ENERGY EFFICIENCY FIRST FOR SYSTEM DECARBONISATION

WHAT IS EE1ST?

Energy Efficiency First (EE1st) gives priority to demand-side resources whenever they are more cost effective from a societal perspective than investments in energy infrastructure in meeting policy objectives. It is a decision principle that is applied systematically at any level to energy-related investment planning and enabled by an 'equal opportunity' policy design.

DEMAND-SIDE RESOURCES	Alternatives to new energy infrastructure by energy end-use efficiency and demand response.
SOCIETAL PERSPECTIVE	Considering the impacts to the society and a long-term view, and not only the short-term impacts to the investors, end-users or the energy system.
ENERGY INFRASTRUCTURE	Both generation and network.
POLICY OBJECTIVES	Aligned with policy objectives (e.g. decarbonization).
'EQUAL OPPORTUNITY' POLICY DESIGN	Rules and regulations allowing for a level playing field for demand-side resources.

WHAT DOES EE1ST MEAN FOR THE ENERGY SUPPLY OF BUILDINGS?

In the electricity sector, EE1st means to invest into energy efficiency and demand response (demand-side resources) – instead of investing in generation and network infrastructure – whenever the former brings more net value to the society.

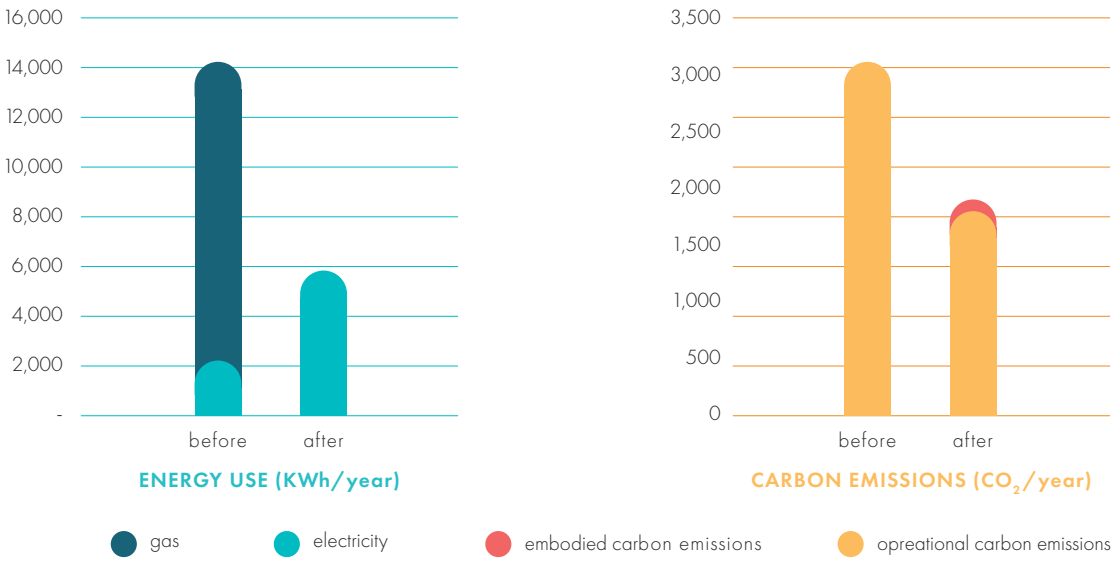
In the gas sector, however, EE1st takes on an even more important role, as demand-side resources are a critical tool for the **necessary phase out of fossil gas in buildings**, in line with the ambitious decarbonisation targets of Europe. The use of demand-side resources is fundamentally interlinked with the **decarbonisation for heating** as the flexibility of buildings can only be used if they are energy efficient. Reaching net-zero GHG emissions by 2050 requires the radical reduction of fossil gas use after 2030 (EC 2020, Impact Assessment of the Climate Target Plan, Part 2).

