EFFICIENCY FIRST: FROM PRINCIPLE TO PRACTICE

REAL WORLD EXAMPLES FROM ACROSS EUROPE

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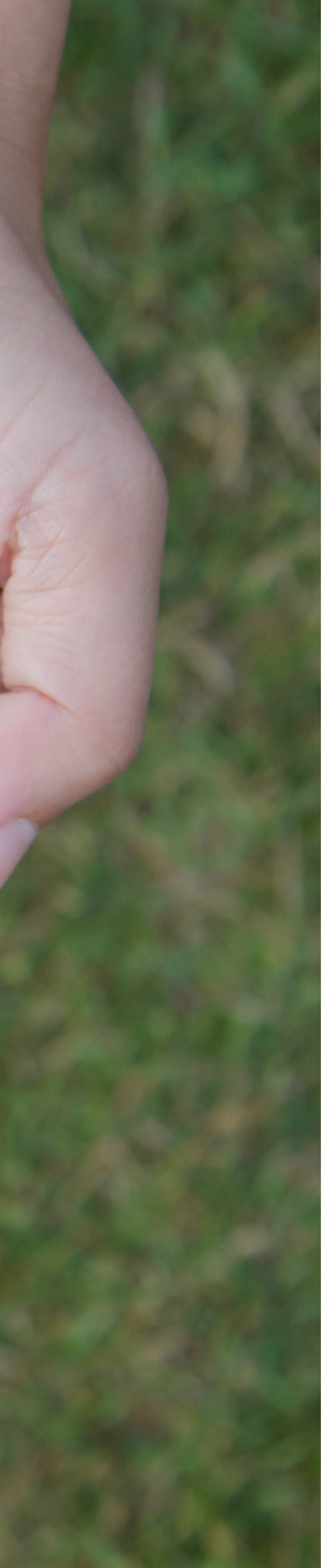


Introduction: applying an Efficiency First approach across the Energy Union

The EU's energy infrastructure faces numerous challenges over the next decades. It needs to be decarbonized whilst ensuring the competitiveness of EU industry, providing energy security, addressing energy poverty, reducing energy bills, and empowering consumers, who play a crucial part in the energy system of the future. Getting those choices right is key for ensuring a sustainable, fair, affordable and secure energy future. The principle of "Efficiency First" (E1st) delivers on all three.

E1st is a principle applied to policymaking, planning and investment in the energy sector. Put simply, **it prioritizes investments in customer-side efficiency resources (including end-use energy efficiency and demand response) whenever they would cost less, or deliver more value, than investing in energy infrastructure, fuels, and supply alone.** At a first look, this is purely a common-sense policy – surely public policy should promote end-use efficiency whenever saving energy or shifting its use in time costs less or delivers greater value than conventional supply-side options. Doesn't this happen automatically? Unfortunately, no. On the demand side, investments in efficient solutions are impeded by numerous market barriers to individual action; and on the supply side, industry traditions, business models and regulatory practices have always favoured, and continue to favour, fossil fuel based energy infrastructure and sales over lower sales and energy saving technologies.

For this reason, rules that prompt an E1st approach need to be built in at all relevant places within the governance framework for the Energy Union, at both the EU and national levels.[1] E1st has gained traction at EU level since the launch of the Energy Union Communication in February 2015[2] and also in some European countries such as Germany where it has become an energy policy principle[3] and is now being explored further in Germany's Green Book on Energy Efficiency[4].

In order to move from principle to practice, and to bring E1st to life in the minds of policy-makers, this paper seeks to answer the questions: is E1st entirely new to Europe? What real-world changes and results does its application bring? Available case studies of E1st in action are mainly taken from the United States where approaches such as Integrated Resource Planning and "all cost-effective efficiency" standards have resulted in the application of the E1st principle (although not labelled in that way).[5] This paper builds on ten key applications of E1st identified through an expert process convened by the European Climate Foundation during 2016, and summarised in the publication '*Governance for Efficiency First: "Plan, Finance and Deliver"*'.[6]

As it turns out, using efficiency as a resource to the energy system is not new to Europe. This report provides selected European examples that illustrate the E1st principle in practice across the 10 policy areas ("asks") defined in the earlier work on E1st. The focus of this paper is on:

(1) efficiency as a resource to the energy system: 'save before you build';

(2) local energy planning and investment: using efficiency to unleash local benefits; and

(3) broader climate and energy policy: putting E1st to solve the trilemma of sustainability, competitiveness and affordability.

While this paper does not cover the broad application of E1st principles across the EU policy and decision-making landscape, it provides an important step in demonstrating its value *in practice*. This, in turn, will be critical in ensuring that efficiency is recognized and valued in other areas, such as the use of EU funds, cross-border infrastructure priorities, and energy security, to name a few.

Case studies of Efficiency First

There are numerous examples of E1st in practice across Europe. They may not have been called E1st but they demonstrate both the logic of the principle and its value. Below, we present a selection of such examples in a range of different areas.

In some cases, the application of E1st was driven by committed individuals who saw the potential in applying a different approach, whereas in others the governance framework explicitly supported E1st. We explain the context in which examples of E1st have been realised for each example in this report. The table below sets out the examples presented and which aspect of the principle they relate to.

