CEE Bankwatch Network

BRIEFING | APRIL, 2021

Alternatives to fossil gas-based district and individual heating in Central Asia – the Asian Development Bank as an innovation champion

For more information

Manana Kochladze
Project Leader
manana@bankwatch.org

The Asian Development Bank's (ADB) Strategy 2030 claims: 'With the region [Southeast Asia, Central Asia and the Caucasus] facing serious environmental challenges, ADB will scale up its support for climate change adaptation, while maintaining its assistance for mitigation through clean energy and energy efficiency projects and sustainable transport.'[1]. However, it is not yet clear how the ADB plans to achieve this, as it still has not made a firm commitment to phase out fossil fuel financing, including financing for natural gas.

In recent years, the ADB has become one of the champions of natural gas related infrastructure development (including pipelines, gas power plants and district heating renovations). Unfortunately, because the Bank portrays gas as a bridge fuel and includes it in its clean energy portfolio, it is likely that many countries will end up with stranded assets.

The ADB continues to invest in gas both for the production of electricity as well as for heating and has invested comparatively less in energy efficiency. The combined amount of financing for district heating and energy efficiency projects from 2009 to 2019 was USD 6.1 billion, with investments in China accounting for 42 per cent of the total. Financing for the 'energy efficiency' and 'sector development and reform' subsectors (both of which include district heating projects) during the same period was concentrated in only a few countries[2].

CEE Bankwatch Network's mission is to prevent environmentally and socially harmful impacts of international development finance, and to promote alternative solutions and public participation.

Learn more: bankwatch.org

[1] Asian Development Bank (ADB), *Strategy 2030, Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific,* July 2018.

[2] The ADB approved USD 42.5 billion for sovereign (USD 32.1 billion) and non-sovereign (USD 10.4 billion) projects in the energy sector during the period from 2009 to 2019. Electricity transmission and distribution (39 per cent of the total) was the dominant subsector, followed by conventional energy generation. Low-carbon technologies, including renewable energy and hydropower projects, accounted for USD 9 billion (21 per cent) of the portfolio.
ADB, *Sector-wide evaluation - ADB Energy Policy and Program, 2009-2019,* August 2020.

According to the Sector-wide Evaluation of the ADB Energy Policy and Program 2009–2019, prepared by the ADB's evaluation team,[3] the 2009 policy did not address numerous issues that have since been highlighted in the ADB 2030 strategy, including the promotion of energy efficiency in buildings, smart grids and electric vehicles, and access to heating and cooling systems that use renewable energy.[4]

Therefore, during the elaboration of the new energy strategy, lessons learnt from the implementation of the old policy should be taken into account. One of the major issues is whether the ADB will continue to finance gas-based district heating systems, or instead follow other MDBs and choose more efficient, innovative technologies that can address both heating and cooling problems.[5]

Uzbekistan, Mongolia and China are among the ADB countries that have recent experience with ADB financing for gas-based district heating. In Uzbekistan, the ADB has not only provided more than USD 2.5 billion for new combined cycle gas turbines (CCGT), but in its advisory function is also supporting the Uzbek government with the rehabilitation of its district heating networks. This requires the replacement of 5,000 kilometres of pipes and will increase the efficiency of boilers in numerous Uzbek cities[6] .

In Mongolia, the ADB is trying to address the lack of sufficient heating supply that affects approximately 60 per cent of the population who are not connected to the district heating system, as well as the heavy air pollution. Since 2014, the ADB has been providing technical assistance to the Mongolian government to support an increase in energy efficiency and improve the environment. This technical assistance has mainly gone towards ensuring support for the construction of a new coal-fired combined heat and power plant (CHP5) through a public-private partnership (PPP) scheme, even allocating up to USD 150 million for the project's private sponsor. The technical assistance implementation report for the project (April 2020) showed that the project was less than successful, as CHP5 was not constructed due to numerous changes that took place in the Mongolian government. In the same evaluation report, the ADB recognised that 'both electricity and heat supply in the [clean energy sector] is still in a critical condition'. The ADB has proposed a 125 MW large-scale battery energy storage system along with the mobilisation of an additional 350 MW of renewable energy for electricity supply to address this. However, in order to solve the heating problem, it states that the switch to a fuel cleaner than coal is imperative. The ADB is supporting the government with the preparation of '[a] methane development master plan to explore switching to a cleaner fuel for heating and power generation[7]'.

