We are *not on track* to meet the Paris Agreement's objectives. What should we do?

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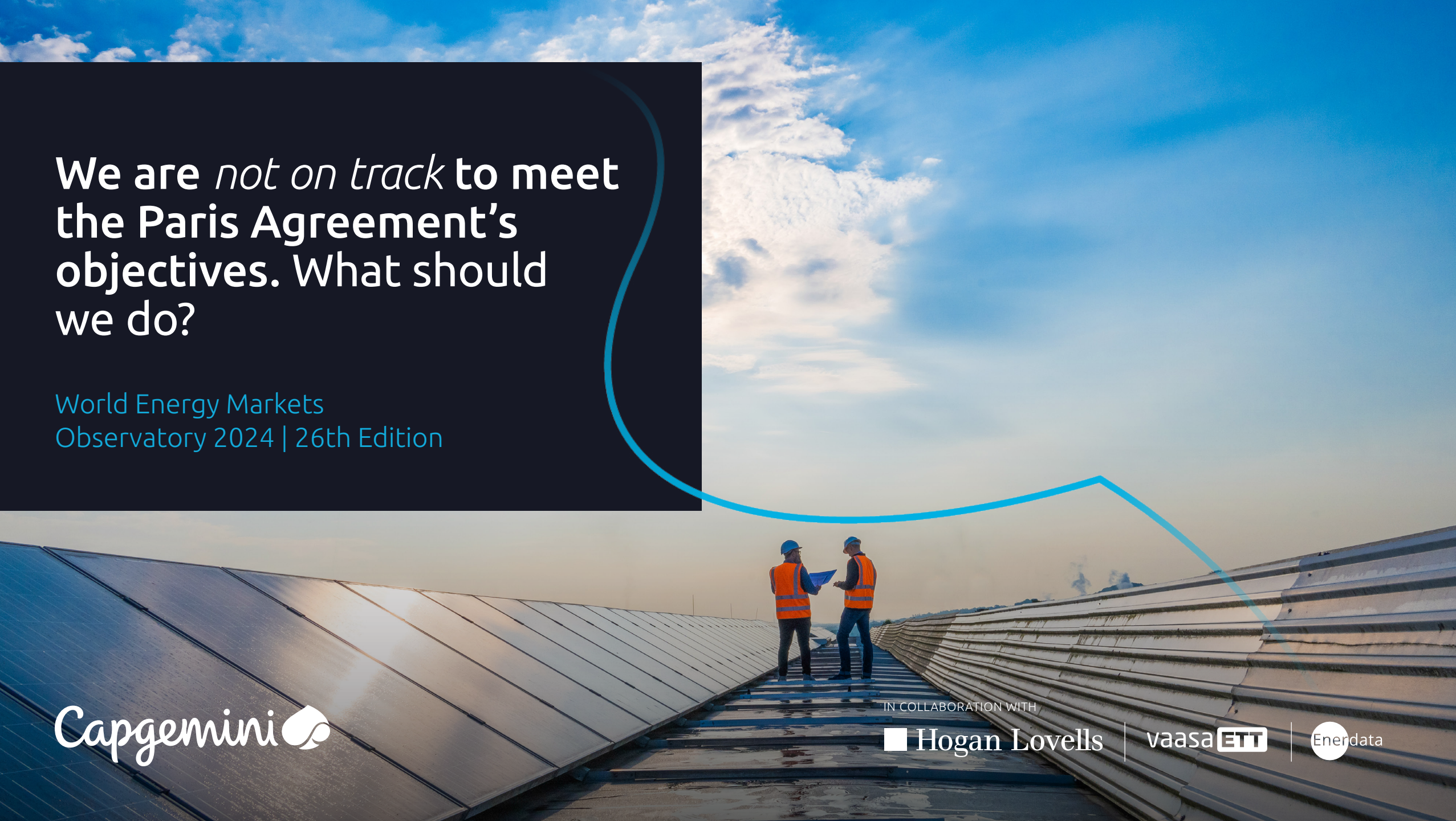