Aspect of Efficiency First	Case study
Efficiency as a resource to the energy system: 'save before you build'	
Using efficiency to defer investment in grid capacity	Holyhead Powersave Project
	French Riviera "Eco-Energy Plan"
Demand response to optimize distribution system operations and reduce the need for costly network upgrades	C2C Capacity to Consumers
Benefitting consumers through improved thermal efficiency of buildings alongside improved efficiency to district heating network	Krakow Energy Efficiency Project
Reducing gas consumption through energy efficiency obligations: aligning the regulatory framework to put "efficiency first"	Integrated resource planning and energy efficiency obligations
Local energy planning and investment: using efficiency to unleash local benefits	
Considering efficiency on equal footing with supply-side alternatives in local energy plans	EU-wide Covenant of Mayors for Climate & Energy
Early demand response programs demonstrate how tariff design can engage customers and benefit the power system	Early time-of-use tariffs
Applying time of use tariffs to reduce investment costs in locally-owned distribution networks	Loire time of use tariff
Energy efficiency as a public 'infrastructure priority'	Energy efficiency as infrastructure in Scotland
Climate and energy policy: putting efficiency first to solve the trilemma of sustainability, competitiveness and affordability	
Benefitting consumers by focusing carbon revenues on efficiency	Czech Green Savings Programme
Aligning efficiency with distributed renewables: optimizing renewables investment by minimizing wasted energy	Minimum energy efficiency requirement prior to renewable energy installation

1. Save before you build': investing in efficiency rather than supply side infrastructure where it is more cost-effective to do so

It may seem obvious to invest in efficiency to the extent that it is a more cost-effective route to matching supply with demand than solely relying on investments in supply-side infrastructure. However, when looking at how the electricity, gas and heating sectors operate in Europe, efficiency is generally overlooked - unless there is a dedicated governance framework that requires decision makers to explicitly consider efficiency alongside other supply-side options.

There is a precedent for such a framework: beginning in the mid-1980s, many US states and Ontario adopted laws and regulations requiring power and gas utilities to follow "least cost" investment practices. In some of those states, major supply-side investments were tested against demand-side alternatives before permits for power plants or transmission lines could be issued or customers charged for more expensive supply-side solutions. Customer-side investments were compared against supply-side investments in terms of both costs and benefits – including benefits to energy systems, customers, and broader societal benefits such as public health and compliance with environmental standards.

A recent study on exploring such an approach in Europe affirms what international experience has demonstrated for a long time: namely, that comprehensive, long-term, and aggressive investment in end-use energy efficiency will yield substantial power sector cost savings. The value of electricity savings in Germany to the power system alone is in the range of EUR 0.11-0.15 per kilowatt-hour.[7]

For this reason, efficiency has been treated in some cases as an energy system resource avoiding costly investments in new supply infrastructure. The following examples illustrate where customer-side resources were mobilized as a valuable part of the energy system – including electricity, natural gas, and district heating systems.

1.1 USING EFFICIENCY TO DEFER INVESTMENT IN GRID CAPACITY

Title	Holyhead Powersave Project
Place	Wales
Time period	1992-1993
Decision makers involved	Energy company serving North Wales

In 1990, MANWEB, the electricity supplier and distributor for the North Wales (now part of Scottish Power), was facing the prospect of having to build a new substation for Holyhead, a community of 13,000 people on Holy Island, at a cost of GBP 850,000 (about EUR 1 million). Electricity demand in Holyhead was increasing by 2% per year and was expected to rise further due to forthcoming development and regeneration of the island. Without another substation, there would not have been sufficient backup capacity in the grid in case one of the two substations failed.[8]

After a Member of MANWEB's board suggested that investment could be deferred through demand reduction, MANWEB launched the Holyhead Powersave Project with the aim of reducing peak demand on the island. Measures to reduce peak included efficient light bulbs, hot water tank lagging and draught proofing, energy efficient electrical appliances, and free energy audits for the industrial and commercial sectors.

The decision was taken in a political context where there was a discussion both within the gas and the electricity sectors about the potential from demand-side solutions. There was an opening for introducing energy efficiency and demand response approaches with the electricity and gas regulators commissioning studies into this subject.[9] [10]

Impact: It was estimated that the Holyhead Powersave Project would cost GBP 500,000 (EUR 600,000) to which the European Commission contributed GBP 80,000 (EUR 100,000) leaving MANWEB with an expenditure of GBP 420,000 (EUR 500,000). This resulted in avoided investment cost of EUR 500,000, as with the implementation of the programme, there was no need to build the substation for another 5 years due to the reduction in peak demand by 10%. In addition, customers received lower energy bills, and costs for wear and tear are likely to have been reduced, although this has not been estimated. The project also had reputational benefits - MANWEB also received considerable public attention and even international recognition for the Holyhead Powersave Project.[11]

Title	French Riviera "Eco-Energy Plan"
Place	France
Time period	2000
Decision makers involved	Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME), Région Provence-Alpes-Côte d'Azur, Electricité de France (EDF)

