Bolstering EU's Energy Efficiency framework: Embracing flexibility across all levels

Policy Brief

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Abstract

This Paper examines the EU's energy efficiency advancements, focusing on Directive (EU) 2023/1791, and the crucial role of district heating and cooling (DHC) systems in elevating overall energy efficiency. It critiques the Directive's narrow focus on large-scale investments. The Paper advocates for a broader inclusion strategy that encompasses small-scale projects within energy efficiency, underscoring the synergy between integrated and renewable energy systems. It presents targeted policy recommendations with the intent of addressing a comprehensive EU framework for flexibility valuation. The aim is to refine and extend the scope of energy efficiency measures to capture the full spectrum of projects cross all relevant sectors, in particular DHC, power and buildings, thereby fostering a more resilient and sustainable European energy landscape.

Key Points

The directive demands energy efficiency evaluation for projects exceeding EUR 100 million, potentially overlooking smaller projects impacts. Expanding the assessment scope is advisable to include these projects' efficiency impacts.
Integrating flexible, effective energy systems is essential for robust, sustainable infrastructure. District energy's role is critical to enhancing EU's energy efficiency and sustainability goals.

Introduction

Energy efficiency stands at the forefront of the Energy Union strategy, embodying a pillar for Europe's environmental, energy security, and economic objectives. (European Commission, 2015) Given the ongoing war in Europe, its role in ensuring energy security and emission reductions has intensified. (Zhang, et al.,2024) This role extends beyond environmental benefits, underpinning energy supply security, aligning with the goals of Directive 2023/1791. (European Commission, 2024) The Directive is a regulatory framework designed to advance the EU toward energy and climate targets. It sets a course for sustainability, competitive energy system, and lowered energy consumption while driving economic growth through energy savings, technology, and innovation. (European Union, 2023)

When discussing energy efficiency, the focus often remains narrowly on quantifying energy savings in MWh reduced. (European Environment Agency, n.d.) Energy efficiency transcends mere MWh savings, capturing factors that determine an energy system's effectiveness, like cost-effectiveness and adaptability to changing demands and intermittent output. While the Directive is extensive in its scope, a primary challenge lies in how the Directive's content is interpreted and how its implementation must be carried out. This paper presents the hidden nuances of energy efficiency in the Directive and what improvements are needed to secure a resilient and dependable energy system for Europe.

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Integrating Flexibility and Efficiency: Implementing the Energy Efficiency Directive

The EU's Energy Efficiency First principle (Paragraph 18, Directive 2023/1791) advocates for a comprehensive energy systems efficiency approach with focus on entire energy chain, from production to consumption and recognizes the energy system's interconnectivity, where improvements in one area bring system-wide advantages and fosters an integrated and resilient energy system (European Union, 2023). This perspective promotes an energy landscape that is dynamic and responsive to fluctuating demands and infrastructure challenges. District heating and cooling (DHC) stand out in the context of energy efficiency and flexibility. These systems exemplify efficiency, harnessing intermittent renewable energy more effectively, thus acting as 'virtual energy storage' (Danish Board of District Heating (DBDH), n.d.). The combination of highly efficient cogeneration plants, electric boilers, large heat pumps and thermal storages, have become integral to the resilient energy system observed in countries like Denmark. Their ability to adjust to the variable output of renewable energy and transfer heat and cold from renewable sources to the buildings in urban areas ensures a consistent supply of heat and electricity. By aligning production with periods of renewable energy abundance, DHC systems benefitting from economy of scale function as buffers, stabilizing the energy grid by absorbing surplus renewable electricity from mainly wind and solar and converting it into thermal energy, which can be stored and utilized later. (Lund, et al.,2014) By curbing the peaks in electrical demand, the urgency for significant upgrades of electricity transmission and distribution systems is mitigated. This flexibility not only promotes energy efficiency but also offers economic advantages by reducing the necessity for expansive grid reinforcements or additional electricity production capacities.

