers and members of energy communities to act more actively according to their role in the energy transition. For more information please see Annex B.

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6. Identification of EES Market Needs, Opportunities and Trends Related to ICT Tools

The energy efficiency services market encompasses a wide range of activities aimed at reducing energy consumption, including energy audits, retrofitting of buildings, deployment of smart technologies, and the implementation of energy management systems. This market has experienced a significant growth in the most recent years as global concerns about climate change and resource conservation have intensified. Additionally, this robust expansion of EES market was also aided by a combination of regulatory pressure, rising energy costs, and an increasing in corporate emphasis on green-thinking, circular econmy and decarbonization.

Moreover, the global focus on sustainability, climate crises and the reduction of carbon footprints has driven and motivated a very strong interest in the energy efficiency services market. Governments, businesses, and consumers and prosumers alike are seeking solutions/services that not only reduce energy consumption but also improve overall operational efficiency. This situation created a positive environment for EES which are critical for improving energy consumption, reducing waste, and fostering a more sustainable approach to managing resources.

The ESPCs need mechanisms that could support their project and at the same time improved their overall efficiency and Information and Communication Technology (ICT) tools emerged as pivotal enablers in this context, offering innovative ways to monitor, analyze, and optimize energy use across various sectors. The role of ICT tools in this market is evolving rapidly, offering new opportunities to meet the market needs and address the challenges associated with energy efficiency.

This Chapter of Deliverable 3.4 aims to explore the market needs for energy efficiency services, highlighting key opportunities, and an analysis how ICT tools can be leveraged to meet these demands. First it important to look at the current landscape of energy efficiency services, followed by an analysis of the market trends and emerging needs. Then this report will explore the opportunities created by the integration of ICT tools and technologies to enhance energy efficiency initiatives, considering both technical and business aspects.

6.1 Energy Efficiency Services Market Needs

Understanding the market needs for energy efficiency services is crucial for identifying opportunities. These needs can vary widely between sectors, but some needs are common to all sectors, such as:

- **Real-time energy monitoring and analytics -** One of the most pressing needs in the EES market is the ability to monitor energy consumption in real-time. Traditional energy audits, which provide a snapshot of energy usage, are no longer sufficient. Businesses and consumers want access to continuous, real-time data to understand their energy consumption patterns and identify areas for improvement. The real-time monitoring allows users to identify energy waste immediately, optimize energy usage dynamically and adjust behaviour or operations based on energy consumption data;

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- **Integrated solutions -** EES often involve multiple stakeholders, including facility managers, energy consultants, and technology providers. There is a need for integrated solutions that can bring together various data sources and provide a unified view of energy performance. ICT tools such as cloud-based energy management platforms can facilitate this integration, enabling better coordination and more effective decision-making;

- **Predictive maintenance and performance optimization -** Energy efficiency is not just about reducing consumption but also about optimizing the performance (e.g. reduction of equipment downtime, etc.) of energy assets. There is a growing demand for solutions that can predict when equipment or systems are likely to fail or require maintenance. Predictive maintenance, powered by ICT tools using AI and ML algorithms, as well as data analytics helps to reduce downtime, improve energy efficiency, and extend the equipment lifespan. For example, smart sensors can detect when an HVAC system is working less efficiently and automatically schedule maintenance before a breakdown occurs. This level of automation and intelligence is a key need in the EES market, especially in energy-intensive industries like manufacturing and commercial buildings;

- **Integration with smart grids and renewable energy sources -** As smart grid technology evolves in combination with rapidly growth of renewable energy sources and battery storage systems, there is an increasing need for energy efficiency services that can integrate seamlessly with these systems. The ability to balance energy demand and supply in real time, especially with intermittent renewable sources like wind and solar, is critical. Consumers, utilities, and businesses need mechanisms and tools that are able to integrate storage systems and renewable energy systems, monitor and manage energy consumption/production dynamically in response to grid conditions, as well as provide demand response capabilities to balance load and prevent grid overload;

- **User-friendly energy management platforms -** Energy Management Systems (EMS) need to become more user-friendly and affordable. There is a demand for platforms that can easily be used by non-energy experts, offering intuitive interfaces and actionable insights. These platforms should be able to present complex energy data in a way that is easily understandable, enabling users to take informed decisions about energy usage. Businesses, in particular, need solutions that can provide detailed insights into energy usage patterns across different departments, facilities, or geographical locations. For residential users, smart Home Energy Management Systems (HEMS) must be easy to use and be able integrate with other home automation tools/systems from different manufacturers;

- **Enhanced User Engagement** - Engaging users in energy efficiency initiatives is crucial for achieving long-term success. ICT tools can support this by providing interactive and user-friendly interfaces that make it easier for stakeholders to understand energy data and take action. For example, gamification elements (application of game-playing elements to another type of activity, such as information screens, badges, and leaderboards, etc.) and personalized recommendations can encourage users to adopt energy-saving behaviors.

- **Affordable, cost-effective, flexible and scalable Solutions -** Cost remains a significant barrier for many organizations and individuals looking to invest in energy efficiency services. There is a need for more affordable, cost-effective and scalable solutions, especially for Small Medium Enterprises (SMEs) and residential users. Cost-effectiveness of EES is not a problem, but for most companies the upfront costs are a barrier that despite the high cost-effectiveness of EES, can not be overcome. Solutions that offer flexibility and modularity, where users can start with basic features and scale up as needed, are increasingly in demand. Efficiency-as-a-service can help to overcome the upfront cost barrier by providing an affordable service without upfront investment if ESPCs are able to present an EES service package at an affordable price.

- **Regulatory compliance and reporting -** Businesses need solutions that help them comply with energy efficiency regulations and report their performance to regulatory bodies. This includes generating energy audits, producing carbon footprint reports, and ensuring adherence to environmental standards. There is also a need for tools that can simplify the process of applying for energy efficiency grants, rebates, and incentives.

6.2 Energy Efficiency Services Market Opportunities

The next step is to identify the EES market opportunities for ICT tools. These tools play a pivotal role in the digital transformation of the energy sector, offering innovations that can unlock new capabilities and boost the overall efficiency. The following points present potential opportunities created by the used of ICT tools:

- **Market expansion -** The increasing adoption of smart technologies in homes and businesses presents a significant opportunity for companies developing ICT tools. IoT devices such as sensors, smart thermostats, lighting systems, appliances, etc. that can be controlled and monitored remotely are becoming more common, providing more business either for smart equipment and for ICT tools developers;

- **Advanced data analytics systems, artificial intelligence and machine learning systems -** One of the most transformative opportunities lies in the application of advanced data analytics combined with AI and ML algorithms. ICT tools can collect vast amounts of data from smart meters, sensors, and other IoT devices, allowing for granular insights into energy consumption patterns. AI and ML algorithms can then analyse this data to identify inefficiencies, predict future energy usage, optimize performance and identify future trends;

- **Predictive analytics systems –** These systems can help organizations to forecast their energy consumption, identify areas for improvement, support the maintenance department in the implementation of predictive maintenance systems and improve the buildings/facility operational performance;

- **Automated anomaly and fault detection system -** These systems can notify users of unusual spikes in energy consumption, potentially signalling equipment malfunctions/fault or

inefficient procedures. For example, Google's use of ML to optimize the cooling systems in its data centres, which has led to a 40% reduction in energy usage[15], demonstrating the potential of these technologies to drive significant savings;

- **Internet of Things (IoT) and Smart Sensors -** The Internet of Things (IoT) has revolutionized energy efficiency by enabling devices and systems to communicate and interact with each other. IoT devices, such as smart devices (e.g. sensors, meters, lighting and thermostats), can provide real-time data on energy usage, environmental and lighting conditions, as well as equipment performance. This data can be used to optimize energy consumption, improve building management, and reduce operational costs;

- **Connected HVAC systems** - These systems can adjust temperature settings dynamically based on building occupancy, external weather conditions (including weather forecast) and even based on the electricity tariffs. The IoT-based solutions for HVAC provide a high degree of automation, allowing users to optimize energy use without onsite intervention.

- **Cloud-Based Energy Management Systems -** Cloud computing offers significant advantages for energy management systems. Cloud-based platforms provide scalable, cost-effective solutions for monitoring, controlling, and optimizing energy consumption. Users can access their energy data from anywhere and receive real-time updates and insights. Moreover, cloud-based systems can integrate with various devices and systems, making them highly adaptable for both large organizations and small businesses. The cloud system also enables more sophisticated analytics, allowing users to leverage powerful computational tools without the need for significant on-premises IT infrastructure;

- **Blockchain for energy transactions and transparency -** Blockchain technology presents an emerging opportunity in the energy efficiency market. By creating transparent, secure, and decentralized systems, blockchain can facilitate energy trading between consumers, producers, and utilities. Peer-to-peer energy trading, enabled by blockchain, allows consumers to buy and sell excess renewable energy (e.g. solar power) directly to other consumers in the grid. In addition to energy trading, blockchain can enhance the transparency and traceability of energy consumption and savings, providing verifiable records for regulatory compliance and environmental reporting;

- **Artificial intelligence and machine learning for the autonomation of energy management -** Artificial intelligence (AI) and Machine Learning (ML) algorithms play a crucial role in the future of EES. AI/ML-powered systems can autonomously manage energy consumption, making real-time decisions (without human intervention to optimize efficiency. AI and ML are set to play a transformative role in the energy efficiency services market, these technologies can be used to develop predictive models that forecast energy demand, identify patterns of inefficiency, and automate energy-saving actions. AI/ML algorithms can analyze historical energy use data to predict when and where energy waste is likely to occur and suggest corrective measures. For example, AI/ML algorithms can control heating and cooling systems in large commercial buildings, adjusting settings based on real-time occupancy data, weather

[15] https://www.datacenterknowledge.com/management/google-is-switching-to-a-self-driving-data-center-management-system

conditions and forecast, as well as energy prices. AI and ML can also enhance demand-side management by automating responses to energy grid signals, ensuring that energy consumption is adjusted during peak times to reduce strain on the grid and lower costs for consumers;

- **Digital Twins for Energy Optimization -** Digital twins are virtual models of physical systems offering another exciting opportunity for energy efficiency services. A digital twin can simulate the performance of a building or system in real-time, allowing for more accurate predictions and optimizations. For example, a digital twin of a factory's energy infrastructure can help managers understand how changes in production schedules or equipment configurations will impact the energy usage patterns. By providing a virtual testing ground for energy efficiency strategies, digital twins reduce the risk of implementing costly or ineffective solutions.

6.3 Emerging Trends in ICT Tools for Energy Efficiency Services Market

The rapid advancement of technology has introduced new opportunities in the energy efficiency services market. These emerging trends in ICT tools are reshaping how energy is monitored, managed, optimized, and conserved across various sectors.