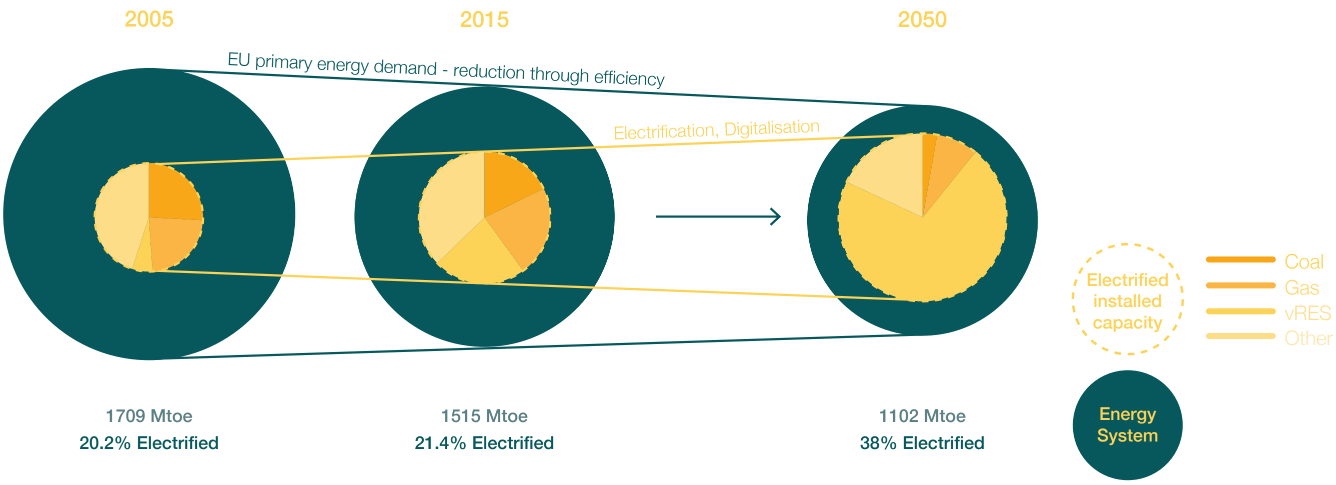
In the 1980s planning began for expanding the electricity transmission network that brings power into the Provence-Alpes-Côte d'Azur region of France. The region is far from electricity supply, with limited transmission lines and a growing population, leading to the risk of supply constraints without reinforcing the network. The plans, however, were met with substantial public opposition: in 1994 and 1997 petitions blocked a total of seven proposed routes. In 2000, a decision was made to develop an alternative solution, which included upgrading an existing line, and implementation of customer-side measures, including energy efficiency and distributed renewable generation. In 2006, a court refused planning permission for the network upgrade, leaving demand-side measures as the only solution to secure stable electricity supply.

A number of studies were carried out to determine the potential for energy savings to relieve pressure on the system, and to identify a detailed program of measures. These studies led to the “Eco-Energy Plan” (le Plan Eco-Energie), a joint undertaking launched in 2003 by ADEME, Préfecture des Alpes Maritimes, Région Provence-Alpes-Côte d’Azur, and EDF. The plan focused on a number of priority areas: information campaigns, new and existing buildings, efficient lighting and domestic electrical appliances, large consumers and distributed generation, demonstration projects, and tourism. **It aimed to deliver peak summer and winter savings, as well as an overall reduction in energy consumption, which together would defer the need for a network upgrade.**[12]

In 2011, in response to continued concerns over the fragility of electricity supply to the region, eight partners including regional and municipal authorities, RTE, and ADEME signed a contract of objectives to secure stable supply to the region. This agreement had three pillars: strengthening the electricity transmission network, decreasing electricity consumption by 20% by 2020, and strengthening renewable electricity production in the region to account for a quarter of consumption by 2020. This combination of supply and demand-side measures is expected to secure supply in the region to 2030.[13]

Impact: The public opposition to building a transmission line in Southern France has drawn focus to opportunities to reduce the need for network reinforcements through demand-side measures and local renewable generation. Since the launch of the “Eco-Energy” plan in 2003, investments in end-use energy efficiency have helped defer the need for network reinforcement, and today, end-use energy efficiency continues to be a strategic component to securing stable electricity supply in the region.

Figure 1: Reducing the EU's greenhouse gas emissions by 80% by 2050 will require a significant reduction in primary energy demand, but an increase in the size of the power sector as heating and transport are electrified. A large share of electricity will need to come from variable renewables, necessitating significant flex-efficiency. The Paris agreement implies even greater emissions and energy use reductions for the EU.



Source: Commission 2050 Roadmap (2011); European Environment Agency (2015)

1.2 DEMAND RESPONSE TO OPTIMIZE DISTRIBUTION SYSTEM OPERATION AND REDUCE THE NEED FOR COSTLY NETWORK UPGRADES

Title	C2C Capacity to Consumers
Place	UK
Time period	2007-2010
Decision makers involved	Electricity North West, Low Carbon Network Fund

As the UK fulfils its decarbonisation obligations under the Climate Change Act 2008 to cut greenhouse gas emissions by 80% by 2050 based on 1990 levels, the demand on electricity networks is likely to increase significantly, which will translate into additional costs to consumers. This increase in network demand will be driven primarily through the decarbonisation of heat, transportation and through local electricity production rather than by population growth.

The C2C project was developed to address this anticipated rise in demand. It is one of several projects funded by Ofgem's Low Carbon Network Fund, which provides distribution network operators with capital to undergo research trials to help develop solutions to the challenges brought on by decarbonisation.[14]

The objective of the C2C Project was to test a combination of enhanced automation technology, nonconventional network operational practices (i.e. increased network interconnection), and commercial demand side response (DSR) contracts alongside customer acceptance to such changes. **The project aimed to prove that demand response could free up network capacity, thereby avoiding (or deferring) the cost and environmental impacts that are associated with traditional network reinforcement.** The project further developed carbon and economic models allowing the distribution network operator to assess impacts of the tested approach on costs and carbon reductions.

For the project, Electricity North West together with its project partners trialled demand-response contracts with ten large commercial and industrial customers connected to the high-voltage system, which represents approximately 10% of Electricity North West's distribution network. The contracts were for new or additional load on the system that, in the absence of demand-side response contracts, would require network reinforcements to accommodate the increased demand. The project successfully released a large part of the capacity on the relevant circuits.

Impact: The project saved participating customers GBP 7.5 million (EUR 8.3 million). The costs to the customers under the project totalled GBP 370, 000 (EUR 415,000) compared to an estimated GBP 7.8 million (EUR 8.8 million) cost of traditional network reinforcements that would have otherwise been needed to accommodate the increased demand.

