# United Nations Environmental Assembly (UNEA)

*Sustainable Creation and Distribution of Heat*

# ***Research Report***

Leiden Model United Nations 2024

*"Out of this world"*

**Forum:** United Nations Environmental Assembly (UNEA)

**Issue:** Sustainable Creation and Distribution of Heat

**Position:** Head Chair

## Introduction

With global concern on the rise and climate change finally receiving its most urgent attention nowadays, the sustainable generation and accumulation of heat along with its successive transfer has become an important issue facing the energy systems of the world. The aspects of the overall heat production and supply system must be examined in an even more extended context resorting to technologies that are economically and ecologically beneficial, evaluating how changes towards less carbon-emitting sources of heat might impact the society and politics and how these factors correspondingly interrelate themselves.

Heat, a basic human need and comfort in societies, is very useful for domestic, industrial, and many other productive operations. With its major activities of warming houses and workplaces, driving manufacturing activities, and agricultural pursuits, heat is an inseparable part of life in the modern world. Nevertheless, conventional methods of heat generation that rely heavily on fossil fuels like coal, oil, and natural gas are the most common and these pose hazards by releasing emissions that pollute the environment. It is clear that countries are leaving nothing to chance in meeting their obligations under the Paris Agreement and with this perspective seeking to move forward to a lower carbon economy than before which suggests that heat production and distribution have to be looked at differently in a reasonable time frame quite a matter of fact.

The world's energy sector is undergoing a major change. While grid-connected renewable electricity production, notably solar and wind, has boomed recently, the heat sector has not yet made the same strides in imbuing sustainability in its fuels and methods. This imbalance is worrying because heat represents nearly half of energy consumption worldwide and contributes a large share of greenhouse gas emissions. Another factor making this issue more complicated is the heterogeneous structure of heat requirements depending on sectors and regions that impose the need for more targeted and complex solutions.

## Definition of Key Terms

1. **District Heating:** A method of heat distribution from a central facility through a network of insulated pipes to meet the space and water heating needs of residential and commercial buildings.

2. **Heat Pump:** A machine used for moving heat from one substance to another termed as a thermal reservoir. The movement of thermal energy is such that work is done in order to cause thermal energy to go away from a low-temperature body to a high-temperature body.

3. **Geothermal Energy:** Heat energy originating from the ground can be used to produce

environmentally friendly electrical power or for heating processes.

4. **Waste Heat Recovery:** The technique of taking advantage of the heat that is otherwise wasted in cooling down the air, exhaust gases, or any fluids, and recuperating such heat for alternate heating purposes.

5. **Biomass Heating:** The burning of materials such as wood pellets, agricultural waste and vegetation purposely grown for energy for the purposes of providing heating energy.

## General Overview

The self-sufficient production and distribution of heat are regarded as an important problem, as nearly half of the energy consumed in the world is directed toward heating, and with it almost 40% of CO2 emissions. Fossil fuels predominantly power it and thus come under increasing pressure to shift to more environmentally friendly forms. New technologies such as heat pumps, district heating systems, and geothermal energy appear to be the solution. However, numerous factors stand as hindrances to these, for instance, the cost which can be quite high, existing systems, and bureaucracy. This shift is being supported by authorities of countries around the world, as they see it as benefiting the creation of employment, energy security, and health. It is a complex problem with inequities and high financial barriers by regions; however, a move towards sustainable heat is aligned with the target of combating climate change.

### Current State of Heat Production and Consumption

Looking at all the sources of energy consumption, the most dominant form of energy use is in the form of heat and accounts for almost 50 % of the world, where fossil fuels are the commonest source of heat energy. Households have the highest demand for heat, followed by the industrial sector and the commercial ones. In most areas of the world, especially the cold regions where towers are used for heating and air conditioning, the cost of heating energy is the highest from electric power supply.