The bolstered flexibility of DHC systems yields substantial socio-economic and corporate benefits. Assessing the value of flexibility in energy systems requires calculating the potential revenue a district heating enterprise could generate by its active participation in diverse electricity markets. Moreover, the financial impact of such flexibility can be assessed through DHC systems capacity to reduce reliance on peak-time energy production from dispatchable power plants, including those utilizing gas, coal, or biofuels. These typically have larger operational costs when compared with renewable energy sources like wind or solar. Reducing the use of these expensive and fossil fuel-based power plants, not only leads to significant financial savings but also to diminished greenhouse gas emissions. As stated, energy system flexibility also lessens the urgency for extensive upgrades to electrical grid networks, which mitigates the risk of extreme energy price. Enhanced flexibility in DHC systems not only fosters considerable technical, financial, and environmental advantages but also aligns with the strategic mandates of the EU.

Paragraph 19 of Directive (EU) 2023/1791 indicates that consistent application of the energy efficiency first principle is vital across all governance (national, regional, local) levels and various sectors during investment-related decision-making process. The

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Directive also requires energy efficiency evaluations for investments above EUR 100 million, considering both demand-side and flexible solutions. (European Union, 2023) However, its concentration on large-scale investments may unintentionally overlook the substantial collective energy savings that smaller projects offer, given their cumulative effect on the energy grid. Therefore, to ensure an energy-efficient future and sustainable development, one could consider that the criterion for energy efficiency should be interpretated as the sum of the collective investment in the many small-scale projects within a city's scope, or a large project could be divided into several sub-projects, each of which falls below the threshold.

The same paragraph mandates Member States to prioritize demand-side solutions over expanding energy supply infrastructures, due to their cost-effectiveness and broader benefits. This includes reductions in operational costs and contributions to economic, environmental, and social outcomes. (European Union, 2023) However, a common misconception considers 'demand-side solutions' as only immediate energy consumption reductions, like insulation improvements, overlook key efficiency contributors such as district energy and storage systems. These enhance efficiency more broadly across the energy network and in buildings HVAC systems (e.g. low temperature heating and high temperature cooling). District heating and cooling (DHC) exemplify this, enabling large-scale energy optimization beyond just buildings, thus moderating the variability of renewables. By integrating these systems into the definition of demand side solutions, member states can leverage their ability to optimize energy consumption at a scale beyond individual buildings. To maximize the impact, it's crucial to clarify that demand-side measures include both end-user actions and larger-scale infrastructural interventions like DHC. This inclusive definition will drive investments in systems that reduce demand and enhance efficiency throughout the energy spectrum, thereby supporting a resilient, cost-effective, and sustainable energy landscape.

Conclusions and Policy Recommendations

The Commission Recommendations 2021/1749 on energy efficiency first (EE1st)(European Union, 2021), highlight several barriers that hinder the full adoption and implementation of energy-efficient solutions. These barriers range from financial and technical challenges to issues relating to information and expertise.

- Financial barriers – insufficient funds or financial aid to energy-efficient solutions that could be linked to the way they are assessed and valued
- Technical barriers – the energy-efficient solution might be technically more difficult to assess or integrated into a viable option
- Information barriers – lack of information and data available to properly identify and estimate benefits of energy efficiency solutions
- Lack of expertise – insufficient knowledge how to implement energy efficiency solutions/ technologies and bias towards certain solutions excluding energy efficiency options

To overcome these obstacles, the integration of energy system flexibility within cost-benefit analyses is necessary. By incorporating energy system flexibility into cost-benefit analyses, it becomes possible to give energy-efficient solutions a more level playing field when comparing them to traditional energy investments. A flexibility

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valuation framework could provide the necessary guidelines and tools to alleviate the aforementioned barriers by ensuring that the full potential of energy-efficient technologies is recognized and adequately appraised. This would likely lead to a systemic shift in how energy projects are conceived, prioritized, and funded, fostering a more energy-efficient and sustainable future.

- **Develop comprehensive EU framework for the valuation of flexibility**: Establish a EU framework for measuring the value of flexibility in energy systems, targeting also investments under 100 million euros. This framework would enable a more precise evaluation of how flexible solutions, such as energy storage, demand-response systems, contribute to the overall efficiency, reliability, and resilience of the energy system.
- **Expand Cost-Benefit Analysis Scope**: Expanding the scope of cost-benefit analyses to include smaller-scale energy projects, it can ensure that these projects are also economically feasible and contribute optimally to the energy system.

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