

Newsletter of the
International Energy
Agency Solar Heating
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Future Role of Solar Heat in the IEA's Net Zero Roadmap



In May, the International Energy Agency published the 224-page report, *Net Zero by 2050: A Roadmap for the Global Energy Sector*, challenging policymakers with 400 milestones that governments need to realize to achieve the 1.5 °C target. At the report's online press conference, IEA Executive Director Dr. Fatih Birol made some surprisingly forceful statements about the global net-zero emission targets for 2050 – statements widely quoted in the media since. “This is not a race between nations but a race against time. And no one wins unless everyone finishes,” he said. He also underlined that there is no longer a need for further investment in oil, gas, and coal.

The IEA's recent publication, *Net Zero by 2050: A Roadmap for the Global Energy Sector*, represents a paradigm shift within the IEA. The co-authors Chief Energy Modeler Laura Cozzi and Head of Energy Technology Policy Timur Gül see a “narrow but still achievable pathway” to a net-zero world by 2050. When Dr. Birol opened the May press conference, he listed the following as the “three biggest homework assignments for all of us – governments, industry, citizens, and academia:”

1. Make the most of available clean energy technologies (solar, onshore/offshore wind, electric vehicles, energy efficiency solutions and – in some countries – nuclear power).
2. Encourage innovation to bring new products, such as novel battery technology and hydrogen equipment, to market after 2030 – including solutions for industrial, long-haul transport, and aviation – in order to cut emissions even further.
3. Substantially reduce the use of fossil fuel.

Solar heat may not have been a focus of the [press conference](#), but the IEA roadmap does list significant milestones for solar heat in the building sector (see the table below). According to the roadmap, the number of buildings using solar thermal energy to provide hot water and space heating will need to increase from 250 million in 2020 to 1.2 billion by 2050, while the share of those using electricity will have to grow from nearly 20% of today's total to 35% by 2030 and about 55% by 2050.

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Key milestones in transforming the global building sector

Category			
New buildings	• From 2030: all new buildings are zero-carbon-ready.		
Existing buildings	• From 2030: 2.5% of buildings are retrofitted to be zero-carbon-ready each year.		
Category	2020	2030	2050
Buildings			
Share of existing buildings retrofitted to the zero-carbon-ready level	<1%	20%	>85%
Share of zero-carbon-ready new buildings construction	5%	100%	100%
Heating and cooling			
Stock of heat pumps (million units)	180	600	1 800
Million dwellings using solar thermal	250	400	1 200
Avoided residential energy demand from behaviour	n.a.	12%	14%

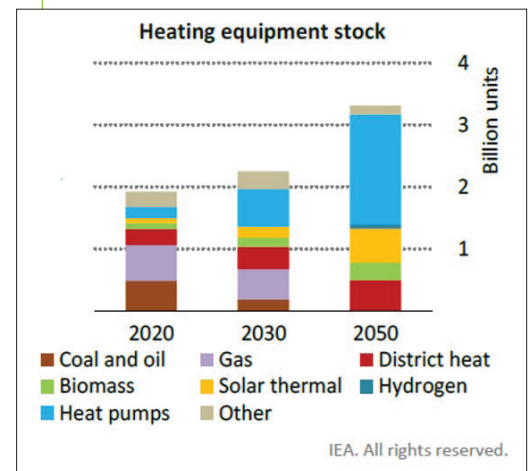
The targets in the Net Zero by 2050 scenario for solar heat in buildings are fairly progressive despite solar district heating and solar industrial heat not really mentioned among the milestones. To better understand this observation, solarthermalworld.org reached out to the roadmap team members responsible for the building sector, Thibaut Abergel (Energy Analyst) and Timothy Goodson (Energy Modeler and Analyst), who were quick to respond. "Your questions regarding the role of solar thermal in the Net Zero by 2050 pathway and the report are very valid since, despite the report being explicit about the technology pathways for a number of subsectors or end-uses, we could not present an exhaustive picture of all the contributions of all technologies modeled." They did provide, however, several elements to help clarify the role of solar thermal technologies in the scenario.