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Industrial Heat is in the *blind spot* of energy transition

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Key points

1. Decarbonization of Heat is Crucial: Heating accounts for 50% of global energy demand, with over 70% generated from fossil fuels. This highlights the urgent need to decarbonize heating and cooling, which collectively contribute to 39% of global CO_2 emissions, particularly in the industrial sector, where industrial heat alone accounts for 22% of global emissions.
2. Technological Solutions Exist: Proven low-carbon technologies, such as heat pumps and electric boilers, are already delivering results for medium and low-temperature industrial processes, which represent 60% of heat consumption. For energy-hungry industries that require extremely high temperatures—such as steel, chemicals, and cement—shifting to alternatives like hydrogen, green ammonia, and biofuels is essential, as these solutions hold significant potential for reducing emissions.
3. Collaboration and Innovation are Key: Successfully addressing the complexities of decarbonization demands partnerships across diverse sectors, including industry, academia, and regulatory bodies. By creating a collaborative ecosystem that supports new business models; by minimizing investment risks and leveraging digital technologies, organizations can accelerate the adoption of climate solutions and effectively tackle the challenges of decarbonizing heating and cooling systems.

Introduction

Heating accounts for half of the world's energy demand, yet the efforts to decarbonize heating and cooling—responsible for a staggering 39% of global CO_2 emissions—have not kept pace with the urgency required to combat climate change. The challenges associated with transforming how we generate and use heating and cooling are multifaceted, varying primarily by sector, industry, process type, and temperature level. In this article, we will delve into the current status of decarbonization efforts within the buildings and industrial sectors, highlighting the specific challenges they face in transitioning to sustainable heating and cooling solutions.

Additionally, we will provide a comprehensive list of actionable steps and enabling factors that can help overcome these complexities and accelerate the path toward a more sustainable energy future.

The decarbonization of heat is a key challenge

50%[1] of the demand for energy is for heat. Over 70%[2] of that heat is generated directly from fossil fuels. This stark fact emphasizes that the decarbonization of heat – and cooling – is critical to the future of our planet. The shift from generating heat from fossil fuels, to generating heat from zero emissions, is essential to mitigating the impacts of climate change.

Shift the spotlight to heat

As we focus on energy transition and the journey towards net zero, the decarbonization of heat has not yet been a sufficient priority. Yet the rewards are significant and not all opportunities are in hard-to-abate sectors.

Efforts to decarbonize heating and cooling, which is responsible for 39%[1] of global CO_2 emission, have been lagging. Now is the time to shift the spotlight to decarbonization.

Industrial heat in focus

Industrial heat is a significant part of these emissions, with 20%[3] of global emissions being currently produced by industrial heat. Decarbonizing energy-hungry industries that require extremely high temperatures, like steel, chemicals and cement, is challenging. But the potential positive impact of shifting to solutions like hydrogen, green ammonia, and other biofuels or, where possible, electrification sources, is huge.

Medium and low temperature industrial processes, which include pulp and paper, food and beverages, plastics, and some chemicals, make up 60%[4] of heat consumption. Here, proven low-carbon energy alternatives, such as heat pumps and electric boilers, are already established and delivering impressive results.

Time to get moving

Established methods are available to directly reuse or upgrade waste heat from industrial processes. The applications can include low temperature processes, space and water heating, as well as cooling provided via heat pumps.

Newer technologies also allow for the storage and transfer of heat energy for onward use. They are already replacing heat generation from fossil fuels at the higher end of the temperature scale.

Thermal batteries store heat using a variety of technologies and can be used in a wide range of industrial use cases. They contribute to improved sustainability and lower cost of heat via two routes. The first is by decoupling timing of energy consumption and heat consumption. For example, by charging when electricity is cheap and then using heat when it's needed. And the second is by providing flexibility in the grid, enabling asset owners to be paid to use electricity when there is overcapacity / supply surplus in the grid.