Below are some of the key trends, some already impacting the market, and other that will have impact inthe medium-run:

- **Artificial Intelligence & Machine Learning for Predictive Optimization** - Many new ICT tools are already using AI and ML algorithms to predict energy usage patterns and adjust building systems, predict equipment failures before they occur, analyse historical data to detect patterns that indicate when a machine/systems is likely to fail, allowing for proactive maintenance and predict future energy consumption based on historical data, weather conditions, and occupancy patterns which will help to optimize energy usage and reducing peak demand costs;

- **IoT and Smart Sensors** - The integration of IoT devices is transforming the landscape of energy management by offering real-time data and control options;

- **Building-to-Grid Integration -** Energy efficiency is being extended to the grid, with buildings acting as "smart" components, due to the use of solar PV and battery storage systems, that can adjust energy consumption based on grid demands;

- **Cloud-based Solutions** - Cloud solutions that allow remote monitoring, automation, and control of building systems are becoming more popular, enabling buildings to reduce their energy consumption more efficiently;

- **Integration of Blockchain for Energy Trading -** Blockchain technology is being explored as a way to facilitate peer-to-peer energy trading, enabling consumers and businesses to buy and sell excess energy directly with one another. This creates a more decentralized and efficient energy market, reducing the need for large-scale energy storage and transmission infrastructure. Blockchain can provide a secure and transparent way to share energy consumption and savings data among stakeholders, improving trust and collaboration in energy efficiency projects. The

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integration of blockchain might create new opportunities for ICT tools to support decentralized energy markets;

- **Advancements in Edge Computing -** Edge computing allows data to be processed closer to where it is generated, such as on-site at a factory or building. This reduces latency and bandwidth requirements, enabling real-time analysis and decision-making for energy management. As the amount of data generated by IoT devices continues to grow exponentially, edge computing allows to process data closer to where it is generated. By processing data locally, edge computing supports decentralized energy management systems that can operate independently of centralized control systems. This is particularly useful in applications like microgrids and distributed energy resources. This trend will enable faster and more efficient analysis of energy data, enhancing the capabilities of ICT tools;

- **Big Data Analytics** - The massive amounts of data generated by smart meters, IoT devices, and building management systems can be analysed using big data tools to uncover patterns and trends that are not immediately apparent. This helps in identifying energy-saving opportunities and faster operational optimization;

- **Interactive Dashboards and Reporting -** Modern energy management platforms offer sophisticated visualization tools that allow users to interact with data through dynamic dashboards. This makes it easier for stakeholders to understand the complex energy data and make informed decisions, as well as it can used as educational tools for other end-user or decision makers;

- **Use of Gamification and Behavioural Change Tools and User Engagement Platforms –** The use of gamification techniques to engage building occupants, inhabitants and employees in energy-saving activities will be crucial over the next years to leverage an increase in energy efficiency levels. For example, platforms that reward users for reducing their energy consumption or participating in sustainability challenges can foster attitudes caring for energy efficiency. The use of ICT tools that are to analyse individual energy use patterns and provide personalized tips and recommendations to help users reduce their consumption will also be essential to engage consumers into the path of sustainability. This approach can significantly enhance the effectiveness of energy-saving programs;

- **Integration with renewable Energy Systems** - ICT tools are being increasingly integrated with renewable energy sources like solar and wind power. Smart grids use IoT devices to manage the intermittent nature of these energy sources, optimizing their use and reducing the need for backup power from non-renewable sources. Advanced energy management systems are now integrating with battery storage solutions, using AI/ML algorithms to determine the optimal times for charging and discharging batteries based on energy prices, demand, and availability of renewable energy;

- **Focus on Cybersecurity:** As ICT tools become more embedded in energy management, the need for robust cybersecurity measures will grow. Additionally, in the medium-run ICT tools will be developed to support resilience planning, helping organizations prepare for and respond to potential cyber threats or natural disasters that could disrupt the provision of energy services.

Adding to this, since energy systems are increasingly becoming more interconnected, the risk of cyber-attacks is increasing. It is essential that the emerging ICT tools will incorporate advanced cybersecurity measures, such as encryption and multi-factor authentication, to protect sensitive energy data and ensure the reliability of energy management systems. Ensuring the security of both energy data and energy systems will be a key concern for the market in the coming years. Moreover, as these technologies continue to evolve, they will play a critical role in advancing global energy efficiency goals.

6.4 Case Studies on the Use of ICT Tools for Improving Energy Efficiency

To support the above-mentioned opportunities and trends for the EES market the following examples of case studies are presented. These case studies are related to the use of ICT tools for improving energy efficiency in buildings and are presented in summarised form.

Case Study nº 1 - Utilization of ICT and AI Techniques in Residential Energy Management[16]

- **Context:** This case study reviews the use of ICT and Artificial Intelligence (AI) for managing energy consumption in smart cities. The integration of these technologies in traditional grid infrastructures enables effective energy management and resource utilization. Techniques such as Demand Side Management (DSM) and Home Energy Management Systems (HEMS) are used to optimize power usage, reduce energy bills, and manage peak loads.
- **Impact:** Improved energy efficiency in residential sectors, reduction in electricity costs, and enhanced grid stability.

Case Study nº 2 – ICT Enabled Energy Efficiency in the Built Environment[17]

- **Context:** Part of the REViSITE[18] project, this case study focuses on how ICT can drive energy efficiency in the built environment by drawing insights from other sectors such as energy grids, manufacturing, and lighting. The study developed a Strategic Research Agenda (SRA) to guide ICT-enabled energy efficiency efforts across these sectors.
- **Impact:** The project provided a framework for research and development priorities, promoting sustainable building practices and improved energy consumption management.

Case Study nº 3 - Power System Strength Evaluation with Inverter-Based Resources[19]

- **Context:** This case study explores the challenges of integrating inverter-based resources like wind and solar energy into modern power systems. The study discusses methods for assessing power system strength, including dynamic model reduction and the use of new metrics for evaluating system stability.
- **Impact:** Enhanced understanding of power system behaviour with integrating inverter-based resources, leading to better management of renewable energy sources and improved system resilience.

[16] https://search.library.wisc.edu/article/cdi_crossref_primary_10_21833_ijaas_2021_07_007
[17] https://search.library.wisc.edu/article/cdi_proquest_journals_1428891572
[18] https://www.revisite.eu/
[19] https://digital-library.theiet.org/content/books/po/pbpo247e

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Case Study nº 4 - Energy Efficiency in AI Model Training at Lincoln Laboratory[20]

- **Description:** The Lincoln Laboratory Supercomputing Centre has developed methods to significantly reduce the energy required for training AI models. By implementing techniques such as power-capping hardware and early stopping of underperforming models, they have managed to cut down energy consumption by up to 80% during the training process. These techniques allow data centres to operate more efficiently without compromising the performance of AI models, thus promoting a wider use of green computing and energy transparency.
- **Impact:** Reduced energy consumption in data centres, lower operational costs, and extended hardware lifespan by reducing cooling needs and stress on systems.

Case Study nº 5 - Grid-Interactive Efficient Buildings (GEB) Initiative by the Department of Energy[21]

- **Description:** The GEB Initiative focuses on transforming buildings into flexible and efficient energy resources by integrating smart technologies and communications. This initiative aims to enhance energy efficiency, reduce emissions, and support the grid by combining energy management systems, advanced controls, and demand flexibility technologies. The GEB Initiative involves several projects across residential and commercial buildings, including the deployment of smart controls, sensors, and analytics to optimize energy use and grid interaction.
- **Impact:** The initiative has demonstrated significant energy savings and increased building performance, contributing to lower energy costs and improved grid resilience.

Case Study nº 6 - Building Technology and Urban Systems at Lawrence Berkeley National Laboratory (LBNL)[22]

- **Description:** LBNL's Building Technology and Urban Systems Division is at the forefront of research in energy-efficient building technologies. They work on a range of topics, including advanced building controls, energy analytics, and smart windows. One of their notable projects involves developing self-correcting building control systems that automatically resolve energy inefficiencies in commercial buildings, significantly reducing energy use and operational costs.
- **Impact:** This research has led to advancements in building automation and control systems, contributing to reduced energy consumption and enhanced building performance.

These case studies illustrate the diverse applications of ICT in enhancing energy efficiency, from residential management to large-scale power systems in services and industrial buildings.

[20] https://www.ll.mit.edu/news/ai-models-are-devouring-energy-tools-reduce-consumption-are-here-if-data-centers-will-adopt
[21] https://www.energy.gov/eere/buildings/grid-interactive-efficient-buildings
[22] https://buildings.lbl.gov/energy-analytics

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7. Conclusions

The collection on data on ICT tools, as well as other tools that are crucial to the companies business model, is challenging due to the strategic importance of these solutions in private business. Companies tend to to resist to disclosure this infomation. In the BungEES survey within the scope of this Deliverable 3.4, this was not different. The majority of the online survey respondants mentioned that the some ICT tools they use are tailor made due to specificities of their IT infrastructure/equipment or business model. Additionally the respondants were not willing to disclosure details (name, operational information, capabilities, etc.) on the ICT tools they used, even though they had less hesitance to share information related to the ICT tools purpose of use.

The methodology used that combined the use of online survey, specific semi-structured interviews and market research revealed to be a good option, by using different sources of information the obtained ICT tools allowed to have a better picture of the ICT tools market, as well as on the market needs and potential opportunities.

The collected data releaved that large companies like Siemens or Schneider Electric tend to have a strong presence due (large portfolio of ICT tools) to its financial capacity and brand recognition. However, other innovative companies like Cleanwatts Energy S.A., Energis or Energy Elephant are starting to make a stand in the market and may have an importat role in the future.

The integration of ICT tools into energy efficiency services offers a range of opportunities to meet the evolving needs of the market. As businesses and individuals strive to reduce energy consumption, lower costs, and comply with increasingly stringent regulations, the demand for advanced, user-friendly, and cost-effective energy management solutions will continue to grow over the next years.

To fully capitalize on the above-mentioned opportunities (see section 6.2), ESPCs/ESCOs and ICT tools developers must continue to innovate and adapt to the changing landscape of the energy sector, focusing on delivering scalable, user-centric solutions that meet the diverse needs of the market. With the right combination of technology and strategy, the energy efficiency services market does have potential for substantial expansion in the coming years.

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Annex A: Questionnaire used in the online survey

BungEES - WP3 Surveys - ICT Tools + Automated measurement & verification techniques

Description
Message
There are 12 questions in this survey.

Part 1

This survey is divided in three parts.

- Part one includes personal details and organization/company details.

- Part two requests inputs regarding the business characteristics and ICT tools used.

- Part three needs information regarding the use of automated measurement & verification techniques and user engagement.

Please answer the following questions which are related to the projects developed or under development by your organization

*

Please write your answer(s) here:

Name:

Email:

Organization/Company name:

Location - Country:

Location - City:

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Part 2 - ICT tools

Building Up Next-Generation Smart Energy Services Offer and Market Up-take
Valorising Energy Efficiency and Flexibility at Demand-Side.

Grant Agreement Number: 101077101 - LIFE21-CET-SMARTSERV-BungEES

Co-funded by the European Union

In the projects developed and implemented by your organization which ICT tools are used to measure and evaluate the project performance?

Please list all the ICT tools used by your organization (software included).

For additional ICT tools please add them in field "Other".

Comment only when you choose an answer.

Please choose all that apply and provide a comment:

- [ ] ICT Tool n°1
- [ ] ICT Tool n°2
- [ ] ICT Tool n°3
- [ ] ICT Tool n°4
- [ ] ICT Tool n°5
- [ ] ICT Tool n°6

Other:

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For each of the previously mentioned ICT tools, please list the purpose of its use (e.g.Automated Measurement and Verification).