Electricity North West's analysis shows that the C2C Solution, applied across the entire network has the potential to deliver significant financial savings to the distribution network operator and to consumers, and to generate additional carbon benefits through avoided emissions associated with avoided capacity and reductions in network reinforcement. The company plans to incorporate the C2C approach in its activities moving forward.[15]

1.3 BENEFITTING CONSUMERS THROUGH IMPROVED EFFICIENCY TO DISTRICT HEATING NETWORK AND IMPROVED THERMAL EFFICIENCY OF BUILDINGS

Title	Krakow Energy Efficiency Project
Place	Krakow, Poland
Time period	2002 – 2007
Decision makers involved	Ministry of Economy, MPEC (The Municipal District Heating Enterprise of Krakow)

In 2002, the Krakow district heating company undertook a project funded by the World Bank to improve the poor quality of the district heating system, which was highly inefficient and generated a lot of thermal and water losses (Krakow Energy Efficiency Project). The project included an energy service company component as part of the modernization program, leading to the creation of POE ESCO, a company wholly owned by the Krakow district heating company, which is itself municipally owned. **This is an early example of an innovative approach to improving the efficiency of the whole district heating system by investing not just in the network itself, but also improving the efficiency of the buildings that consume the heat, with direct benefits to the end-user.**[16]

Photo credit 1

The project built off an earlier, deep reconstruction project that was undertaken in the 1990s. The 2002 Krakow Energy Efficiency Project primarily focused on improving the efficiency of the network, but also on efficiency at the end-user level investing in retrofitting of schools.

The main objectives were realised by: continuing the modernization program of the district heating system of the City of Krakow, helping consumers reduce their consumption by improving energy efficiency at the end-user level, and developing the knowledge and mechanisms necessary to fund end-user energy efficiency projects.

It is worth noting that initially, due to various difficulties, energy service company activity was not developed in the housing sector. Barriers arose out of suspicion and misunderstanding of why a district heating company would want to help consumers save energy. A problem also arose due to the structure of housing co-operatives, which had their own sub-contractor base, and were reluctant to engage with the new company. For this reason, the project focused on retrofitting of schools.

Impact: Thanks to the combination of improvements to the district heating network and to schools, the main benefits included: connection of new consumers, decreasing primary energy consumption, reduction in thermal and water losses. Water losses from the district heating system declined by almost a quarter between 2000 and 2008 even though more consumers were connected. The cost-benefits analysis includes environmental impacts including the reduction of air pollutants.

According to the energy service company's report, which focuses on savings achieved through the retrofitting program, cost savings at the end of the project were PLN 1.3 million (EUR 300,000) per year that is 31% of the initial energy supply costs of PLN 4.2 million (EUR 970,000). The project generated significant energy savings (6,444 MWh) and capacity savings (4.5 MW).[17]

1.4 REDUCING GAS CONSUMPTION THROUGH ENERGY EFFICIENCY OBLIGATIONS: ALIGNING THE REGULATORY FRAMEWORK TO PUT "EFFICIENCY FIRST"

Title	Integrated resource planning and energy efficiency obligations
Place	Great Britain, Denmark
Time period	1994-present
Decision makers involved	Government ministry, energy regulator, energy companies

In Britain, until 1991, gas or electricity purchase costs by energy suppliers could be passed through 100% to customers. However, this was not the case for energy efficiency measures, and energy suppliers had to bear the cost without being able to recoup the investment. Hence, it was argued, here in the case of gas, that the regulation was 'an active disincentive operating on British Gas to undertake gas conservation and efficiency investments which could provide the least-cost gas services to consumers'[18]. A similar point was made by the House of Commons Energy Committee.[19]

Because of those discussions, **in May 1991, the Office for Gas Regulation announced a new gas price control formula to operate from April 1992 to March 1997 with the purpose to encourage British Gas to compare the costs of supplying gas with the option of investing in demand-reducing alternatives.** This formula would include an 'E factor' allowing gas suppliers to pass 100% of the costs of energy efficiency projects approved by the Director General through to gas customers. Also the electricity regulator indicated that it would allow the costs of efficiency projects to be passed on to consumers.[20]

Following the change in the law, the UK was the first country in Europe to establish an Energy Efficiency Obligation in 1994. This policy is still in place today requiring energy suppliers to deliver a fixed quantity of energy savings in homes.[21] The original energy savings target increased eightyfold from 1994-1998 to 2008-2012.[22] The majority of the savings have been achieved through insulation and heating system upgrades - given that most of the UK's homes use gas as the main heating fuel, most of the impact of the Energy Efficiency Obligation in terms of energy savings affected gas consumption.

Similar policies have been adopted in other EU countries - in Denmark, a law was introduced in 1995 based on Integrated Resource Planning.[23] This law obliged vertically integrated utilities to present 15-year plans to the government specifying how they will achieve their commitments on energy efficiency and environment policies balancing this with the core business of supplying electricity. The Danish Integrated Resource Planning law formed the basis for introducing Energy Efficiency Obligations in 2006. **There are clear parallels with the UK example - a change in the regulations eventually led to the introduction of ambitious end-use energy efficiency policies, with a direct link to the energy sector.**

It is important to note that while little work has been done to track the effect of energy savings on gas demand, some recent studies have highlighted the contribution that end-use energy efficiency can make to security of gas supply in Europe. This is a particularly important issue given the concerns over dependence of many European countries on a single supplier. The European Commission in its impact assessment to the energy efficiency communication in July 2014 found that every 1% in additional (economy-wide) energy savings translates into a 2.6 % reduction in natural gas imports.[24] A recent study by the Buildings Performance Institute Europe finds that in South-Eastern Europe – one of the most vulnerable regions in Europe to security of gas supply concerns and in terms of low-income customers – an aggressive cost-effective renovation strategy rolled out over 20 years could cut overall gas consumption by 70%.[25] Another paper commissioned by the European Climate Foundation has identified ambition on end-use energy efficiency in Europe as a key element in increasing the level of security of gas supply in Europe.[26]

Impact: Between 2004 and 2011, total household gas consumption in the UK decreased by 5% per year on average, or approximately 3.6% per year after temperature correction (Figure 2: Gas consumption by UK households (2002-2013)). This led to a cumulative reduction in residential gas demand of around 15% even as the number of households in the UK was increasing.