1 International Energy Agency, Renewables 2022 https://www.iea.org/reports/renewables-2022/renewable-heat
2 IRENA: Power to heat and cooling: Status

3 McKinsey & Company: Industrial heat pumps: Five considerations for future growth
4 IEA: Industrial heat demand by temperature rang

Don’t underestimate residential and civic demand

Demand for the heating of residential and civic buildings is almost the same as industrial demand for heat. This observation is less surprising when you realize that district heating is mainly used by buildings and not industry. In fact, according to the International Energy Agency[5], industrial processes account for 53% of demand, buildings account for 44%, and agriculture the remaining 3%.

However, the shift away from gas to green technologies, such as heat pumps, is accelerating in civic and residential buildings. Likewise, district heating and cooling systems are increasingly viable and attractive. Especially in urban, multiple occupation locations providing shared access to low-cost, low-carbon heat and cooling.

District heating, also known as a heat network, is a system for distributing heat generated in a centralized location through a system of insulated pipes. It satisfies residential and commercial heating requirements, such as space heating and water heating as well as low temperature industrial process heating.

Overcoming complexity

Various challenges need to be overcome to accelerate the scale and speed of the decarbonization of industrial, civic, and residential heating and cooling.

We must consider variations in technological and supply chain maturity. The establishment of appropriate financial, investment, incentive, subsidy and regulatory models. The role of partnerships and collaborative innovation in overcoming technical hurdles. The identification of new and cost-effective ways of replacing key components within traditional industrial processes. And, of course, the huge role of digital and AI.

5 International Energy Agency, Renewables 2022 https://www.iea.org/reports/renewables-2022/renewable-heat

To enable decarbonization at speed, we've identified several actions and enablers:

Actions:

Support for new business models. Governments can reduce the risk of embracing new technologies by lowering the barriers for industry players to test and adopt. For example, by providing funding for trial schemes where a third party owns and operates the asset and sells back heat-as-a-service, less risk is carried by the plant where the asset is installed.

Research into proving technology to system integration is needed. Assess the impact of decarbonization on existing systems, including impact on overall costs, product performance, reliability, sustainability, and compliance. This means modelling scenarios and running simulations that assess these impacts and feed into the organization's climate tech adoption strategy, de-risking investments.

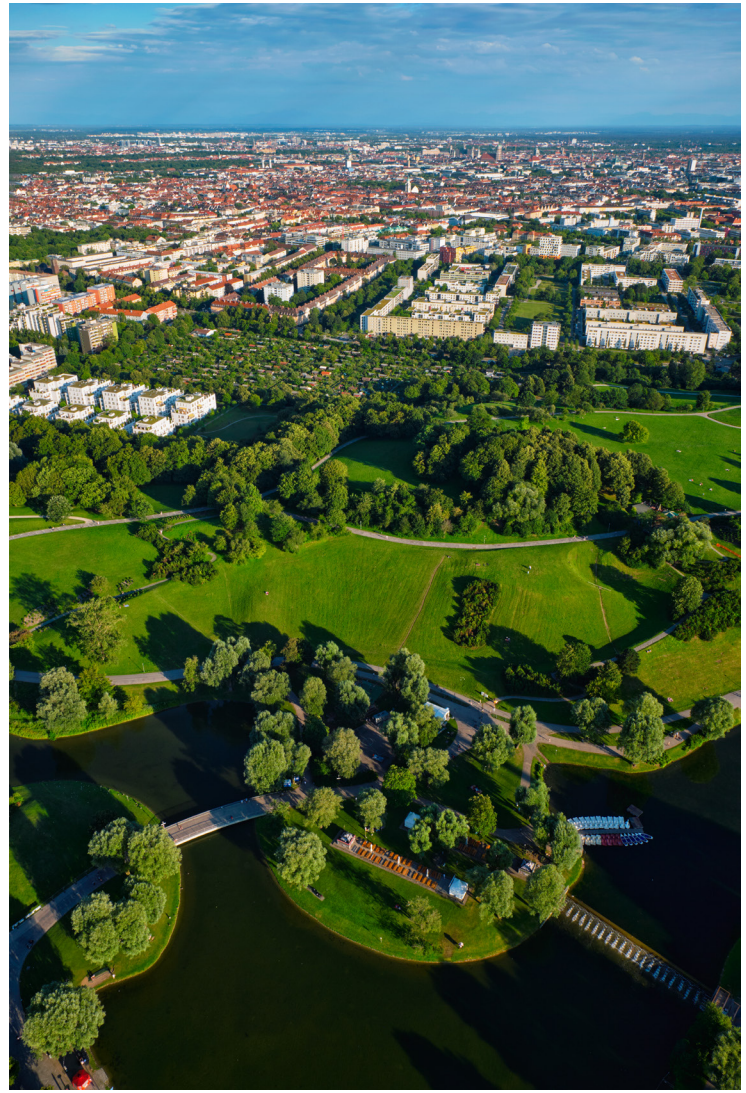
Explore ecosystem integration. Work as part of an ecosystem of organizations across the value chain and wider industry to address the complexities of decarbonization. All ecosystem members will need to work closely with a broad group of stakeholders including industry peers, academics, startups, regulators, and non-governmental organizations (NGOs).