Additional purposes please add them in field "Other".

ⓘ Comment only when you choose an answer.
Please choose all that apply and provide a comment:

- ☐ Purpose of ICT Tool nº1:
- ☐ Purpose of ICT Tool nº2:
- ☐ Purpose of ICT Tool nº3:
- ☐ Purpose of ICT Tool nº4:
- ☐ Purpose of ICT Tool nº5:
- ☐ Purpose of ICT Tool nº6:

Other:

Please select what you consider to be the benefits of using ICT tools.

Note: Please select as many benefits as necessary

ⓘ Check all that apply
Please choose **all** that apply:

- ☐ Automated measurement and verification
- ☐ Monitoring and operational management
- ☐ Enhanced data analytics
- ☐ Data management and improved accessibility to data
- ☐ Enhanced productivity and efficiency
- ☐ Improved customer service
- ☐ Cost reduction (including maintenance)
- ☐ Security and resource management
- ☐ Predictive capabilities (including maintenance optimization)
- ☐ Innovation and competitive advantage
- ☐ Increased resilience
- ☐ Resource planning
- ☐ Increased flexibility
- ☐ Assure compliance with energy regulations
- ☐ Reduction of carbon footprint

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Please insert other potential benefits (not included in the previous question) of using ICT tools.

Indicate as many as necessary.

Please write your answer here:

Please list the ICT tools (software included) that your organization plans or is interested to adopt in the future (either in the short, medium or long term).

ⓘ Comment only when you choose an answer.
Please choose all that apply and provide a comment:

- ☐ Planned ICT Tool n°1
- ☐ Planned ICT Tool n°2
- ☐ Planned ICT Tool n°3
- ☐ Planned ICT Tool n°4
- ☐ Planned ICT Tool n°5
- ☐ Planned ICT Tool n°6

Please insert other potential ICT tools that your organization is planning or considering to use in the future (either in the short, medium or long term).

Please write your answer here:

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Part 3 - Automated measurement & verification techniques and user engagement

Building Up Next-Generation Smart Energy Services Offer and Market Up-take
Valorising Energy Efficiency and Flexibility at Demand-Side.
Grant Agreement Number: 101077101 - LIFE21-CET-SMARTSERV-BungEES

Co-funded by
the European Union

Does your company use any type of measurement and verification protocol (e.g. IPMVP- International Performance Measurement and Verification Protocol, internal measurement and verification plans or procedures, etc.)?

ℹ Check all that apply
Please choose **all** that apply:

- ☐ No
- ☐ Yes. (Please list in the next question which type of automated measurement and verification protocols are used in your organization)

If you have answered **YES** in the previous question, please answer this question and list bellow which automated measurement and verification systems have been used in your organization projects.

Otherwise please answer **NO** and move to the next question.

Please write your answer here:

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From the list of automated measurement and verification systems bellow please select the one(s) you think your company might be interested in using in the future (either in the short, medium or long term).

Note: Please select as many as needed.

ℹ Check all that apply
Please choose **all** that apply:

- ☐ Smart metering (including sub metering of specific loads or circuits)
- ☐ Remote energy monitoring system
- ☐ Remote power quality system
- ☐ EMS - Energy Management System
- ☐ BAS – Building Automation System
- ☐ Building energy simulation/modelling software
- ☐ AFDD – Automated Fault Detection and Diagnostic
- ☐ Energy analytics platforms (e.g. systems using machine learning and/or artificial intelligence for systems optimization)
- ☐ Predictive maintenance systems (using machine learning and data analytics)
- ☐ Energy benchmarking tools (to optimize the energy use through comparison with similar buildings)
- ☐ Automated demand response system
- ☐ Automated building control systems (e.g. smart thermostats, lighting, HVAC, information dashboards) with predictive capabilities based on building occupancy and weather conditions)
- ☐ Automated systems based on Artificial intelligence (AI) and/or Machine Learning (ML) techniques

Please insert any additional (not considered in the previous question) automated measurement and verification systems that your organization might be interested in using (either in the short, medium or long term).

Please write your answer here:

The BungEES project team would like to express the deepest thanks for the time spent on this survey.

In the future we hope to continue to have your valuable collaboration.

Please send us comments and suggestions (in the answer box bellow) related to this survey or to smart energy services in buildings.

Please write your answer here:

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Annex B: ICT Tools Collected for this Deliverable

ICT Tool Name	Company Name	Website	Short Description	Field of Application	Score
Building X	Siemens	https://www.siemens.com/global/en/products/buildings/building-x.html	Building X is a scalable digital building platform to digitalize, manage and optimize building operations, allowing for enhanced user experience, increased performance and improved sustainability. The benefits of Building X are: ● Unlocking the buildings full potential through monitoring and managing buildings with different lifespans and systems – on a single platform; ● Deconstructing complexity by having access to building data from multiple sources, disciplines, and systems on a single cloud-based platform without compromising cybersecurity; ● Empowering people because no matter your role in building operations and management, you'll have the right data, at the right time and right place; ● Increased performance due to the use of a single-platform principle of Building X that provides a seamless user experience for fast access to the data needed for informed decision-making; Outperforming with Artificial Intelligence (AI). With AI, Problems can be detected before they occur, optimization of operational costs, and precisely predict tomorrow's energy consumption with yesterday's data.	Building Management	35
Buildings Energy Management	Eficia smart building	https://eficia.com/en/energy-monitoring-platform/	A responsive SaaS platform, compatible with all browsers on the market, to effectively monitor and control the energy performance of your real estate assets.	SAAS based energy monitoring	33

				web platform (API)	
Cleanwatts™ OS	Cleanwatts Energy S.A.	https://cleanwatts.energy/cleanwatts-os/	Cleanwatts offers its clients an energy infrastructure-as-a-service with zero upfront investment, smart energy efficiency-as-a-service and a skilled team to take care of the entire process providing customized turn-key solution to its customers. Cleanwatts™ OS is a community energy management platform with modular, interoperable and localizable solutions. The community energy management platform. Modular, Interoperable & Localizable. Cleanwatts™ OS connects the dots between through: • Behind-the-meter optimization for the energy community members; • Front-of-the-meter grid resiliency; • Transaction management for local energy markets. In terms of front of the meter Cleanwatts™ OS gives its customers the possibility of taking advantage of flexibility services, energy market trading, asset management at community level (generation, consumption and storage) and inter/intra community energy settlements. Additionally, it allows behind the meter energy management & efficiency for consumers/prosumers.	Energy Management software/platform	35
DABBEL	DABBEL Software Solutions	https://www.dabbel.eu/	Technologies to optimise building management systems – and operations such as heating, ventilation, and air conditioning – are essential to the green energy transition. That's where the new customer product DABBEL, which uses artificial intelligence (AI) to save energy, comes in.	Energy Management Software with AI capabilities	34

			DABBEL's software directly targets the operational energy consumption of buildings. Using sensors and algorithms, it collects data on a continuous basis according to changing conditions such as temperature, CO2 levels and humidity. Thousands of data points per minute are collected from internal conditions, but also external ones such as weather data too. The technology uses all this information to adjust each building's heating, ventilation, and air conditioning in real time. The AI behind DABBEL "learns" how different parts of each building reacts to changing conditions – for example, DABBEL might learn that a room with thicker walls takes longer to heat up and cool down than other parts of the building, and therefore will time the heating earlier or later of that room. On a sunny day, it may turn down the room's heating altogether. As DABBEL gets more sophisticated in its decision-making, building management systems are optimised to conserve maximum energy (e.g. at a specific pilot site DABBEL's technology has saved 26% of energy consumption on average). Since DABBEL is an Internet-based software without any hardware or equipment component, scaling is expected to be fast and straightforward. DABBEL can be installed and up-and-running in any building in no more than a week's time. Customers only pay a monthly product fee to use DABBEL – a cost which usually pays for itself in saved energy fees.		
Deepsights	Bosch	https://www.bosch-softwaretechnologies.com/en/services/enterprise-services/energy-platforms/deep-sights/	DEEPSIGHTS platform allows you to make informed decisions about energy-saving that results in lower energy costs. DEEPSIGHTS is a digital suite that targets energy, utility conservation, and sustainability. It enables enterprise-wide accountability, transparency and promotes sustainable value creation. It enables sustained value generation through a five-step analytic framework which includes eliminating wastage,	Monitorization of energy-consuming equipment using AI algorithms	33

			increasing asset efficiency, improving process and operations, optimizing production plans, and effective prediction & sourcing. This solution aids in the monitoring of various energy-consuming equipment. Based on that, data is analysed using AI algorithms to provide actionable insights.		
Delta System Controllers - DSC	Delta Controls	https://deltacontrols.com/products/dsc/	DSCs are perfect for controlling critical equipment such as air-handling units or hydronic systems. DSCs provide programming flexibility and include features such as memory backup and a battery-backed, real-time clock. Control Your Network - The real-time clock and memory backup make the DSC ideal for managing your network or controlling critical equipment. **A Flexible Array of Sizes -** The DSC comes in an array of sizes. Use it to control small terminal units or to take care of your central plant. The controller is completely programmable, making it possible for GCL+ programs and BACnet objects to be tailored to the specific application	Programmable system controller (without IoT capabilities)	34
Desigo CC	Siemens	https://www.siemens.com/global/en/products/buildings/automation/desigo/building-management/desigo-cc.html	Acting as the backbone of your system, it provides a powerful, open building management platform that revolutionizes comfort, security and efficiency. As part of the Siemens Xcelerator portfolio, Desigo CC enables the transformation to self-adapting buildings. Desigo CC is a state-of the-art building management platform. Desigo CC is the integrated building management platform for managing high-performing buildings. Offering an open architecture, it simplifies technology integration and ensures adaptability to future requirements. Combine the power of Desigo CC as the on premise building management system with the strengths of Building X cloud-based	Building Management	35

			platform. Remotely and efficiently manage single or multiple Desigo CC sites via secure connection; without complex VPN settings or intrusive network changes.		
Desigo Optic Management Software	Siemens	https://www.siemens.com/global/en/products/buildings/automation/desigo/building-management/desigo-optic.html https://assets.new.siemens.com/siemens/assets/api/uuid:7a5a4f8f-597e-4a17-aae7-f35bf2d18aa7/DesigoOpticWhitePaperGlobal.pdf	Desigo Optic lets you take building efficiency to the next level with its simple, powerful and scalable software solution for visualizing and controlling building automation systems. Powered by FIN Framework, Desigo Optic redefines openness by applying Haystack native semantic tagging for seamless data harmonization and fast access to critical building information, streamlining workflows by 33%. Desigo Optic is built on openly distributed FIN Framework, provides one of the first completely open solutions offering a system that avoids vendor lock-in and improves serviceability. This software offers an array of open protocols to communicate with field and edge-level devices, and delivers a fully open, yet solid and secure enterprise-level system for seamless and scalable solution to FIN-enabled devices. Additionally, it enhances real-time data visualization by integrating systems and devices through BACnet and an open Haystack application programming interface (API). Desigo Optic provides better data visibility and more informed decision-making to enhance a building's performance and lifecycle operation.	Building Management	35
Dexma Energy Intelligence	Spacewell Energy	https://www.dexma.com/	AI powered energy savings tool. Spacewell Energy Platform (Dexma) covers more than 200 hardware integrations from 50 different vendors and counting. From sensors to gateways, going through SCADAs and BMS, our integration team is always up for new challenges.	Data management platform and energy savings tool	32