Speeding up gas supply independence is even more crucial given the gas price rollercoaster since late 2021 and the **critical supply security situation** since the breakout of war in Ukraine. The RePowerEU Plan targets the reduction of EU demand for Russian gas by two thirds before the end of 2022. As **buildings use 36% of the EU's total fossil gas demand** (based on Eurostat), the decarbonisation of the building stock is a priority as projections anticipate fossil gas largely being phased out of use in buildings by 2050.[1]

Cutting dependence from Russian gas is an immediate necessity. Meanwhile, permanently moving away from fossil fuels and gas is a key EU objective, strategically adopted in 2019 as part of the EU Green Deal. This major transition is already initiated in gas-abundant countries – like the Netherlands – that decided to stop relying on gas for heating as they recognise the risks linked to fossil fuel supply and its incompatibility with the climate targets.

To achieve the needed decarbonisation of buildings, decision makers must approach the problem from the perspective of not only removing fossil gas from the system, but of thinking about **creating a more integrated energy system overall.** Starting with end-use efficiency and demand response measures allows for the needed demand reduction and flexibility possibilities that facilitate greater electrification and reveal where the use of alternative gases (e.g., H2 or biomethane) may be needed (cf. energy system integration and related discussion below). Electrifying heat increase end-use efficiency and is an addition to improving the building fabric to reduce heat energy need.

Figure 1: Heat electrification improves efficiency and reduce emissions (example from the UK), source: RAP



Specifically, end-use efficiency and the flexibility offered by electrification are needed as part of more comprehensive and resilient demand/supply side solution sets rather than one-for-one assertions of decarbonised gases (or blending), namely:

Requiring a hard look at new gas infrastructure to ensure it is necessary – i.e., to determine whether the serviced end uses can be met with end-use efficiency, demand response and clean heating solutions, and that these solutions are in line decarbonisation plans. Without such analysis, many investments will likely **become stranded much before the end of their useful lives with consumers bearing the costs.**

Reducing heat demand through renovation and zero-energy construction for new buildings to define the suitable alternative to supply it.

Assessment of individual and industrial scale (district level) heat pumps and other clean heating options in parallel with options for continued reliance on gaseous fuels.

The coordination of the network investment and divestment by the national regulator.

Planning for a timely, efficient and equitable **decommissioning of unneeded gas networks.**

Figure 2: Geographically targeted electrification to reduce infrastructure needs
Source: Graphic concept inspired by Aas D., Mahone, A., Subin, Mac Kinnon, M., Lane, B., & Price, S. (2020). The Challange of Retail gas in California's LOw-Carbon Future: Technology Options, Customer Costs, and Public Health Benefits of Reducing Natural Gas Use; graphic modified by RAP.

Non-pipe alternatives **are efficiency, flexibility and electrification options that avoid unnecessary expansions or upgrades of gas infrastructure. Targeted electrification is to retire the distribution grid area by area. Selected area should first go through energy demand reduction and then electrification so that a part of the gas distribution network can be retired. Scattered electrification would leave fewer gas-using customers paying a greater share of network cost, increasing their energy bill.**

HOW DOES THIS COMPARE WITH REALITY?

Over 130,000 kilometres of gas transmission pipelines[2] and around 1,800,000 kilometres of gas distribution pipelines are spread across Europe.[3] Despite EU decarbonisation targets, EU and national commitments for end-use electrification, and development of district heating supplied with RES or waste heat, **Transmission System Operators (TSOs) and Distribution System Operators (DSOs) for gas continue to request approval for system expansion.** These investments are often occurring in parallel with decarbonisation discussions, and thus not subject to scrutiny regarding whether they are needed – including consideration of whether end-use needs could be met through demand-side measures, electrification or other substitution (e.g., district heating) – or in line with transition to a decarbonised system. Moreover, the focus on system expansion crowds out **needed discussion of system decommissioning** in areas where gas will need to be phased out.

This situation is caused by an **inflated focus on gas decarbonisation**, including discussions around hydrogen and other alternative gases in lieu of overall system decarbonisation. Although gaseous fuels will still be needed in a decarbonised system, they will not be used as fossil gas is used today. Instead, they will be **reserved for hard-to-electrify end uses**, such as heavy transport and aviation.

What is needed instead is an integrated approach that allows for consideration of solution sets that fit within a decarbonised system. The **EU Commission's** Energy System Integration Strategy calls for and outlines such an approach starting with the development of a more circular energy economy, with **energy efficiency at its core**, increased electrification, and usage of alternative gases and also other clean heating solutions (e.g. waste heat) when electrification is not technically or economically feasible.