Figure 2: Gas consumption by UK households (2002-2013)

Source: DECC (2014b): Energy consumption in the UK. London, DECC and DECC 2014, Energy trends section 7: weather. Online: https://www.gov.uk/government/statistics/energy-trends-section-7-weather

These changes in consumption were driven by changes in the number and size of households, income, average internal temperature and the changing stock of appliances; together with investment in energy efficiency measures. While it is not straightforward to estimate the relative contribution of each, the Centre for Economics and Business Research[27] estimate that energy efficiency measures provided the greatest contribution to the reduction in gas consumption. Specifically, approximately two thirds of the reduction in household gas consumption between 2006 and 2009 (4.9%/year) was attributed to energy efficiency, of which 36% was due to insulation, 36% to condensing boilers and the remainder to behavioural change. As most of these measures were subsidised by the Energy Efficiency Obligations, it is evident that those were the primary driver of energy savings over this period.[28]

Photo credit 2

2. Local energy planning

European cities and regions are in the driver's seat in the transition to an ever more decentralised energy system and a low-carbon economy. Many cities are energy actors in their own right, with municipally-owned energy companies and local city councils supporting communities to become energy 'self-sufficient.' Local decision makers are delivering the Energy Union through increased investment in renewable energy capacity, energy efficiency programmes and ambitious greenhouse gas reduction targets. They are confronted with a number of issues they are bound to resolve: air pollution affecting nearly everyone, and energy poverty that affects one European out of ten are the first two that come to mind. Faced with these challenges, cities and regions innovate. They are experimenting and trialling different energy and climate projects. They can see their immediate effects and understand best what works and where the barriers lie. It does not come as a surprise that E1st has emerged at the local and regional level.

2.1 CONSIDERING EFFICIENCY ON EQUAL FOOTING WITH SUPPLY-SIDE ALTERNATIVES IN LOCAL ENERGY PLANS

Title	EU-wide Covenant of Mayors for Climate & Energy
Place	EU-wide
Time period	2008 - current
Decision makers involved	Mayors

The adoption of 2020 energy and climate goals led to the creation of the Covenant of Mayors. The Covenant is a bottom-up initiative designed to support the implementation of EU climate and energy targets by encouraging local action. Cities voluntarily commit to go beyond EU targets by implementing Sustainable Energy Action Plans. Such a plan is adopted by the city council and forwarded to the Joint Research Centre of the European Commission for evaluation. To date, over 5,500 plans have been adopted by Covenant signatories.[29]

The template used for the plan leads signatories to consider energy efficiency on equal footing with supply-side alternatives. The Covenant's secretariat has drafted guidelines to support local authorities in drafting their action plan.[30] This guidance remarkably requires local authorities to develop an integrated and inclusive energy plan, focus on reducing the energy demand in their territory, and match energy demand with supply by promoting the use of local energy resources. This integration of energy efficiency is remarkable and speaks to the requirement to have demand-side options front and centre. The action plan is based upon a mandatory template developed by the secretariat of the Covenant in cooperation with the Joint Research Centre. It requires local administration to realise what is very similar to an integrated planning of energy efficiency, renewable energy development and the investment needed to upscale these sectors.[31] Considering these elements as part of one planning exercise is not common at national level, at least as far as planning in existing directives is concerned.

The Commission has upgraded the template to factor in 2030 targets and is proposing an even more integrated planning process by including climate risks and resilience actions in the plans.[32]

Impact: The Joint Research Centre of the European Commission has been tasked with monitoring the progress made by local authorities. In a 2016 report, the institution notes that signatories have decreased their final energy consumption by 20% in comparison with 1990 levels (final energy consumption per person fell from 21.20 MWh/per year to 16.93).[33]

2.2 DEMAND RESPONSE PROGRAMS DEMONSTRATE HOW TARIFF DESIGN CAN ENGAGE CUSTOMERS AND BENEFIT THE POWER SYSTEM

Title	Early time-of-use tariffs
Place	Poland, France
Time period	1960s to today
Decision makers involved	Energy companies

Mobilizing customers to conserve energy or shift consumption in time to benefit the power system is not new. Since at least the 1960's, several European countries have employed tariff designs that include cheaper and more expensive hours, often called "time of use tariffs." These tariffs aim to drive customers to use less energy when demand on the electricity system is high, and more when demand is low. **In this way, customers act as another resource on the system, helping to balance the system alongside power plants. In essence, this simple form of demand response represents Efficiency First '101'.**

The Polish G12 tariff is one such example. It charges a lower rate for the electricity used at night (10pm – 6am) and selected hours during the day (1 pm and 5 pm), compared to the rate paid during the rest of the day. These tariffs are offered to households and are approved by the Energy Regulatory Office. The tariff was introduced in the 1960's, when electrical accumulation radiators became popular for space heating. The additional low rates in the middle of the day were designed for households that had to warm-up radiators to avoid temperatures from dropping too low. These days more efficient electrical heating appliances have largely replaced electrical accumulation radiators. However, G12 still exists and is popular among owners of detached houses.