			Automate your energy management process with 24/7 powered anomaly detection. Scale your process, detect anomalies, and optimise your consumption.		
Dusun IoT	Dunsun	https://www.dusuniot.com/landing-pages/zigbee-gateways/?utm_source=google&utm_medium=cpc&utm_campaign=19860619641&utm_term=149309675238&utm_content=&utm_source=google&utm_medium=cpc&utm_campaign=19860619641&utm_term=149309675238&utm_content=&gclid=CjwKCAjw44mlBhAQEiwAqP3eVkdP9bx5PvW6yTAAqpja8fs29_CoSH-DM7dUG0XQRA-vDYKdNJhD6hoCN-8QAvD_BwE	Dusun is a IoT Gateway Company and IoT Solution Provider. Focused on the supply of kernel hardware in the Internet of Things(IoT). Dedicated to long-term investment in wireless communication technology researches, Dusun is capable of offering high quality hardware products and professional sales services for various IoT and AIOT device manufacturers. What's more, our embedded software solutions based on chips and modules will help smart IoT hardware manufacturers quickly serve their customers' human-computer interaction and wireless IoT products. Dusun IoT gateways support reprogram, multi-protocol, and various platforms compatible. Dunsun system can be integrated with data platforms like SaaS, PaaS, and so on, and API interfaces are open. Dunsun is specialized in the manufacture of multi-protocol IoT gateways aiming to provide maximized convenience for customers and maximize the cost of time and labour. Dunsun has 15 software copyrights with focus on the application of technologies. We integrate technologies into product applications	Asset Management, smart home/building automation, medical application, cold chain monitoring, smart lighting, etc.	33
é.VISOR and	Limón	https://www.limon-gmbh.de/data-science/energiemonitoring/	Energy monitoring, energy management & energy efficiency evaluation in just one software. é.VISOR is independent of manufacturers and uses different interfaces. This gives you full flexibility, regardless of whether your company is a medium-sized company or a global corporation. All relevant energy and production data are recorded and sensibly linked in order to increase the transparency of the energy and process technology processes.	Energy monitoring, energy management & energy efficiency evaluation software	35

			Effectively reduce your energy costs by using our correlation analysis. Use é.VISOR as an engineering tool to quickly determine your savings potential. Monitor the optimizations that have been carried out and establish a continuous improvement process with our automated cockpits. Carry out benchmarks of production plants and use the alarm function in the event of deviations from limit values. é.VISOR supports all energy monitoring systems from data acquisition to analysis with accurate visualizations for successful energy management according to DIN		
Earthright Dashboard	Delta Controls	https://deltacontrols.com/products/energy-dashboard/	Be proud of your building's efficiency. Use the Earthright Energy Dashboard to communicate your real-time and year-to-year energy conservation results with your occupants. Get people involved with your energy conservation efforts using an interactive dashboard in your building's lobby or other public areas. Promote conservation, gain LEED points, and make your impact known. An excellent system for engaging building (residential, industry and non-residential) owners, tenants, workers, visitors, etc.) into the improving the building energy efficiency rating and at the same time stimulated human behavioural change in order to achieve higher levels of energy savings.	Energy Dashboard to communicate real-time and year-to-year energy conservation results and engage people to participate in energy efficiency improvements	32
EcoStruxure Building Advisor	Schneider Electric	https://www.se.com/uk/en/product-range/39297330-ecostruxure-building-advisor/?parent-subcategory-id=26426255&filter=business-2-building-	For real impact on operating costs, occupant comfort, and asset value, you need systems performing optimally with limited budgetary and maintenance resources. Building Advisor provides key insights into your building operations by monitoring systems and identifying faults to proactively address building inefficiencies.	Facility Management Software	34

		automation-and-control#overview	EcoStruxure Building Advisor, a suite of analytic monitoring services, unlocks your Building Management System's operational performance so you can remotely and proactively maintain your buildings. It provides key insights into your building operations by constantly monitoring systems and identifying faults to proactively address your building's inefficiencies. Watch the video to learn more.		
EcoStruxure Power Monitoring Expert 9.0	Schneider Electric	https://www.se.com/uk/en/product-range/65404-ecostruxure-power-monitoring-expert-9-0/?parent-subcategory-id=59326966&filter=business-2-building-automation-and-control#overview	Software that brings intelligent analytics and visualisation to a facility's power and energy data, turning that data into actionable information that can be used to help improve availability and reliability while creating operational and cost savings. Energy supply management software for large sites. Award-winning EcoStruxure Power Monitoring Expert is designed to help power-critical and energy-intensive facilities, such as large building (residential and non-residential) maximize uptime and operational efficiency. It leverages IoT connectivity and distributed intelligence. provide the flexibility and adaptability needed for today and for the IoT-enabled future. As power grid technology becomes more dynamic, systems more complex, and regulations more challenging, PME brings unique new capabilities that make it simpler to protect people and assets, keep operations running, and save time and money.	Power & Energy Monitoring Software and Services	34
EcoStruxure™ Building Operation	Schneider Electric	https://www.se.com/uk/en/product-range/62111-ecostruxure-building-operation/?parent-subcategory-id=26426255&filter=business-2-building-automation-and-control	EcoStruxure™ Building Operation (formerly known as StruxureWare Building Operation) is building management software that delivers the right information when, where and how you want it. Operations are simplified with drag-and-drop trending, calendar-like schedules and one-click reporting. Native open protocols provide the freedom to choose the best equipment for your application. With EcoStruxure Building Operation, see up to 30% energy savings.	Facility Management Software	29

			EcoStruxure Building Operation is an open and scalable software platform providing insight, control and management of multiple building systems and devices in one mobile-enabled convenient view. It delivers valuable data for decision-making to improve energy management and increase efficiency for better building performance and comfort, reduced carbon, and more sustainable building environments. healthy, sustainable environment.		
EcoStruxure™ Facility Expert	Schneider Electric	https://www.se.com/uk/en/product-range/63106-ecostruxure-facility-expert/?parent-subcategory-id=26426255&filter=business-2-building-automation-and-control#overview	EcoStruxure™ Facility Expert (formerly known as Facility Hero) is a powerful app designed to make your operations simpler, more effective, more convenient and to make your processes and assets more reliable. EcoStruxure™ Facility Expert works on your smartphone or tablet, so you can stay in touch with your team from anywhere. EcoStruxure™ Facility Expert is a cloud-based facility management software and app that delivers operational and energy efficiency while ensuring business continuity and occupants' comfort in individual facilities or across an entire portfolio of buildings. This software is a must-have software for any building manager or operations manager for retail chains.	Facility Management Software	34
EcoStruxure™ Power Advisor	Schneider Electric	https://www.se.com/uk/en/product-range/65478-ecostruxure-power-advisor/?parent-subcategory-id=59326966&filter=business-2-building-automation-and-control#overview	EcoStruxure™ Power Advisor is a proactive, analytics-based service for your power management system, delivering optimized performance and power reliability. Advanced algorithms at your reach - Your business relies on reliable, high-quality electrical power. However, most facilities have significant power quality problems, and nearly all power monitoring systems have data quality issues. EcoStruxure Power Advisor is a cloud-based diagnostic service designed to improve power system reliability and help you make the right decisions. Using analytics from your power network, our	Power & Energy Monitoring Software and Services	34

			expert team finds, prioritises, and recommends ways to resolve problems impacting your system performance.		
EcoStruxure™ Power SCADA Operation	Schneider Electric	https://www.se.com/uk/en/product-range/65405-ecostruxure-power-scada-operation/?parent-subcategory-id=59326966&filter=business-2-building-automation-and-control#overview	No matter the size or complexity, every part of your electrical system needs to provide reliable power, 24/7. Your team needs continuous visibility into every risk, and the ability to react immediately. As a key element of EcoStruxure Power, Power SCADA Operation is engineered to help facilities like data centres, hospitals, industrials, airports and electro-intensive operations maximise uptime. With rich data integration from connected devices, PSO's unique capabilities provide real-time situational awareness, and offer a high performance, cyber-resilient solution for your specialised power networks. Manage and control your medium and low voltage networks with a flexible, secure, scalable, and redundant platform designed specifically for your needs. Flexible, redundant architecture - With extensive communication and data exchange protocol support, connect to hundreds of smart devices, extracting rich data from meters, relays, circuit breakers, PLCs, RTUs, and more. Native architectural redundancy gives you the peace of mind that PSO will remain reliable even during a worst-case scenario. Generic SCADA platforms simply do not offer the depth of capability compared to a purpose-built Power SCADA. Information and control exactly how you need it - Stay on top of power system status using patented animated one-line diagrams. Our graphical engine allows HMI and mobile views to be completely customised. Receive alarm notifications in real-time, use power events analysis tools to determine cause and effect, then re-establish normal operation using automated or manual control actions.	Power & Energy Monitoring Software and Services	34

EcoStruxure™ Security Expert	Schneider Electric	https://www.se.com/uk/en/product-range/65214-ecostruxure-security-expert/?parent-subcategory-id=26426255&filter=business-2-building-automation-and-control	Driving Efficiency Across the Enterprise Security Expert not only unites all components of a security infrastructure, it seamlessly integrates with other building management systems including lighting, energy management, and IT to deliver significant efficiencies across the enterprise. Enhance physical and cyber security with a scalable end-to-end software and hardware solution. Easily integrate security and IT solutions to enhance building safety and value, improve efficiency and user experience with the intuitive and flexible interface, and utilise EcoStruxure Security Expert's array of best-in-class hardware or connect with compatible devices to design a smart building security system. In a smart building security will also include the energy security, i.e. it prevents any potential cyber-attacks to the buildings energy network (e.g. if local PV generation is available).	Facility Management Software targeting security risks (energy systems included)	34
Eensight	EU funded project/Open source	https://build-up.ec.europa.eu/en/resources-and-tools/tools/eensight-next-generation-machine-learning-tool	The eensight web platform contributes to the advancement of automated measurements and verification methods for energy efficiency.	Automated measurement and monitoring tool	30
EM Performer	Energie Steiermark	https://www.e1-energie.com/leistungen/EMPerformer.aspx	EM performer is a cloud-based building control and energy management platform. EM Performer is just as suitable for new installations as it is for merging existing building services systems. EM Performer integrates a wide variety of control technology in one solution - manufacturer-independent and based on powerful and proven industrial solutions such as ABB Zenon.	Cloud-based building control and energy management platform	34
ENEGYCAP	EnergyCAP	https://www.energycap.com/energy-monitoring-software/	Integrates a multitude of real-time data types, including electricity, gas, water, CO2, air quality, production, operational and other 3rd party sources such as degree days, BMS, and more. Whatever data you need, we've got you covered.	Monitoring and Energy management, Connect to	31

				many supported devices and systems,	
Energis	Energis S.A.	https://energis.cloud/en/	Data-driven Energy Management Software that helps you to get visibility on energy and all the related data. Energis has three main products: platform services, raspicy data logger and Energis.cloud data collector. Energis.Cloud is data-source agnostic software and can collect data from: building management system, dataloggers and gateways, energy meters, IOT operators/devices, sensors, weather services, etc.	Cloud based energy management software with aggregation/data collection capabilities	34
Energy Analytics	Bosch	https://www.bosch-softwaretechnologies.com/en/services/enterprise-services/energy-platforms/energy-analytics/	Energy Analytics solution, assists in monitoring various devices that consume energy. The data of the energy consumed and utilised by these devices are read by energy readers and stored on cloud. Here the data is processed with the use of high-level algorithms to give you information as per your requirements, making it possible for the right decision to be taken towards energy conservation, leading to lower energy bills.	Cloud based energy management systems for energy consuming equipment	34
Energy Manager APP	Siemens	https://www.siemens.com/global/en/products/buildings/building-x/energy-manager.html	This tool is used in combination with Building X, Energy Manager APP collects the data and stores it in Building X platform. This APP is a user-friendly interface that allows users to optimize energy consumption and monitor sustainability KPIs by tracking energy consumption, cost and carbon emission footprint across your entire building portfolio. Make data-driven decisions by using accurate sustainability data, allowing to access consumption and emission data in real-time for your entire portfolio in a consolidated view, and easily compare energy consumption, related CO2 and water usage between buildings, and over time. AI-based forecasting allows you to be alerted to potential budget overruns and take action.	Building and/or multi-buildings management	34