### Environmental Impact

The thermal energy area contributes a large share of global CO2 emissions. The International Energy Agency (IEA) indicates that heating processes contribute about 40% of the energy-related CO2 emissions. This underlines the immediate necessity to seek sustainable alternatives to conventional heating measures.

### The HEATSTORE project

The HEATSTORE project is an innovative research program of European scope that aims at raising underground thermal energy storage as one of the transition instruments for energy systems. Headed by TNO (Netherlands Organisation for Applied Scientific Research), this ambitious project retains 23 parties and spans 9 countries indicating significant international collaboration. HEATSTORE is aiming to build up and test concepts for big-scale underground heat storage and it intends to perform 6 such practical trials in the Netherlands, Belgium, Germany, France, and Switzerland. The goals of the project include the implementation of high-temperature thermal energy storage (HT-UTES) from 25 to 90

degrees Celsius using different sources of heat including geothermal, solar, or waste heat, and the use of aquifers, underground thermal energy stores, and former coal mines for storage. In addition to technological developments, HEATSTORE also deals with intelligent control technology for heat end use, means for social embedding, business aspects, and legislation. Seasonal heat storage technologies need to become available in order to bring together heat supply and demand regardless of the season, consequently enabling large seasonal shifts in heat supply. The HEATSTORE project aims to bring forward the timeline and perfect the market, the technological development, and its introduction to the market, which will allow in the shortest possible time to achieve a significant reduction of carbon dioxide emissions and increased energy efficiency in Europe, forming the fundamentally new ways of generation and distribution of sustainable heat.

## Major Parties Involved

### 1. International Energy Agency (IEA)

It is fair to say that the International Energy Agency (IEA) has a vital role in the promotion of sustainable heat creation and its use worldwide. The document states that in 2022, heat comprises almost 50 % of total final consumption and is responsible for 38% of energy-related emissions. Having said that, the IEA sees a rise of 40% in consumption of renewable heat from 2023 up to 2028. This is however not enough for the targets set by the Paris Agreement. According to this scenario, additional pressure will be placed on the consumption of renewable heat, and energy efficiency measures will be undertaken along with heat pump and solar thermal increases: Bonfire the sales of all new fossil fuel-fired boilers in developed countries by 2025 as part of new climate policy. Basically, via these recommendations, IEA propels policymakers and industry to pursue greener heating options.

### 2. The Netherlands

When it comes to sustainable heat creation efforts, the Netherlands is more advanced than many countries, with state-operated EBN focused on implementing geothermal projects that target to heat 500,000 homes each year. They are investigating hot aquifer thermal energy storage and constructing an agricultural heating demo plant. Dutch research institutions, composed mainly of the TNO, lead the international HEATSTORE project and explore active and passive geothermal heat and cost reductions. In this area, the country is enhancing the public heat transition through private partnerships where EBN plays a critical role. Acknowledging funding gaps, the Netherlands stresses the purchase of heat network assets. These initiatives place this country high on the podium of sustainable heating technologies which in the future may be adapted worldwide in the course of energy transition.

### 3. China

China has firmly established itself as one of the leading countries when it comes to the creation and distribution of heat for various activities in an environmentally friendly manner. This country has seen many developments in renewable energy. By 2022, China's renewable energy had attained a capacity of 1213 GW, now accounting for 47.3% of its entire generation mix. Wind and solar are being aggressively developed in the country, whereby the gross abit reached 1200 TWh in 2022, a growth of 21% as compared to the previous year. The nation is

also pouring a lot of money into distributed energy sources, mostly in distributed solar projects. In industrial heat end use, China is at the forefront of replacing conventional process heat with renewable electricity and targets to increase the uptake more than five times in the next few years. That is nevertheless the case with regard to these improvements; Chinese electricity generation is still more than 70 percent fossil fuel-based. However, these actions of the country show its clear stands in the solutions for sustainable heat, thus marking China as a strong player in the energy transition.