In France, EDF has had time of use tariffs in place since the 1960's (and earlier for large consumers).[34] Customers with electric space or hot water heating can benefit from these tariffs (customers with few electric appliances can choose a flat "base" tariff option).[35] A peak/off-peak (heures pleines/creuses) tariff, introduced in the 1980s, provides customers with a higher peak price, and lower offpeak price – from 10pm – 6am each night. The Tempo tariff, launched in the 1990s, is one of the more sophisticated long-standing tariff designs in Europe. It bases electricity prices on two factors: weather and time of day. It is designed around the fact that electricity demand on the system is highly temperature-sensitive during the heating season due to the high level of electric hot water and space heating in the country. Tempo customers have a day and night tariff, with the low- and high- tariff levels depending on outside temperatures. Customers receive a total of 300 blue (normal) tariff days, 43 white (higher prices) and 22 red (highest prices). During the heating season, customers receive a day-ahead warning of whether to expect tariffs the following day to be blue, white, or red. The designation will depend on anticipated temperatures.

Similar examples can be found in many other countries, including in the Nordic countries, and in the UK with its Economy 7 and Economy 10 tariffs.[36]

Impact: In Poland, about 2 million households out the total population of 14.5 million are on some form of time of use tariff today. In France, the Tempo Tariff has been chosen by a small proportion of households (1.2%), and has reduced the national peak by about 4%. About a third of households participate in the peak/off-peak tariff, shifting about 6GW of load daily.[37]

Dynamic time of use tariffs are in place in many parts of Europe. They demonstrate the value of capturing customer responsiveness, though oftentimes the benefits to the power system of these services have not been quantified. The role of consumers will only increase with the recognition of the role of end-use energy efficiency and demand management in reducing peak demand and meeting decarbonisation goals cost-effectively. With increased penetration of renewable generation across Europe, demand management – both "down" and "up" customer response – will be increasingly valuable. New technologies and business models will play an important role for increased demand response to reflect market prices and system conditions.

Title	Loire Time of Use tariff
Place	Loire région (France)
Time period	1998-2003
Decision makers involved	Municipal councils and associations of municipalities

In France, local authorities (municipalities or associations of municipalities) own the electricity distribution networks. In rural regions, the cost of reinforcing or replacing part of the grid is a serious burden to already strained budgets. In many circumstances, the cost is much higher than the annual financial return, making it a loss for the local budget. **Demand-side measures and energy efficiency provide a welcome relief by reducing the need for more costly grid reinforcement.**

The Loire région (West France) is no exception. The association of municipalities took part in a Time of Use Tariff Program to reduce future costs. EDF, the energy supplier, helped identify more than 500m-long feeders with less than 20 customers, and reached out to the customers to propose a new tariff when it would make financial sense for them.

Impact: The tariff was adopted by 946 residential customers. Computer simulation showed the tariff has deferred reinforcement for more than 5 years in 31 of the 53 feeders selected. The benefit for the public budget is estimated at EUR 213,785.

2.3 ENERGY EFFICIENCY AS A PUBLIC 'INFRASTRUCTURE PRIORITY'

Title	Energy efficiency as infrastructure in Scotland
Place	Scotland
Time period	2015-current
Decision makers involved	Scottish government

The energy performance of Scottish households is an issue recognised by the Government. In 2014 more than one third of the population was suffering from energy poverty. The Government recently recognised it would fail to meet the self-imposed goal of ensuring that people are not living in fuel poverty by November 2016. This shortcoming does not mean the end of the road, only the recognition that more needs to be done. This is why, in 2015, the Scottish Government recognised energy efficiency as a National Infrastructure Priority in its Infrastructure Investment Plan.

This plan sets out priorities for investment and a long-term strategy for the development of public infrastructure in Scotland. It intention is to set out why, where and how the Government invests. **The plan makes energy efficiency an infrastructure priority, demonstrating the political commitment made by the Government and ensuring a substantial level of funding for the long term. This is a demonstration of the E1st principle in practice in that it recognises buildings as infrastructure similar to other types of (supply-side) infrastructure.**

The immediate consequence is the launch of Scotland's Energy Efficiency Programme: an ambitious renovation program to help buildings achieve a good energy efficiency rating over the next 15-20 years. The first phase (2015-2018) of the programme will provide funding for pilot projects while the delivery of the core of the program will take place between 2018 and 2033. The longer-term aim of the plan is to ensure the long-term funding and policy stability to give home and business owners and private sector partners the certainty to continue to invest in improving the energy efficiency of Scotland's buildings.

Impact: Scotland's Energy Efficiency Programme will receive GBP 500 million (EUR 550 million) of public funding over the next four years. The high political commitment will be reflected in the upcoming energy strategy under preparation and published later in 2016.

Photo credit 3

3. Broader climate and energy policy

Efficiency First is important in many other areas that have an influence on how energy-related policy is shaped and implemented, and how we address the decarbonization challenge in a coherent manner to achieve a timely and affordable transition. Two examples are highlighted here, with the recognition that there are many more areas of interaction to explore: investing carbon revenues in efficiency and integrating minimum energy efficiency standards with feed-in tariffs.

3.1 EFFICIENCY AS A PRIORITY FOR CARBON REVENUES: ALIGNING CLIMATE POLICY WITH LOW-COST EMISSIONS REDUCTIONS THROUGH EFFICIENCY

Title	Czech Green Savings Programme
Place	Czech Republic
Time period	2008 - present
Decision makers involved	Ministry of Environment

The EU ETS focuses on decreasing carbon emissions of large-scale emitters, but does little to stimulate cost-effective end-use savings. **Investing carbon revenues in end-use efficiency can achieve 7 times more savings than relying on price increases alone, aligning the ETS with the broader goal of achieving economy-wide carbon reductions at the lowest reasonable cost to society.**[38]

Photo credit 4

Since 2008, the Czech Republic has dedicated a portion of carbon revenues to renovating residential buildings (multi- and single- family). The first program, called Zelená úsporám (green savings), deployed revenues from sales of carbon credits under the Kyoto Protocol and ran through 2013. Since then, the program ("New" Zelená úsporám) has been modified to invest about ½ of the revenues received by the government from auctioning of CO2 allowances from the EU ETS (Emissions Trading Scheme) into retrofitting single-family houses and other customer-side efficiency improvements. There are about 1.5 million single-family homes, out of a population of 10 million inhabitants, and accounting for about 63% of residential gas consumption in the country.