As the integration strategy notes, **energy efficiency needs to come first** in the development of a decarbonised system. In practice, that means that decision makers will need to consider energy efficiency and demand response on a level playing field with requests to invest in further gas infrastructures. This analysis is critical to determine where energy efficiency plays a role to reduce demand and facilitate electrification, and where there may need to develop infrastructure in line with meeting hard-to-electrify end uses.

Unfortunately, the **Commission's proposed** gas package focuses on gas decarbonisation, and thus **fails to require an integrated system approach** that would put efficiency first. Because the gas package does not prioritize efficiency first, it does not develop the structure needed to allow for a larger role for efficiency and demand response, opting instead for a myopic focus on one-for-one gas solutions.

WHAT WOULD AN EE1ST COMPLIANT GAS REGULATION LOOK LIKE?

System integration requires **improved planning processes** where decision makers determine end-use needs first[4], then evaluate alternatives to meet those needs, instead of making independent investment decisions. Importantly, planning processes should overarch **multiple decision levels**. The framework for decarbonisation is developed at **national level** (e.g., in the National Energy and Climate Plans); then **system operators** align their planning with Member State objectives, and the **national regulatory authority** considers infrastructure requests in the light of the decarbonisation plans. The major role of energy system operators and national regulatory authorities in implementing EE1st has indeed been stressed in the proposed recast of the Energy Efficiency Directive (see proposed Article 25(2)). The integration of demand options in the planning of system operators is a challenging novel task, not least for the regulators that must be able to assess across supply and demand options proposed by the network company.
By prioritising demand-side measures, decision makers can then determine whether infrastructure requests are suitable for climate-aligned scenario planning, and where decommissioning of unneeded infrastructure is a next step. In case of **municipal-level** heat planning, regulators are informed also by local understanding of potential pathways to decarbonise heating systems. Developing policies that provide for **transparent data and information** across the decision-making levels will allow stakeholders to provide input for decision-makers and inform efficient solutions.

Taken together, the following recommendations will ensure that the Energy Efficiency First principle facilitates the development of an energy system that is aligned with net-zero climate goals.

	BUSINESS AS USUAL	ENERGY EFFICIENCY FIRST
MANDATE	**Maintain an efficient level of network infrastructure…**	
	…by executing cost-effective gas network investment based on the current structure and level of fuel demand.	…by investing in the cost-effective mix of **energy network and demand-side resources** considering the need for a **speedy phase-out of gas** in Europe
NETWORK REGULATION	**to minimise the cost to and fairness among consumers while maintaining the economic viability of network companies.**	
Remuneration of network companies	Bias towards capital expenditures in covering costs of gas distribution system operators and transmission system operators.	**Similar remuneration for both capital** expenditures **and operating** expenses. Financial drivers to **support decarbonisation goals** by adjusting infrastructure size.
Network planning	Matching network investment to forecasted exogeneous demand.	Selection based on **CBA covering wide range of costs and benefits** of all energy network investment options (including district heating and power) and **demand-side solutions.**
	Separate planning for power, gas and heat	**Coordinated network planning** across energy carriers.
REGULATORY CHECK	**for approving the proposed investment to be covered by network tariffs.**	
	Closed process.	**Transparency, availability of data and open processes** to ensure that stakeholders can submit alternative scenarios
INVESTMENT	**…into network infrastructure elements.**	**…into the identified mix of network infrastructure and demand-side measures.**
	Closed procurement to maintain, upgrade and extend gas networks.	**Tender-based** procurement to achieve **decarbonisation goals.**

LITERATURE

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2. https://globalenergymonitor.org/projects/global-fossil-infrastructure-tracker/summary-tables/ (Gas Pipeline kilometers by country (Dec. 2020)); CEER Benchmarking report, https://www.ceer.eu/documents/104400/-/-/963153e6-2f42-78eb-22a4-06f1552dd34c; https://www.entsog.eu/sites/default/files/2021-11/ENTSOG_CAP_2021_A0_1189x841_FULL_066_FLAT.pdf

3. CEER Benchmarking report, https://www.ceer.eu/documents/104400/-/-/963153e6-2f42-78eb-22a4-06f1552dd34c.

4. For more details about integrated energy planning, see part 1 of ENEFIRST (2021): Guidelines on policy design options for implementation of E1st in buildings and the related energy systems.

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