In buildings, solar thermal plays a predominant role as a decentralized energy resource for water heating. In the Net Zero by 2050 Scenario, it meets 35% of demand by 2050, up from under 10% in 2020.

We see a more rapid growth for solar thermal applications where heating needs are low. About 70% of the global population in 2050 will have cooling needs with no or limited space heating needs. For such regions, coupling solar thermal water heating with affordable cooling-only, refrigerant-free solutions (e.g., evaporative cooling with a membrane for humidity control) can be cost-optimal. Further, many such regions have ideal conditions for high solar thermal performance, notably the Middle East and North Africa, parts of China and India, and Australia, just to name a few regions. Technology choices in the Net Zero by 2050 Scenario also account for the ability of equipment to shift electricity demand away from peak times. Solar thermal technologies are a beneficial solution in this respect as they avoid electricity demand, maximize the use of solar irradiation during the middle of the day, and store hot water for later use. In the Net Zero by 2050 Scenario, all buildings with available roof space and sufficient solar insolation are equipped with solar thermal water heaters by 2050 (some of which may be PV-thermal).

In industry, solar thermal heat sees rapid growth in the Net Zero by 2050 Scenario as a key available mature technology that can be rapidly deployed for medium and low-temperature heat provision. Despite competition with heat pumps or electric boilers (for low and medium temperature), solar thermal is expected to continue

(Source: IEA (2021), Net Zero by 2050, IEA, Paris)



▲ **Global building heating equipment stock by type in the Net Zero by 2050 Scenario. By 2050, over 85% of buildings will be zero-carbon-ready, with heat pumps meeting over half of heating needs. The installed stock of heating equipment increases +45% over the next 30 years primarily due to the combined effect of population growth and improved living standards, which tends to reduce average household occupancy.** (Source: IEA (2021), Net Zero by 2050, IEA, Paris)

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to grow and, by 2050, cover 11% of industrial heat demand below 200 °C, up from 3% in 2030. Applications are mostly restricted to non energy intensive industries and ancillary or downstream processes in heavy industries. The share of heat provided by solar thermal technologies is lower for high-temperature heat applications, where emerging electrolytic hydrogen technologies and natural gas with CCUS (carbon capture, utilization, and storage) play a stronger role.

Select key milestones

	2020	2030	2050
Million dwellings using solar thermal	250	400	1,200
Share of solar thermal and geothermal in buildings	2%	5%	12%
Million dwellings with a PV rooftop system	25	100	240
Stock of heat pumps (million units)	180	600	1,800

(Source: IEA (2021), Net Zero by 2050, IEA, Paris)

For solar district energy, there is a role in the Net Zero by 2050 Scenario, but its use is tailored to where such technologies are most suitable. Existing district energy systems today are generally located in areas with high heating densities – typically in very cold or very densely-populated cities – while the installation of solar collectors is often limited by land availability constraints. While power-to-heat, waste heat recovery, and bioenergy remain the backbone of district heat decarbonization in many areas, solar thermal plays an increasing role in new district energy network expansions, typically in medium-size cities where climate and land space conditions are favorable.

For power generation, concentrating solar power (CSP) plays an important role in decarbonizing electricity while maintaining electricity security in the Net Zero by 2050 Scenario. For example, global CSP capacity increases 12-fold by 2030 in the Net Zero pathway, as shown in Annex A of the report. CSP is also noted in the report as providing system benefits, especially when coupled with thermal storage. Together with demand-side response, energy storage and electricity network robustness, it contributes to maintaining electricity security.

Visit <https://www.iea.org/reports/net-zero-by-2050> to find more data and download the report. And don't miss the new [Renewables 2021 publication](#), and the report's [Renewable heat extract](#).

This article highlights two solarthermalworld.org news articles, "IEA Net Zero by 2050 Roadmap: 400 milestones but very few for solar thermal" and "Future role of solar heat in IEA's Net Zero Roadmap".