Today, about BZK 2 billion (EUR 750 million) of carbon revenues are dedicated to retrofitting single family homes in the Czech Republic. These funds leverage about another BZK 4 billion (EUR 1.5 billion) in private investment, essentially tripling the impact of the program.[39]

It should be noted that the Czech Republic is not the only Member State to recycle carbon revenues for energy renovation. France, Germany, Hungary, Lithuania, and Malta also have active programs to invest carbon revenues in energy efficiency measures, reducing both GHG emissions and consumer energy bills at the same time.[40]

Impact: Benefits have been quantified in terms of additional revenues to the state budget, GDP and jobs. For every Czech crown (or Euro) spend in the programme, an additional CZK 0.96-1.21 is expected to feed the state budget via income taxes of SMEs, employees, social and health insurance and spared support for unemployed people. GDP is expected to rise by CZK 2.13-3.59 million as most of the labour and materials are domestic and run the wheels of the local economy. The single-family housing programme is estimated to generate approx. 8,000-10,000 new or sustained jobs in the construction sector, including production of technologies and materials.

The impacts of housing retrofits are also striking in terms of reduced gas consumption, and related energy security. The cost-effective potential for gas savings through retrofitting of the residential housing stock in the Czech Republic to 2030 is calculated as up to up to 1,084 million cubic metres of avoided gas consumption – 682 million cubic metres in the single-family housing sector targeted by the carbon revenue investment scheme.[41]

3.2 ALIGNING EFFICIENCY WITH DISTRIBUTED RENEWABLES: OPTIMIZING RENEWABLES INVESTMENT BY MINIMIZING WASTED ENERGY

Title	Minimum energy efficiency requirement prior to renewable energy installation
Place	UK and Flanders
Time period	2012-present (UK) and 2010-present (Flanders)
Decision makers involved	Government ministries, regulator

In some jurisdictions, minimum energy efficiency standards apply before a property can benefit from a Feed-in Tariff for renewable energy. The rationale behind such an approach is to prevent valuable renewable energy from being wasted by an inefficient property. Two examples have been identified here:

Since April 2012 the UK Government put in place a minimum energy efficiency requirement for households who want to install solar panel modules on their building and claim the full Feed-in Tariff. The homeowner will be required to produce an Energy Performance Certificate rating of 'D' or above to be able to claim the full Feed-in Tariff rate. The certificate shows the energy performance of the building from A (best) to G (worst).[42] A similar mechanism was operating at local level prior to 2012: under the RE-Charge Scheme of Kirklees Council, properties could only get funding if they had already undergone basic energy efficiency measures.[43]

A similar approach has been taken in Flanders (Belgium) in case of photovoltaic: roofs and attic floors are required to have a minimum thermal resistance of 3m²K/W in order to be eligible for green certification.[44]

Impact: An analysis of the Feed-in Tariff scheme in the UK found that households with PV installed were much more likely to have energy efficiency measures (such as wall insulation or double-glazing) installed. The data show that a large proportion (86%) of all households with solar PV installations also had installed energy efficiency measures, most frequently cavity wall and loft insulation.[45] No such data could be found for Flanders.

Photo credit 5

Conclusions

In this report, we show that E1st is not a new idea in Europe. There are many examples where E1st is already happening across the EU because it is economically advantageous, simpler to do, and delivers a wide range of energy and non-energy benefits. In the past, many of the examples commonly cited were from other regions, particularly the US. Our analysis shows that there are also many good examples for E1st in Europe in areas such as efficiency as a resource to the energy system, within the context of local energy planning and investment, and in broader climate and energy policy.

However, examples are easier to find in some places than in others. The picture differs from one EU Member State to another and even between different regions or cities within the same country. In other words, some countries, regions and cities have already gained experience with E1st whereas others have done much less. Even where examples have been found, they are often not driven by an overarching framework incentivizing an E1st approach, but by specific actors who saw potential in using a different, more innovative approach.

Such a mixed uptake of E1st is the result of an insufficient integration of E1st into the policy framework across EU Member States and at EU level. In many cases, an E1st approach has been applied thanks to inspired leadership from a particular individual. This is to be warmly welcomed in those cases, but it is also clear that so far, it is not a systematic reflex in all decision processes to first consider what the demand side could offer. The result is that, even though we clearly know in the EU how to put E1st in practice, this is neither done consistently nor at sufficient scale. What can be done to make E1st a reality in the Energy Union, EU Member States, regions and cities? We offer three avenues for change, although there are many more:

(1) E1st should be at the heart of the **2030 climate and energy policy framework.** There is no single policy lever for E1st. Decisions that affect energy systems are made by EU policymakers, national and local governments, regulators, network operators and energy providers. If each of these has a process in place to prioritise efficiency, the system as a whole will deliver. The 2016 Winter package of energy legislation offers a unique opportunity to embed E1st across the legislative framework governing the Energy Union.

