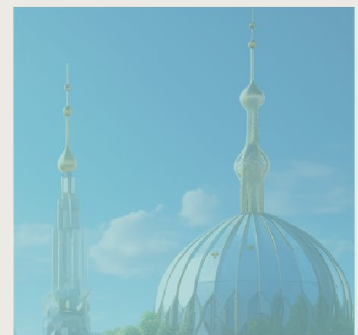
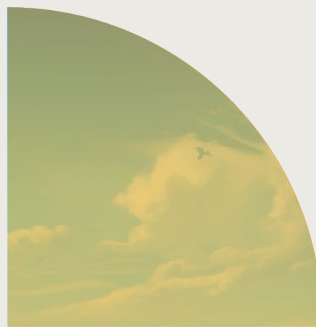


# Buildings



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Roadmap for a climate-neutral,  
sustainable Ukrainian energy sector  
and its role in an integrated EU  
energy market

# Roadmap for a climate-neutral, sustainable Ukrainian energy sector and its role in an integrated EU energy market

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## Buildings

As the sites of most of the components of any economy, buildings are not merely a neutral backdrop. The way they are built, inhabited, and operated can facilitate or obstruct economic activity and innovation, and has a major influence on sus-

### Construction

In 2021 there were more than 17 million residential units in Ukraine. According to the Kyiv School of Economics, by the end of 2022, war damage in the housing sector was USD 54 billion (of a total of \$138 billion). This included 149,300 damaged or destroyed housing units. Given the degree of damage Ukraine has suffered, the country has major choices to make during its rebuilding. Here, as

#### Recommendations

One general way to rebuild or build more modern buildings would be to embrace a **more circular economy** model, attempting to **minimize waste** and **maximize resource efficiency** throughout the entire lifecycle of buildings. This includes promoting the **reuse and recycling** of materials, as well as designing structures that can be easily disassembled and repurposed – for instance, sustainable building standards that prioritize the use of **environmentally friendly** materials such as wood, straw, lime, or carbon-concrete composite instead of steel alternatives (at least until such a time as sustainably produced steel is widely available).

### Heating

Space heating is an integral aspect of how buildings are used and inhabited. For instance, in 2021, the largest share (50%) of final residential energy consumption was taken up by space heating. This is often quite energy-intensive and includes room for improvement in terms of efficiency or carbon footprint. One particularity of Ukraine's built environment is the prevalence of district heating – a centralized network of pipes that distributes heat to homes, businesses, and public services, on which 53% of urban households relied in 2021.

The size, age and dispatchability requirements of these systems mean that they were built for, and are currently almost exclusively powered by, fossil

fuels. However, being large-scale centralized heating systems, they can be adapted for use with more sustainable fuels more easily than the small-scale distributed heating systems that are more common in Western European residential buildings. They could be fueled by biomass or waste heat from sewage systems, industrial processes or even data centers, and could be combined with electric-power generation in combined heat and power plants. The heat-generation efficiency of boiler houses in Ukraine is 89% on average, but many of the boilers as well as auxiliary equipment such as pumps need to be modernized or replaced. Most pipelines are old and poorly insulated. Companies' operational expenses are therefore quite high, while income is

tainability. The results of the analysis carried out under the auspices of the Ukraine Energy Roadmap project are here presented for construction methods and heating solutions separately.

in other aspects of the postwar economic recovery, there is a possibility to catch up with current and future EU standards – with which the country will eventually have to comply on its road to European integration – and even leapfrog them, as opposed to simply building everything back the way it used to be, including in terms of inefficiencies and high carbon footprint.

Specific measures that can be undertaken include developing **energy-efficiency programs** for the public sector and equipping government buildings with more solar facilities and storage systems, and **reconstructing** buildings with **improved energy-efficiency measures**. Eventually, **renewable heating** systems and measures to increase energy efficiency in **existing buildings** should also be undertaken. A report by the consultancy Ukrainian Industry Expertise calculated in November 2022 that Ukrainian manufacturers could eventually provide 90% of the construction materials needed for reconstruction.

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limited due to tariffs being capped by politicians. The level of investment in modernization has therefore been insufficient for many years.

Heat metering nowadays is carried out at the level of individual buildings, making it difficult for end users to control their consumption and reducing the impetus for energy-efficiency improvements. Instead, investors and inhabitants have installed many individual heating units (mostly electrical) to top up the heat supply in a way that consumers can fine-tune. Between 1995 and 2018, the share of ur-

ban households in Ukraine benefiting from district heating decreased from 89% to 55%. The solutions which have replaced it have led to reduced efficiency and increased pollution, while creating a burden on other infrastructure, including electricity and gas supply. This contributes to overcapacity and operational inefficiency in district-heating systems, which now have too much capacity (although this is partly also due to the fact that they were built in an era when there was more demand from industry, and energy efficiency was lower).

### Recommendations

Any economy looking to bolster its efficiency and sustainability must look for solutions to replace fossil fuel-based heat generation with renewable energy sources, and to **prioritize energy efficiency in buildings. To achieve this**, Ukraine should establish **regulatory frameworks** that support the adoption of energy-efficient heating technologies, such as **building codes and energy-efficiency standards**. Such standards could include best-in-class building codes (net-zero-energy buildings). This can also help to create a level playing field and promote investment in state-of-the-art heating technologies.

Ukraine will require a **comprehensive heating strategy**, supported by **action plans** at the state and local levels, including a long-term **building-renovation strategy**. The planning of heat-supply systems in settlements could be improved through further development of the national energy and climate plan with clear targets and roadmap for the deployment of heat technologies.

Non-fossil alternatives should be found for all heat sources, and **efficiency should always come first** in planning and rebuilding. Private households and small & medium enterprises should be given more access to **support schemes**, and governments should provide incentives to **encourage investment** in new heating technologies, thus offsetting the high upfront costs and promoting adoption.

There should be an analysis of the state of existing large-scale centralized district-heating systems throughout Ukraine and a thorough **cost-benefit review for a range of future options**, such

as refurbishing of existing systems, decentralization to smaller units, or installation of individual heating systems in residences and offices. Where possible, competition should be encouraged in the district-heating sector.

The use of **biomethane and waste heat** for heating should be boosted where possible. Large heat pumps can be used to provide district heat to buildings, commercial premises, and industrial facilities, and can **recover heat** from wastewater, data centers, metro tunnels, industrial facilities, or electrolyzers. Cogeneration can also be considered. Moreover, **individual metering** should be expanded, creating incentives for households to improve energy efficiency and avail themselves of cleaner technologies.

Innovative financing instruments such as **green bonds** can be used to finance certain actions, such as the construction of green office buildings, residential complexes, and industrial facilities, or retrofits of existing buildings. This should rest on a **comprehensive analysis that takes into account** the complexity of the required investments, the availability of equipment as well as the time & cost required for installation and maintenance, and the net-value added for consumers, municipalities, suppliers, and investors. Before a comprehensive approach is defined, individuals and institutions should be **discouraged from installing multiple smaller systems**, which are likely to run on fossil fuels and may end up being comparatively harder to convert to sustainable operation given that they will be more recent and decentralized.