### 4. Denmark

Denmark can be pointed out as the first 'country' in supply and utilisation of sustainable heat with measures underway to actualize towering ambitions. The country expects all district heating systems to be climate-neutral by 2030, with about 2/3 of Danish households using this system currently. There is heat source diversification in Denmark, as low biomass heating systems are replaced by geothermal, industrial waste heat, and solar heat energy. As for the areas not connected to district heating, the government is also planning to ban completely gas supply by 2035 replacing it with heat pumps or district heating connections. There is a similar strategy consisting of rapid development of municipal heat planning, which has been under practice over many decades. Denmark is also moving to build solar thermal systems faster and looking for seasonal storage of heat energy. Such multi-faceted endeavours position Denmark as a forerunner in the quest for sustainable heat solutions and energy transition.

### 5. United Nations Environment Programme (UNEP)

The United Nations Environment Programme (UNEP) strives to foster the efficient production and distribution of thermal energy in the world. UNEP helps poorer countries enhance their energy efficiency initiatives and renewable energy projects through various projects and partnerships. Their work encompasses a variety of areas such as, transport, buildings and district energy. They also work on the heat, healthier cities initiative, launching publications such as the Sustainable Urban Cooling Handbook. The institution supports the development of geothermal, in particular, through the facilities for the African Rift Geothermal Development Facility. UNEP produces and uses externally reviewed annual reports and research works such as REN21 Renewables Global Status report as a solution to lack of foresight in energy policy making. Through these initiatives, UNEP also contributes to the problem of heat in the energy ecosystem by promoting energy with a higher degree of sustainability.

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## Timeline of Events

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| ***1973*** | The oil crisis brought interest towards the use of alternative heat sources which were foreign at that time |
| ***1988*** | Focus of Intergovernmental Panel on Climate Change (IPCC) formation is outreach knowledge on the climatological effects of energy with respect to development heating |
| ***2015*** | Knock on effect towards the heating sector with regards to the commitments which were reinforced by the Paris Agreement on climate change as adopted |
| ***2018*** | Emphasis on the report underscoring how the world must move towards decarbonisation in all sectors and not only the electricity generation sector |
| ***2019*** | For the first time within the European climate policy framework the announcement of the European Green Deal that implies comprehensive revision of heating policy targets has been noticed |
| ***2021*** | Third session of climate change conference aims to deliver the significance of the role of heat's dismemberment as part of tackling climate change |

## Possible Solutions

In the recent past attention has been given to the enlargement of the internally focused scholars' drives of creating totally perfect electricity systems and to making emphasis on heat pumps adoption complemented with heat solar radiation using green electricity. For without a shadow of a doubt, heat pumps have the ability to extract heat energy from outside air, the ground, or even water and they use energy supplied via electricity. This is especially advantageous in countries with high potential for renewable electricity, especially wind and solar. For instance, Denmark has the ambition to supply almost a third of its district heat consumption needs through heat pumps for the year 2030. On the other hand, this solution might not be applicable for the countries that have limited capacity with renewable electricity or for the country which has extremely cold weather that hinders the efficiency of the heat pumps to be used.

Also, there is a solution that presupposes the increasing and the renewal of the district heating systems that would include the use of other heat sources like the renewable ones and the waste ones. This method can work well in populated cities and countries that have a district heating system like those in Vatikan. For example, Sweden turned its district heating program 'renewable' and utilised mostly waste and recovered heat resources. Countries that do not possess a lot of district heating piping systems have also other possibilities with the same solution where they can introduce new district heating systems in cities.

The third solution deals with enhancing the existing gas networks with the addition of renewable gases, biogas, and green hydrogen. This could be particularly useful for countries with large natural gas systems as they will be able to make use of the existing facilities in replacing conventional heat sources. For instance, in the Netherlands, the uses

of hydrogen as a heating fuel are being investigated. This, however, may be less relevant for countries with no significant legacy gas infrastructure, or who wish to decarbonise their energy systems by full electrification.

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