(2) There are already good examples, some of which are discussed in the report, where demand-side solutions have been deployed to **avoid and defer costly supply-side investment.** In many cases, this was made possible through regulatory changes. Appropriate regulation would require network operators to consistently evaluate all cost-effective resources on the demand as well as the supply side. Furthermore, their revenues should be linked to specific performance criteria, not energy sales. The most relevant EU legislation in this case is the MDI framework, the Energy Efficiency Directive and the future governance instrument. The MDI proposals should integrate E1st as a fundamental principle governing decision-making by the Commission, Member States, national regulatory authorities, Agency for the Cooperation of European Regulators (ACER), ENTSO-E and ENTSO-G on planning, investment and regulation within the internal energy market. Article 7 of the Energy Efficiency Directive provides a key driver for introducing Energy Efficiency Obligations in Europe - it needs to be maintained and strengthened post-2020.

(3) The report identified examples of E1st in **national and regional energy planning.** However, there are currently only a few examples and E1st could and should play a much bigger role in all national plans and reporting on the Energy Union. These plans should include projections of energy demand out to 2030 and 2050, in line with energy efficiency targets. Governments should set out a transparent, comparative assessment of potential supply- and demand-side investments. At the regional level, more EU support is needed, both technical and financial, to develop a better pipeline of bankable energy-efficiency projects. Regional governments often have jurisdiction over heating infrastructure. Cities need a formal role in urban planning for heating, cooling and electricity. They need accounting and investment rules that give them greater leeway to invest in energy efficiency.

Our report shows that E1st can and has been done in Europe. There are many good examples of applying this approach in practice and we can draw on this rich experience going forward. Making E1st a reality across the Energy Union requires effort across the political landscape that governs the energy system. Ultimately, this means a shift in how we think about energy and climate policy. This is clearly not an easy ask - the benefits of putting E1st and the ambitious energy and climate goals demand that we take the concept seriously. It can be done and has been done – but we need to create high-level governance mechanisms and sectoral decision rules to ensure that the many benefits of end-use demand management are actually delivered to European economies, energy systems, families and businesses. With major reforms underway towards meeting 2030 energy and climate goals, the opportunity to put Efficiency First has never been greater.

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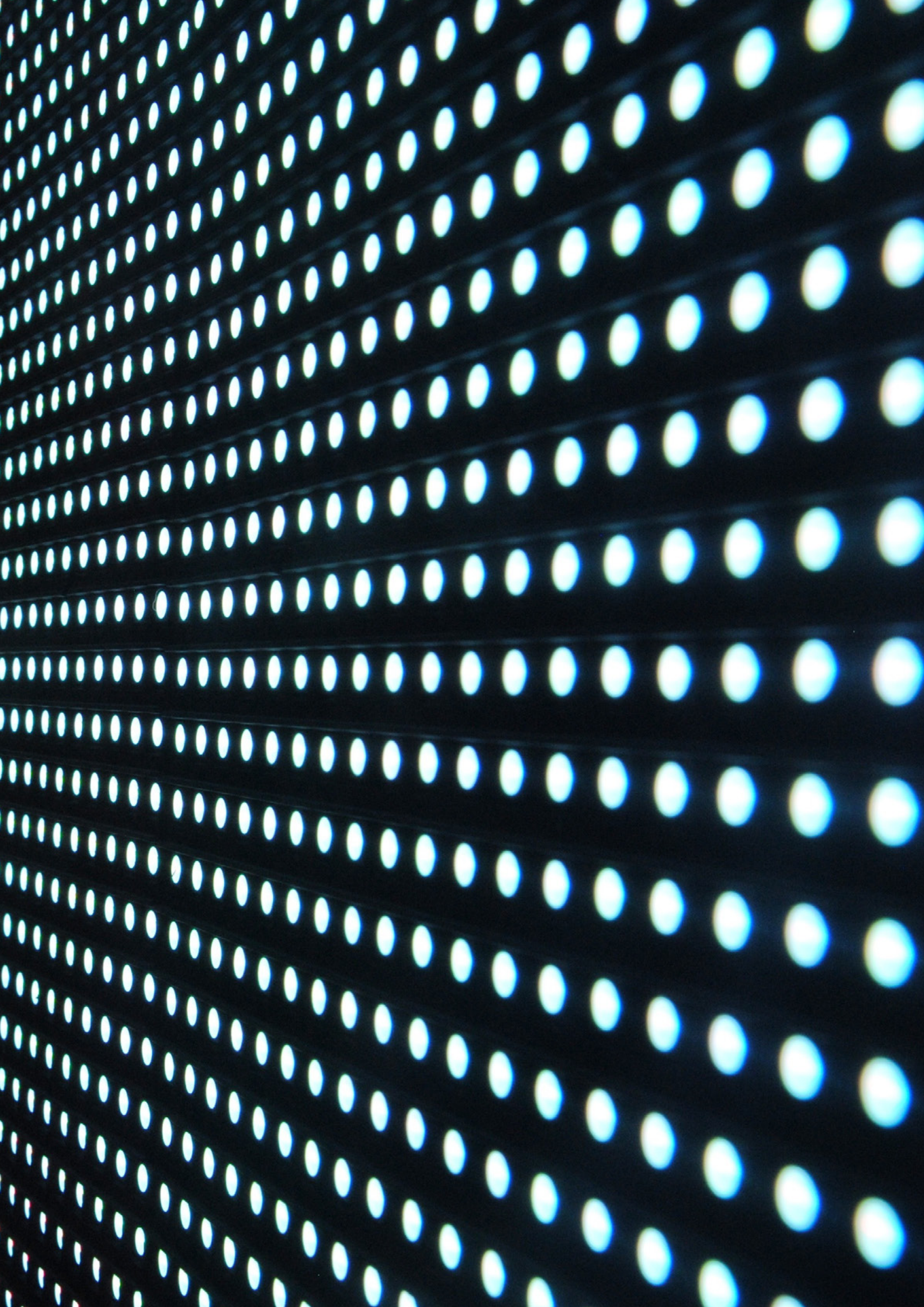

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