Move from analog to digital. Develop digitally enabled industrial systems, such as power plants, energy infrastructure, and steel plants, which can be optimized and modernized as climate tech evolves. For instance, in transitioning steel plants to green steel production using low-carbon hydrogen, digital enablement becomes crucial, given the long operational lifespan of a steel plant.

Enablers:

Securing access to finance. Organizations should tap into increasing public and private funding, including government grants, subsidies and tax credits, VC funding, and debt financing, to fast track the development and deployment of decarbonization solutions. Designing and scoping projects for eligibility for funding is key.

Developing new skills. They should also partner with startups and academics to access new skillsets and invest in employee reskilling and upskilling programs. For example, Enel has set a target of upskilling and reskilling 70% of its employees before redeployment from coal plants between 2023 and 2025.[6]



6 Enel, "Zero Emissions Ambition," retrieved from https:// www.enel.com/content/dam/enel-com/documenti/ investitori/sostenibilita/zero-emissions-ambition-report. pdf.

Decarbonization innovation in action

Innovation is already having a significant impact on initiatives to decarbonize heat. For example, the seenergies.eu project provides open-source heat demand data as well as industrial waste heat potential and a planning toolbox. Allowing public authorities to identify, analyze, model demand and map resources and solutions to supply energy needs within their territories.

Positive outcomes may include development of industrial hubs in which organizations share low-carbon heat not only with their business neighbors, but with nearby residential and public buildings too. And potentially provide grid balancing services, easing supply and demand pressures.

Another example is the innovative Kyoto Group in Norway, which acts as a flexible asset on the grid, providing services for industry and transmission system operators (TSOs). Kyoto enables charging a thermal battery during off peak hours and retrieving thermal energy when needed. It shields businesses from price volatility, CO_2 taxes, and grid tariffs. This helps to prevent global warming and contributes to a new license to operate when policy makers want CO_2 emission to end. And it provides a secure option for energy delivery.

No time to spare

The time to act is now. Accelerating decarbonization of heat is critical to mitigating the impact of climate change, as well as other environmental challenges. A variety of challenges need to be overcome to accelerate the scale and speed of the decarbonization of industrial, civic, and residential heating and cooling, but these are not insurmountable.

Viable solutions exist and help is at hand to address the complexities of decarbonization. Adopting new climate technologies, as well as embracing the key actions and enablers that we have identified, accelerates decarbonization. Collaborating with the partners, as part of an ecosystem of organizations across the value chain and wider industry is critical.

Without doubt, rapidly addressing the decarbonization of industrial heat is a key part of our fight against climate change and our journey towards net zero.

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