			Spot inefficiencies both across a building or a group of buildings. Access the entire portfolio of buildings, anytime and anywhere, and quickly spot outliers and unusual behaviour. This allows to take action early to prevent budget overruns and stay informed via notifications. Easily switch between monitoring consumption and cost over time and between different buildings, while taking out external factors in your comparison by normalization of your data – e.g., weather normalization. Thanks to the heatmap dashboard, you can focus on the consumption pattern of one specific building, choosing the metric groups (heating, water, etc.), type of consumption (high vs. low) as well as time frame.		
Energy Performance Classification (EPC) Tool	Siemens	https://epc.bt.siemens.com/EPC/	This online tool allows a quick analysis of the Building Automation and Control System (BACS) functionality for the installed technical building infrastructure (HVAC plants, lighting, shading) and an estimation of potential energy savings and payback time. It assesses the BACS Energy Performance Classification of your building based on the EN ISO 52120 standard. The key functions are: ● Acquisition of the current state of an existing BACS and allocation of its control functions to energy performance classes A to D; ● Determination of the new state of BACS following modernization and allocation of improved the controls to energy performance classes A to D; ● Determination of annual potential energy savings and indication in the respective currency; ● Providing information on payback time; Quick establishment of customized documentation.	Building Management and control system	32

EnergyElephant	Energy Elephant	https://energyelephant.com/benefits	Energy elephant is a cloud-based energy monitoring service that helps users track and manage energy consumption. It can be used for: automated data collection, bill processing & validation, improve sustainability across energy, waste, water & carbon, reduce costs and identify opportunities (e.g. electricity suppliers, etc.), fuel switching (EnergyElephant can show you which energy sources are cheaper to use such as night rate electricity versus gas), monitoring & verification of all energy sources consumption, savings calculation forecasting, etc.	Cloud based energy monitoring software	34
EnergyLogix Tools & Services	EnergyLogix	https://energylogix.com/software-for-energy-services/	EnergyLogix sells software and metering services to help Energy Brokers, Consultants, Landlords and their Managing Agents retain customers, increase revenue and differentiate themselves in a competitive market place. A fully branded, customisable platform specifically developed for the delivery of the high value, energy services your clients are demanding. ● Utility and meter data management ● Invoice validation services ● Detailed energy analytics and reporting ● Carbon reporting ● Energy Bill Generation ● Broker branded Utility Management Portal ● Project identification & performance tracking with our Energy Analytics ● Tenant billing services ● Metering & Sub-metering services to offer more granular information Energylogix can be used for different services, such as: ● Meter data collection and data quality management ● Secure data and application hosting ● Meter surveys and metering strategy development	Data collection platform for utility information management, invoice validation, energy and carbon reporting	34

			Meter and energy logger installation and maintenance		
Enertiv	Enertiv	https://www.enertiv.com/	Enertiv platform combines robust workflow automation with real-time monitoring and data-driven insights. Real-time monitoring, fault detection, and efficiency insights. Portfolio-level utility management, automation and ESG reporting. The Energy & ESG platform covers the first step in an ESG journey: measurement and disclosure. The module automatically pulls in utility bills to streamline benchmarking, budgeting and reporting. When you're ready for ESG 2.0, Enertiv can incorporate energy management systems and energy analytics systems, equipment monitoring, tenant utility billing and capital planning to drive efficiencies and tenant partnerships.	Energy management Platform	31
ENTECTIV®	Engie	https://www.engie-deutschland.de/en/energy-monitoring	Engie ENTECTIV® relies on a systematic approach that is as simple as possible: energy monitoring platforms bring together energy data from various sources, providing a convenient overview and reliable evaluations. For this purpose, we work with different systems and are manufacturer-independent. In addition, with ENTECTIV® we have our own platform, which is recognized as energy monitoring software within the framework of energy management in accordance with DIN EN ISO 50001. The system compares your energy consumption over a defined period of time, displays the data for individual consumers, exposes energy guzzlers and calculates individual energy performance indicators. This enables you to uncover savings potentials in real time. Another important benefit for you: When it comes to implementing specific savings measures, the ENGIE team has the necessary technical expertise.	Intelligent Energy Monitoring	34

enteliBUS	Delta Controls	https://deltacontrols.com/products/entelibus/	Modular, expandable and flexible software. The enteliBUS Control System is a powerful, fully programmable BACnet controller that features modular, expandable I/O. enteliBUS has hot-swappable I/O modules for fast and easy installation. With HAO switches, save your equipment from short cycling and make troubleshooting a breeze. Use enteliBUS as a BACnet router or join multiple network segments. Hot-Swappable - Modules can be changed out while enteliBUS is powered. Reduce downtime for troubleshooting. HAO Switches - Outputs use manual Hand-Auto-Off switches. You can change from Auto to On or Off without short-cycling equipment.	BACnet controller	34
enteliCLOUD	Delta Controls	https://deltacontrols.com/products/entelicloud/	enteliCLOUD is a cloud based building management system service. enteliCLOUD is a cloud Software as a Service (SaaS) that securely acquires, transfers, and stores your building automation system data to improve organization, management and savings. With enteliCLOUD, you can monitor, operate and control your portfolio buildings across geographies with your computer or smart device.	Software as a service for building management system	34
enteliTOUCH	Delta Controls	https://deltacontrols.com/products/entelitouch/	enteliTOUCH is touchscreen Building Controller that gives instant access to the heart of a Building Automation Systems (BAS). The enteliTOUCH has a 7-inch, high-resolution display that serves as an interface to your building. Use it as a primary interface for smaller facilities or as an on-the-spot access point for larger systems. The intuitive, easy-to-navigate interface gives instant access to manage your BAS. The enteliTOUCH provides customizable and intuitive graphic navigation of your system.	BAS user interface system	34
Envoria	FISA	https://envoria.com/	Envoria is an all-in-one software for sustainability reporting, simplifies work by making your Environmental, Social, and Governance (ESG) processes more efficient. Collect, monitor, and reports all sustainability data.	Software for sustainability reporting	33

			Assess your organization contribution to global greenhouse gas emissions with the "Emission Management" module from Envoria. Calculates your organization carbon footprint based on GHG factors. Envoria allows to: - Create company and product carbon footprints; - Calculate the carbon footprint based on GHG factors; - Gather data on all levels of your organization – per area, legal, entity, plant, product line, or single product.		
ETAP-EMS	ETAP-Electrical Power System Analysis & Operation Software	https://etap.com/packages/energy-management-system?httpsetapcomdemo-dow=capterra	ETAP Energy Management System is mostly used at DSO and TSO levels, however it can be use at district level or even to monitor and control distributed renewable generation systems. This intelligent energy management software control system is designed to reduce energy consumption, improve the utilization of the system, increase reliability, predict electrical system performance, and optimize energy usage to reduce cost. There are many objectives of an energy management software, including an application to maintain the frequency of a Power Distribution System and keeping tie-line power close to the scheduled values. In ETAP's Energy Management System, scheduled values will be maintained by adjusting the MW outputs of the AGC generators so as to accommodate fluctuating load demands. The energy management software application will also calculate the required parameters to optimize the operation of the generation units under energy management action. It can be used for: ● Automatic generation control (A multi-area supervisory control system to regulate generation levels) ● Interchange scheduling (Manage electrical transaction schedules and dispatches tradings)	Power grid, microgrid control, monitorization and reserve management/ demand response	34

			• Economic dispatch (Allocate changing generation demand of a power system amongst controllable generator units) • Load forecasting Reserve management (Monitor system operating capacity and dynamically calculate the system generation versus load forecast balance)		
Facility Scheduler	Delta Controls	https://deltacontrols.com/products/facility-scheduler/	Facility Scheduler integrates your smart building systems into a central, easy-to-use platform. Facility Scheduler integrates third-party scheduling, booking systems and tenant portals with enteliWEB. Worried about the process changes that accompany a new system? Facility Scheduler lets you preserve your existing workflow while gaining all the benefits of a fully-integrated Delta Building. Key Features: Tie Building Automation to Occupancy - The Facility Scheduler allows you to sync HVAC, access, and lighting to occupancy; Create Savings in Your Building - Save money by leveraging on-demand control. Give your smart building more intelligence by telling it when spaces aren't occupied; Advanced Scheduling- Take advantage of the built-in calendar for more scheduling options.	Integration of multiple systems in order to increase building efficiency (includes energy related benefits and Non-energy benefits)	34
FleXunity APP	Cleanwatts Digital S.A.	www.flexunity.eu	This application has been developed within the framework of the European FleXunity project and is part of a "Virtual Power Plant (VPP) Management Platform" toolkit aimed at validating in real-world conditions the flexible management of energy assets within the Energy Communities project deployed in the UK and Iberia. This application is an energy management application, used by the owners of the pilot home site, which allows the user to		34

			monitor electricity consumption and production, and control electrical appliances connected to the integrated smart plugs. The app shows which parts of the house are inefficient and where the user can save energy. It also helps to optimize the use of electrical appliances in an easy way, eliminating waste and unnecessary costs. The main objective of FleXunity is to develop and validate a commercial-ready Virtual Power Plant (VPP) Management Platform based on advanced Artificial Intelligence, remote automation and Blockchain technology to optimize the flexibility of Energy Communities, match consumers' energy needs, ensure further development of RES, optimize distributed energy resources, and contribute to the current challenges of energy security and climate change, while increasing the competitive advantage of retailers and aggregators.		
Hiven energy management solution	Hiven Energy	https://hiven.energy/	Consumers with connected smart appliances will benefit from connecting and enabling Hiven - cost savings, lowered environmental impact and smoother user experience. Manufacturers can enable smarter services directly to their customers. With Hiven smart services, energy companies are able to acquire and retain high-margin customers with EV's and smart home appliances.	Energy Management software/platform	34
Home Energy Management	GridX	https://de.gridx.ai/use-cases/home-energy-management-system	Energy management for home and remote monitoring		34
Honeywell Building Solutions	ARENA NX	https://buildings.honeywell.com/us/en/products/by-category/software/buildi	ARENA NX is a web-based building monitoring and management solution build upon the Niagara 4 platform. It is capable of integrating CentraLine BACnet and Niagara controllers, third party devices and internet protocols into a centralized software	Building management	34

		ng-control-software/supervisors/arena-nx	platform that is designed to manage buildings at corporate level (to handle a huge amount of data). It is used to supervise HVAC systems and non-HVAC systems (e.g. lighting, security, life safety) in a building or across multiple buildings. ARENA NX serves real-time graphical information to standard web browser clients and also provides server-level functions such as: centralized data logging, archiving, alarming, real time graphical displays, master scheduling, system-wide database management, and integration with corporate software applications. ARENA NX helps to maximize operating and services opportunities and to minimize associated costs.	and supervision	
Honeywell Forge Energy Optimization	Honeywell	https://www.honeywell.com/us/en/press/2020/02/honeywell-launches-first-autonomous-building-sustainability-solution-to-fight-rising-global-energy-consumption	Honeywell Forge Energy Optimization is a cloud-based, closed-loop, machine learning solution that continuously studies a building's energy consumption patterns and automatically adjusts to optimal energy saving settings without compromising occupant comfort levels. Honeywell Forge Energy Optimization, the first autonomous building solution focused on decreasing energy consumption, may deliver double-digit energy savings, decrease a building's carbon footprint, and can be implemented without significant upfront capital expenses or changes to a building's current operational processes. System Agnostic Optimization and Advancing the Latest Building IoT Technologies. During a pilot at Hamdan Bin Mohammed Smart University (HBMSU) in Dubai, United Arab Emirates, Honeywell Forge Energy Optimization demonstrated an initial 10% energy savings. HBMSU is the first accredited smart	Energy management and monitoring system	33

			university in the UAE and is known for its technology and innovation programs.		
HVAC Optimization	Enerbrain	https://www.enerbrain.com/en/	Enerbrain can integrate on different types of HVAC systems and with devices already installed in the field.	API based monitoring platform	33
I.R.I.S., the intelligent malfunction prediction system	2G	https://2-g.com/en/products/digital-and-control-solutions	I.R.I.S., the intelligent malfunction prediction system is a real piece of pioneering work by 2G. Every week, more than 400,000,000 sensor readings are transmitted by our systems installed across the world to be analysed by our service department – a fully automated process. Based on this analysis, the system detects and reports irregularities before they even occur. I.R.I.S. is also able to sustain CHP operation. I.R.I.S., constantly monitors your system and detects irregularities before they even manifest.	Maintenance prediction software	33
IBM Maximo Application Suite	IBM	https://www.ibm.com/products/maximo	IBM Maximo Application Suite is a set of applications for asset monitoring, management, predictive maintenance and reliability planning into a single platform. Manage and maintain high-value assets with AI and analytics to optimize performance, extend asset lifecycles and reduce downtime and costs.	Building assets management	33
Inavitas EMS Platform	Inavitas	https://www.inavitas.com/	Inavitas is an energy management platform with seamless integration that allows to do energy monitoring and management, demand response management, smart tariff analysis, benchmark and performance management, load control and management and centralized management and benchmarking. The Inavitas platform provides customised energy efficiency and management solutions to reduce the burden of energy costs and increase efficiency.	Multi asset control and management	35

Interact	Signify (Philips Lighting)	https://www.interact-lighting.com/pt-pt/what-is-interact	Where there is light, there is knowledge. Interact's IoT platform enables connected LED lighting systems and embedded sensor networks to deliver information, benefits, and new services to customers. It makes lighting smart. It provides an IoT ecosystem to our partners, customers and developers controlled by the world's largest network, connected LED lighting. Interact is a secure and scalable IoT platform that collects insights from your connected LED lighting, your embedded sensors, and your IoT devices across an entire IoT-ready connected lighting system. The open API allows the lighting software and system architecture to share data between LED light points, sensors and Interact's IoT platform. Interact's IoT platform executes millions of data transactions daily through the best available processing capabilities. In this way, it will leverage cutting-edge technologies, big data processing and analysis, and machine learning. Interact's IoT platform will provide new insights that will help you drive operational efficiencies and make more effective decisions.	IoT platform for large lighting systems (commercial and industrial sectors, district or city level systems)	34
Itron Enterprise Edition (IEE) Meter Data Management (MDM)	Itron	https://www.itron.com/na/solutions/product-catalog/itron-enterprise-edition-meter-data-management	Itron Enterprise Edition™ (IEE) Meter Data Management (MDM) is an industry-leading data management solution for residential gas, water, and electric meters, commercial & industrial (C&I) meters, and Internet of Things (IoT) sensors. Our ever-evolving platform provides you with the flexibility, value, and functionality needed regardless of your deployment size. For the larger Investor-Owned Utilities (IOU) market, IEE MDM is a highly scalable enterprise application that centralizes the	Metering Data Management	33

			collection, processing, storage, and complex analysis of smart device data, device events, and alarms.		
Kiome®	Cleanwatts Energy S.A.	https://cleanwatts.energy/kiome/	Kiome® offers real time energy visualization, management and control to homeowners and tenants in respect of their energy consumption, generation and storage as well as local tariff-based saving opportunities, historical reporting, basic analytics and forecasting. Kiome® main fixture are: - Optimizes home and small offices' energy consumption; - Allows consumers/prosumers to participate in energy communities; - Controls and schedules consumption remotely; - Controls household appliances; - Integrates storage and EV charging; - Allows residential energy cost savings; - Provides tariff-based saving opportunities - Historical reporting, basic analytics and forecasting.	Energy Management software/platform	35
Kiplo®	Cleanwatts Energy S.A.	https://cleanwatts.energy/kiplo/	Kiplo® is a 'energy markets platform' designed to aggregate small and medium energy loads, including batteries, EV chargers, heaters, boilers, chillers and distributed generation systems. Kiplo® works through our VPP to support community managers and energy market operators. Kiplo® includes three modules: ● Kiplo® Energy Communities: enabling the optimization of renewable energy communities and peer-to-peer trading within a community; ● Kiplo® Flexibility Management: allowing both implicit and explicit demand response programs to generate additional energy savings for community members;	Energy Management software/platform	35

			• Kiplo® Energy Markets: supporting market operators to manage bids for improved day ahead and intraday planning.		
Kisense®	Cleanwatts Energy S.A.	https://cleanwatts.energy/kisense/	Kisense® is a behind the meter efficiency and optimization engine, designed for commercial and industrial enterprises, including energy consumers and prosumers. Kisense® provides a wide range of advanced energy management services from real time visualization and predictive analytics to optimization and control of DER assets, individually and collectively, across multiple locations. Kisense® main fixture are: - Aggregation, management and optimization of distributed energy resources; - Manage energy consumption, generation and storage; - Artificial intelligence data analytics and forecasts; - Alarms, reports, baselines and remote control; - Multi-utility management; - Interoperable with multiple HW vendors; - Bill management from generation to consumption; - Calculation of energy credits and grid charges; - Renewable energy sources and/or Independent power producers remote management.	Energy Management software/platform	35
KNX Smart Home	KNX	https://www.knx.org/knx-en/for-your-home/	KNX allows to combine all kind of smart home solutions to automate and simplify daily life. It is an all-in-one system.	Control and automation of equipment	35

MaintainX Reporting Tool	MaintainX	https://www.getmaintainx.com/	Mobile workflow management platform for industrial and frontline workers. It is a modern IoT-enabled cloud-based tool for maintenance, safety, and operations on equipment and facilities. Helps businesses track reactive and preventive maintenance, maintains a update inventory and controls the daily operations, such as safety inspections, quality inspections, and operating checklists—all with a digital audit trail	Equipment maintenance, safety, and operation	30
Merbon Contport	Domat	https://www.domat-int.com/en/?gclid=EAIaIQobChMI0-a779OJgAMVAJCDBx0bWgJEEAAYASAAEgKdXPD_BwE	Domat is a technology provider for energy management systems supplying both software and hardware. Provide a comprehensive range of products and system solutions for building, energy control and measuring systems. Standard signals, interfaces, and communication protocols are used at all system levels. Therefore, the system is open for a wide range of integrated solutions. Domat supplies a complete range of control system components – from SCADA to peripherials, all supported by a single supplier.	Energy Management System	34
Metasys® Building Automation System	Johnson Controls	https://www.johnsoncontrols.com/building-automation-and-controls/building-management/building-automation-systems-bas/metasys-software-and-servers	Metasys® Building Automation System connects commercial HVAC, lighting, security and protection systems – enabling them to communicate on a single platform to deliver the information you need, allowing you to make smarter, savvier decisions while enhancing your occupants' comfort, safety and productivity. *Metasys*® software functions as a complete family of systems and servers designed to work together as one cohesive unit that helps your building energy management efforts. Proven reliable for even the most demanding applications, *Metasys*® software is made up of various components that provide coordinated control over your building's systems. Choose from options like our Application and Data Server/Extended Application and Data Server (ADS/ADX), Open Data Server (ODS) and Advanced Reporting System (ARS).	Building management system	34

MTWO	Schneider Electric	https://www.se.com/uk/en/product-range/48127370-mtwo/?parent-subcategory-id=48127309&filter=business-2-building-automation-and-control	Schneider Electric Energy Management software solutions are a sustainable and efficient way to accelerate the digital transformation for Buildings, Infrastructure and Industry to create a smart and green future in a new electric world. We have built a strong agnostic software solutions portfolio and we partner with world-leading independent software companies to bring energy management and automation digitisation, empowering all users with a seamless and collaborative dataflow across the entire lifecycle, from design and build to operate and maintain. Construction Management Software, which is an innovative cloud platform for enterprise management, project planning, costing, real-time construction monitoring and carbon emission monitoring to drive efficiency and sustainability across CAPEX and OPEX in the building market.	Management Software	33
MyVoltalis	Voltalis	https://www.voltalis.com/particuliers/notre-solution	Voltalis is the most innovative energy-saving device for electrically heated homes. Not only can you better monitor your consumption and program your heating thanks to our connected thermostat, but you are also making an ecological and supportive gesture, for the benefit of all. Indeed, in the event of an imbalance on the electricity network, the Voltalis device can optimize in real time the consumption of radiators or other heating devices such as the heat pump, which are the most energy-intensive in the home, while preserving your comfort. This is what is called intelligent consumption management.	Energy management, monitoring and control of appliances and equipment to create flexibility	34
Name of the product not defined yet - Product still under development (in piloting stage)	*E.ON Ubirch*	https://www.eon.com/en/innovation/future-of-energy/communities-and-living/how-cyber-security-can-improve-energy-tariffs.html	*German cyber security company Ubirch have built a digital infrastructure for developing neighbourhood-specific electricity tariffs. Soon, it will be a new product offering customers an important benefit: for the first time, the Ubirch cyber security technology makes it possible to see where, when and by whom each individual kilowatt hour was produced and consumed.*	*n/d*	*Product is still under development*

			Such transparency, data certified in accordance with European GDPR data protection laws, is provided by Ubirch's SaaS (Software-as-a-Service) technology. In the future, this new cyber security technology, integrated with smart grids and meters, will provide customers with more attractive tariffs – accurate to the individual kWh – and help citizens to create energy communities. *Together with Ubirch, E.ON launched a nationwide pilot project to develop a "plug and play" solution with around 100 households. After the successful development phase, the teams are now integrating the innovative energy certificate into E.ON products supplying energy communities with decentralised, locally generated energy.* *In the pilot, developers used Ubirch technology to read inventory meters, generation and consumption data, securely verify it in almost real time. Cryptography and blockchain technologies are now being impressively applied to and integrated into existing software products for energy communities. This will make scaling energy communities possible with access to reliable, securely verified use of digital twins in near real time.* *The use of blockchain and cryptography represents a technological breakthrough for collaborative and sustainable energy use, smart meter applications and smart grids. The real-time capability of this solution enables customers and members of energy communities to act more actively role in the energy transition.*		
Navigator	Siemens	https://www.siemens.com/global/en/products/buildings/performance.html	Navigator is a cloud-based data management platform designed to help you optimize the performance of your buildings. The platform is customizable, allowing you to achieve your energy, sustainability, and system performance targets.	Digital Energy and Asset Management	34

		https://assets.new.siemens.com/siemens/assets/api/uuid:e3c6eaec-07fa-4edd-8adf-0870f43d1370/bt-cc-navigator-brochure-en.pdf	Navigator seamlessly integrates complex sources of data from energy procurement, energy consumption, system performance, and sustainability—helping you make sense of it all. – Mitigate energy pricing risk by combining multiple energy procurement options, conducting comparisons, and analysing long-term costs; – Monitor system performance and reliability by gaining a holistic view of your infrastructure's performance across your enterprise, from the building envelope to individual equipment and meters; – Achieve sustainability targets through comprehensive energy usage, greenhouse gas inventory, and total CO2 emissions data—over time and across buildings. Navigator allow to perform specific task directly targeting energy efficiency, some examples are: – Compares consumption and performance across an enterprise, a building, or equipment; – View best and worst performing buildings from a variety of reports – Identify short and long term optimization measures.		
NeuralSolar Device	Neural Solar	https://neuralsolar.pt/device/	A scalable and modular device targeting solar installations with no need of extra infrastructure. NeuralSolar Device assure an increase production efficiency + 12%, operational cost savings and an innovative wireless Device to Device Communication & Data Analytics. The product Innovation within this equipment includes a fault identification system using low-cost hardware, the software and a new wireless network communication protocol. The fault identification system includes features such as: operating temperatures, degradation rate, partial shadowing, soiling loss index, open circuit faults, hot spot alert and maintenance alerts. This product targets solar energy systems	Solar power systems	27

			without any type of online monitoring and allow to make a monitorization per solar panel in systems that usually can achieve maximum levels efficiency around 75%.		
Next-Gen Energy Services Platform (Next-Gen ESP)	Capgemini	https://www.capgemini.com/ca-en/solutions/next-gen-energy-services-platform/	Next-Gen ESP is an end-to-end, modular, integrated platform that leverages the latest in data, analytics and automation to support foundational elements of a modern energy system, including the deployment and operation of a next-generation advanced metering infrastructure (AMI), as well as a wide range of supplemental services that can accelerate the transition to electric vehicles (EVs), increase the share of renewables, better manage decentralized energy sources and improve consumer engagement.	Control and automation of equipment	33
O3 Sense and Edge	Delta Controls	https://deltacontrols.com/products/o3/	Winner of the AHR Expo Innovation Award in Building Automation in 2020. With seven different sensors onboard, the O3 utilizes Sensor Fusion to enhance occupancy detection and temperature reading. The O3 reacts fast when you leave the room—turning off lights, reducing heating and ventilation, saving you money. With advanced temperature sensing, the O3 provides a more comfortable environment for you and your staff. The O3 reacts to changes in temperature and people entering and leaving a space faster than any other sensor on the market. Sleek, smart, and efficient, the O3 is designed to complement a room, not distract from it. Installed on the ceiling, the O3 provides the best vantage point for better control and better detection, without cluttering your walls. Wirelessly configure your O3 from your smartphone using the Proviso app, no internet needed. The main fixtures are:	Smart sensors	34

			• Integration with the touchless apps your occupants already use; • No internet needed, wirelessly connects to your phone • Control lighting, fresh air, and temperature		
O3 Sensor Hub	Delta Controls	https://deltacontrols.com/products/o3-sensor-hub/	With a top-down view from the center of the room, the O3 Sensor Hub detects motion, sound, light, and temperature with new levels of accuracy. With a complete sensor package, O3 provides your BAS with the data it needs to make economical and occupant-friendly decisions. Key Features: • Sensor Fusion • Communicate with occupants via RGB light ring and integrated speaker. • Save time with easy-to-install mounting plate. • Detect occupancy using sound and motion. • Measure surface temperatures precisely with IR sensors. • Combine temperature, humidity, light, and motion in a single package. Use sensor fusion to detect motion, sound, light, temperature, and occupancy with new levels of accuracy. The sensor hub replaces multiple room sensors with a one-per-room cost-competitive solution when installed together with an O3 room controller.	Smart sensors	34
Phantom Energy	Bosch	https://www.boschphantom.com/	Bosch provides industries with efficient Phantom energy management systems. It is an AIoT platform that blends AI with	Multi asset control and	34

		https://www.bosch-softwaretechnologies.com/en/services/enterprise-services/energy-platforms/phantom-connected-machines/	IoT to provide information about equipment, electrical parameters, and the usage to create a digital twin. With this solution, you can get real-time granular energy consumption data at the asset level. Compare assets, identify anomalies and drive behavioural change for energy saving. Phantom is a non-intrusive, AI @ Edge, AIoT based asset and energy monitoring solution. A powerful combination of sensors, software and services, Phantom is perfect for monitoring equipment status and metrics in real-time.	energy management system for Industry that blends AI with IoT to create digital twins.	
Planon	Schneider Electric	https://www.se.com/uk/en/product-range/54934199-planon/?parent-subcategory-id=26426255&filter=business-2-building-automation-and-control#overview	Planon is the leading global provider of real estate and facility management software that enables building and service digitalization by integrating the diverse landscape of smart building technology, business solutions and data into one source of truth and turning that into value for building owners, building users, and service providers.	Facility Management Software	34
Planon Workplace Insights	Schneider Electric	https://www.se.com/uk/en/product-range/117451134-planon-workplace-insights/?parent-subcategory-id=26426255&filter=business-2-building-automation-and-control#overview	Planon Workplace Insights improves comfort and productivity while making the most effective use of your space. This workplace management software transforms and analyses data in easy-to-understand dashboards. Respond proactively to the needs of your building occupants and business stakeholders with intuitive dashboards that transform data into knowledge. Information captured from occupancy and healthy building sensors is analysed and displayed in easy-to-understand dashboards that help you make the right decisions and act for more engaging and productive work environments.	Facility Management Software	34

Red5 Plus & Edge	Delta Controls	https://deltacontrols.com/products/red5/	Red5 is Delta Controls' next generation of native BACnet controllers with secure and scalable IoT connectivity. The Red5 product line replaces our legacy DSC and DAC-E controllers, offering faster processing speed and flexibility with increased memory and I/O modularity. Our new Proviso provisioning app saves you time and reduces installation costs with improved workflows. An open protocol integration means you can unleash your smart building's full potential beyond traditional heating, ventilation, and air-conditioning controls. Red5 builds on a solid foundation to transform data into intelligent decisions. Red5-EDGE is the next generation DAC-E replacement with IoT connectivity. Red5-PLUS is the next generation DSC replacement with advanced IoT connectivity and BACnet routing capability.	Programmable IoT system controller	34
SkySpark	SkyFoundry Software Solutions	https://skyfoundry.com/product https://skyfoundry.com/	SkySpark is a comprehensive software platform for connecting, storing, analysing and visualizing data from smart devices and equipment systems. SkySpark's automated analytics, KPIs, Energy and GhG Apps, turn your data into actionable intelligence providing improved performance, reduced downtime, and operational savings. SkySpark collects, manages, and automatically performs analytics on the data from building automation systems, metering systems, lighting, weather, and other smart devices to identify issues, patterns, deviations, faults and opportunities for operational improvements and cost reduction.	Building management including automation systems, all types of energy meters, smart devices, sensors, IOT devices, etc.	31

			SkySpark is a software analytics platform that automatically analyzes system-level building data and provides building insights, aka building analytics. It helps building owners and operators, business managers, and facility staff identify cost saving opportunities and building operation improvements. SkySpark provides a complete suite of tools for energy analysis and reporting applications and is often used as a stand-alone Energy Analysis application. It supports applications involving the full range of energy resources including: electricity, alternative energy generation including solar and storage, natural gas, oil, and water – basically any resource that is metered.		
Smappee Infinity	Smappee	https://www.smappee.com/energy-services/ https://www.smappee.com/infinity/	Smappee offers Energy-as-a-service (EaaS). Smappee is a one-stop-shop for a fully integrated energy solution that allows to accelerate companies' business as aggregator or energy service provider (ESP) with turnkey solutions. Rather than only supplying kilowatt-hours, offer subscription-based energy services through monitoring, automated remote control and optimisation of loads and energy consumption. All of this without discomforting the customer. Implement dynamic pricing mechanisms, such as time-of-use tariffs, spot market prices, real-time energy stock exchange pricing and offer your customers the Smappee tariff. This way, they always benefit from the most advantageous rate.	New energy services, buildings energy efficiency, smart homes, self-consumption, smart EV charging, Demand response,	34

				Energy trading and microgrids	
Smart MAIC	Smart-MAIC LAB LLC	https://smart-maic.com/en/	Cloud based solution that collect data from smart meters for any kind of consumptions. • Monitoring for electricity, water, gas, heat ... • Temperature, Humidity, Pressure, CO2, TDS, pH ... • One interface for all resources • Dashboard for data visualization • Remote load management • API Tools for developers • MQTT client interface Smart-MAIC devices will help to analyse the consumption of electricity, water, gas, heat, to monitor temperature, humidity, pressure, light, wind, CO2, TDS, pH and any other resources, conditions and events.	Cloud based energy management software	31
Smarthive	Auraicity	https://auraicity.com/solucoes-cidades-inteligentes/	Smarthive is a combination of Internet of Things (IoT) and Big Data. Smarthive is a smart and connected platform that provides building managers, district managers or municipalities a global and integrated view of their energy assets (e.g. related lighting systems including street lighting, irrigation meters, waste, tree control, flood control systems, street and indoor billboards, interactive screens, kiosks, software with app features + electric vehicle charging station management and payment gateway, smart Bus stops, smart water control for supply management, etc.)presenting a unique set of information in order to facilitate the work of those who manage them and improve the quality of life of those who live there. Through intelligent and innovative solutions, Auraicity help cities and companies to optimize resources and become more sustainable and competitive.	Software for Control and Management of X-as-Service	31
SW Efficiency – Save to improve	Smartwatt	https://smartwatt.pt/en/energy-efficiency/	Pinpointing opportunities for improvement offers continuous savings in consumption. With Smartwatt knowledge, flexibility,	Software-as-a-Service for	32

			and collaboration, clients always have the advantage of making sustainable decisions aimed at optimizing energy consumption. Provides support to companies that look for the best support in energy related decision making.	energy related decision making	
SW Efficiency – Saving is On (Energy Management System)	Smartwatt	https://smartwatt.pt/en/energy-efficiency/	SW Efficiency Saving is On (Energy Management Systems) offers a complete and scalable solution that allows customers to achieve significant improvements in energy use, reducing consumption and operating costs and minimizing environmental impact. It allows for obtaining data in real time and reducing energy costs by taking measures to avoid production downtime and optimizing the use of operational equipment. As a differentiating factor, it enables real-time operations with flexible SaaS business model and multi-channel capability.	Software-as-a-Service for Energy Management System	32
SW Efficiency – Smart Decision	Smartwatt	https://smartwatt.pt/en/energy-efficiency/	Audit and certification-as-a-service. Smartwatt as more than 12 years of experience in the development of energy optimization plans, which in addition to meeting the legal requirements of SGCIE and SCE, have already made our customers more than €7M in savings.	Software-as-a-Service for Energy Audits and certification	32
SW Intelligence	Smartwatt	https://smartwatt.pt/en/artificial-intelligence/?doing_wp_cron=1689010919.8269650936126708984375	Smartwatt empowered by AI solutions using proprietary AI algorithms developed by merging client's needs and knowledge with the latest technology. SW Intelligence is a designed a platform that evaluates each signal every 10 minutes to detect performance anomalies. SW intelligence links and syncs all data sources across different platforms and systems into a logical database that is then used to learn and extract insights from complex challenges via the deployment of AI models. The final product includes a tailor-made AI solution that speaks your business language.	AI-as-a-service platform.	32

			SW intelligence can be used to improve energy management systems, renewable energy systems (photovoltaic and wind including large-scale systems) monitorization and performance		
Synco Building Automation	Siemens	https://www.siemens.com/global/en/products/buildings/automation/synco.html	Synco is a building automation and control system for small and medium-size buildings. It offers all the products and tools for complete system solutions: Primary plant control, room automation (HVAC and electrical), multi-site, remote operation and management, remote energy monitoring and billing. The latter is enabled by connecting Synco IC with Siemens remote metering products and solutions.	Building Management	34
Systematic energy and resource management	KOFLER ENERGIES Energieeffizienz GmbH	http://www.koflerenergies.com/managementsysteme/index.html	With a tailor-made energy and resource management system, companies achieve greater savings and can continuously improve their efficiency. The successful reduction of the use of energy and resources is not only a question of the right technical measures, but also of effective management. In many companies, however, several unconnected systems exist side by side. Kofler Energies starts here with a detailed analysis and develops individually adapted management systems, which result in a reduction in energy and resource consumption or an increase in product quality. Evaluations in the energy sector show that companies that give their energy managers their own budget reduce their costs by an average of 8.3%. If a comprehensive process documentation was also set up and tasks were clearly assigned, the figure is already 15.6%. Systems that have been implemented according to the ISO 50001 standard are particularly profitable: According to an analysis by the auditing company PricewaterhouseCoopers, costs have been reduced by around 25% on average.	Energy Management systems	32
Tado° - intelligent climate management APP	Tado°	https://www.tado.com/de-de	Tado° APP controls smart appliances related to heating, cooling and air quality. This APP is combined with smart thermostats to control appliances or can be easily connected with appliances with smart connectivity. With the Tado° app, you can control the	Intelligent temperature control	34

			temperature in each room individually, just as it makes sense from an energy perspective. Or you can create a schedule that does it for you. Allows smart home integration with other systems (e.g. Siri, Alexa, Google Assistant, etc.)		
TRIRIGA Application Suite - intelligent asset management and IWMS	IBM	https://www.ibm.com/products/tririga	Data and AI are increasingly critical tools in how organizations are evolving their facilities management. IBM® TRIRIGA® is an intelligent asset management solution for integrated workplace management systems (IWMS) that equips you to meet the needs of modern facility management. Real-time insights infused with AI support dynamic space planning. Allow occupants to make service requests and book rooms. Right-size your portfolio and increase efficiency of lease administration, capital projects and more. Simple, fast and flexible, TRIRIGA has the right mix of applications in one modular solution to maximize your building lifecycle while preparing you to meet future needs. Increases the utilization of valuable real estate and building infrastructure assets through the use of advanced space planning, space management, and move planning. It provides space management and audit tools; space use agreements and chargeback tools; as well as move planning and move execution management. It also automates preventive and condition-based maintenance processes to improve the condition of critical facilities assets and extend their life. Identifies resource intensive facilities and processes, analyse financial and environmental benefits of environmental sustainability investments, and automate carbon reduction actions to reduce energy costs and achieve environmental and energy management strategies.	Building assets management	33

Trulifi	Signify (Philips Lighting)	https://www.signify.com/global/innovation/trulifi	More and more devices connect to the Internet every day, most wirelessly. Conventional wireless connectivity solutions use the crowded radio spectrum to communicate. What's more there are areas where radio frequency wireless connectivity is not permitted or the best fit. Trulifi by Signify is the perfect solution. It's a range of LiFi (connectivity through light) systems, providing two-way wireless communication that provides consistent high-speed connectivity, unique physical security and has low latency for real time data streaming. High performance secure data connectivity where you need it and a consistent high-speed connectivity through the lighting systems. Trulifi systems modulate light waves to transmit data, mostly using invisible light. A USB access key plugged into a laptop or tablet receives data and data back to a transceiver. By leveraging lighting infrastructure, Trulifi customers get the best of both worlds: great quality lighting and consistent, secure and low latency data connectivity. Trulifi can be retrofitted in existing luminaires or installed as a single system.	Data connectivity through lighting systems	34
UBIRCH ESG Data Management Platform	Ubirch	https://ubirch.com/anwendungen/esg-zertifikate	A growing number of companies are treating their ESG balance sheet in the same way as their financial records, and due to emissions reduction targets building most likely will have to do the same in the future. The new EU CSRD directive even requires to report sustainability information for most companies in the EU in a verifiable form. This also creates a growing threat from ESG fraud and new liabilities. Solutions where ESG/CSRD data is recorded in a verifiable way automatically are needed. With the UBIRCH Trust Platform and its unique capability to record data in different situations from sensors in a chimney to a web-based form for entering basic data the perfect solution for verifiable ESG/CSRD data has arrived. This is also becoming increasingly	Software for sustainability reporting	28

			important for environmental management systems in accordance with ISO 14001 and the new reporting standards out of the CSRD directive to generate auditable evidence of activities. How it works: Before data is transferred from the physical to the digital world, we seal every single data packet directly at the point of data capture using robust cryptography and block chain technology. This creates an unalterable "chain of trust" that guarantees at source that IoT data is not manipulated, duplicated or deleted. The data can be verified by any recipient anytime, anywhere, just as if they were at source.		
Verasys Building Automation System	Johnson Controls	https://www.verasyscontrols.com/	Verasys configurable controls create an easy-to-use, easy-to-install solution to help maximize HVAC investments for your customers. Convenient centralized building control, coupled with remote access and monitoring, enables the building to operate more efficiently and is delivered in a scalable, cost-effective way.	Building management system	34
Voltalis Pro	Voltalis	https://www.voltalis.com/entreprises	The Voltalis PRO is specially designed for SMEs and large office companies and allows to make immediate energy savings and gives you access to a simple and ergonomic management tool. The benefits of the Voltalis PRO system are that one solution for all your needs: - Easy programming of heating, device by device - Remote control of all your electric radiators - Consumption monitoring in kWh and euros - Alerts in case of excess consumption - Professional advice and expertise and other innovative services to help achieve the goal of the sobriety plan.	Energy management, monitoring and control of appliances and equipment to create flexibility	34
Voltalis H	Voltalis	https://www.voltalis.com/entreprises	The Voltalis H is specially designed for Hotels and large University campius. This product allows to make immediate energy savings and gives you access to a simple and ergonomic management	Energy management,	34

			tool. The benefits of the Voltalis H system are that one solution all the needs of clients such as hotel and university campus users. These benefits includes easy programming of heating devices individualy, allows remote control of all your electric radiators, energy monitoring (kWh and €uros), event alerts (excess consumption, offline, etc.), professional advice and expertise and other innovative services to help achieve the goal of the creating flexibility.	monitoring and control of appliances and equipment to create flexibility	
Watt-IS data analytics engine	Watt-is	https://watt-is.com/services/	Incorporate our Data Analytics results into your own apps in a Data Analytics as a Service solution. Use Watt-IS data analytics engine in a Software-as-a-service (DAaaS) approach. Get valuable information from our AI-powered data analytics modules and services and integrate them through API's into your own applications or visualization tools, to deploy informed strategies with deeper insights about clients energy consumptions. It allows user to detect anomalous consumptions, perform demand side flexibility, the proprietary AI-based algorithms can identify which appliances have been used and the energy consumed, looking only at the smart metering data as collected by the DSO, and tariff optimization	Data Analytics as a Service	31
Wattsense Tower	Wattsense	https://www.wattsense.com/de-de/products/tower/	View and manage your devices remotely via a cloud server.	Remote monitoring of appliances and buildings	31
WILLBEE Energy Sources	Willbe Energy	https://www.willbeenergy.de/	Over 1,200 audits, 300 completed projects, investments of EUR 1 billion, annual savings of EUR 360 million or 8.3 Terawatt hours. With tailor-made audits, we determine the potential for improvement in your company. Willbe Energy offer includes a low-threshold walk-through audit, mandatory energy audits according to EDL-G/DIN 16247-1 and more in-depth energy	Audit-as-a-service and Financing-as-a service	29

			efficiency audits. On this basis, we propose changes and investments that are worthwhile for your company. Energy sources are an essential element of the infrastructure of large and energy-intensive companies. They enable stable and competitive conditions while controlling energy costs. They also provide protection against network failures. The modernization of power generation plants often requires high investments. At the same time, however, appropriate measures contribute to above-average savings. With WILLBEE energy sources, short amortization times of 3 to 5 years are guaranteed.		
WIS4Enterprises	Watt-is	https://watt-is.com/services/	WIS4Enterprises provides companies including SMEs a fully automated Artificial Intelligence cloud-based "Virtual Energy Manager", fully focused on increasing Energy Efficiency and reducing energy costs. Ideal to support multi-site companies (retail shops, restaurants, bank branches, clinics, etc.), to give you actionable insights rather than just monitoring capabilities. WIS4Enterprises is a software as a service solution. WIS4Enterprises has all the functionalities of WIS4Households and also includes additional features such as: adaptive alarms, multi-location (e.g. different types of buildings, retail chains, restaurants, clinics, etc.) and user to do energy consumption benchmarking information.	Software-as-a service	31
WIS4Households	Watt-is	https://watt-is.com/services/	Data analytics services and solutions, translating smart metering data into valuable information. Improve your customer's experience by deploying our user engagement platforms in a software as a Service approach, WIS4Households and WIS4Enterprises are software-as-a-service solutions.	Software-as-a service	31

			WIS4Households provides clients a responsive and versatile user engagement platform, as a fully automated Artificial Intelligence cloud-based “Virtual Energy Manager”, with straightforward and quantifiable tailor-made tips to help them to be more energy efficient, reduce their energy bill costs and increase their satisfaction with our value-added services. WIS4Households allow the users to do load disaggregation, apply efficiency measures and make peer comparison.		

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