In 2012 under its Clean Energy Program[8], the ADB financed the 'Shanxi Energy Efficiency and Environment Improvement Project[9]', which replaced 232 small, old coal-fired boilers with five large, new coal-fired boilers in four counties in China. In total, four coal-fired boilers and one gas fired boiler were installed. Although the ADB's promotion of a project that replaced coal boilers should be welcomed, its support for the substitution of coal with gas is concerning. In 2020, the Bank approved the Low-Carbon District Heating Project in Hohhot, Inner Mongolia Autonomous Region[10], China with a hybrid heating system that uses boilers powered by natural gas and wind.

Although it continues to invest in gas projects, the ADB already has successful experience with renewables-based district heating projects in China, including solar, geothermal and combined gas and wind. In the city of Qingdao[11], the existing coal-based district heating system was replaced with a low-temperature district energy distribution

---

[3] ADB, *Sector-wide evaluation - ADB Energy Policy and Program, 2009-2019.*

[4] European Commission, Shaping a sustainable industry: Guidance for best practices & policy recommendations, final report, 2020.

[5] Kira Taylor, '"Gas is over": EU bank chief signals phase-out of fossil fuel finance', *Climate Home News*, 21 January 2021.

[6] 'ADB helps Uzbekistan to improve district heating in Tashkent city through public-private partnership', *The Tashkent Times*, 6 August 2019.

[7] ADB, *Mongolia: Preparing the Energy Efficiency and Urban Environment Improvement Project*, TCP validation Report, September 2020.

[8] Asia Regional Integration Center, Webpage: Regional Public Goods - ADB Clean Energy Program.

[9] ADB, China, People's Republic of: Shanxi Energy Efficiency and Environment Improvement Project, last accessed 7 April 2021.

[10] ADB, China, People's Republic of: Low-Carbon District Heating Project in Hohhot in Inner Mongolia Autonomous Region, last accessed 7 April 2021.

[11] ADB, China, People's Republic of Qingdao Smart Low-Carbon District Energy Project, last accessed 7 April 2021.

network with a smart energy management system supplied through a diversified combination of natural gas, solar thermal, geothermal and waste heat from industrial plants.

The Review of the ADB Clean Energy Program notes that from 2008 to 2018, 'all district heating projects were implemented in [China] due to the country's high demand for space heating. Interventions done in this sphere can be characterized by the use of low-carbon, low-emission, and energy-efficient district heating systems'. Total expenditures reached USD 1.1 billion[12]. The goal of these projects was both to reduce dependence on coal as well as to increase energy efficiency. The Bank carefully researched the potential of solar district heating in China, concluding that it would have huge potential if the country's policies were to promote solar heating by easing the regulatory framework (land and technical regulations and financial incentives)[13]. In general, in order to facilitate a switch towards more energy efficiency and renewables in district heating, governments such as China should establish clean heat targets, ensure low grade excess heat access as a structural energy efficiency measure, improve access to the network for third parties, and increase the transparency of pricing (including for air pollutants, carbon emissions, etc.).[14]

Despite the fact that the ADB has significant knowledge and several positive experiences in this area, as well as information about positive experiences in countries such as Denmark[15], it has not significantly changed its approach within its own countries of operation.

Unfortunately, the Sector-wide Evaluation of the ADB Energy Policy and Program 2009–2019 does not assess the importance of fundamentally changing the heating and cooling sector from a decarbonisation perspective. Although it recognises that 'while natural gas is considered a cleaner fuel, it still contributes significantly to greenhouse gas emissions', it does not recommend the ADB fully phase out fossil fuels, and it calls for the establishment of selection criteria for gas projects. These criteria includes stipulations that the projects must be a substitute for coal, increase energy security through fuel and source diversification and provide system flexibility that expands the system's ability to absorb renewable energy. These are considered prerequisites for projects to contribute to direct poverty alleviation and local air quality improvement.

Europe's experience with district heating shows that fourth and fifth generation district heating systems do not need coal or gas.[16] The advantage of these systems is that they do not need to be designed as a single large-scale district heating system. Another big advantage is that they can be used for both heating and cooling. In places where the construction of a district heating system is not justified (because of low population density, mild winters, long and complex construction processes, etc.), the focus should be on alternatives to a district heating system and meeting needs for individual heating and cooling. An especially important challenge in Asian countries is to achieve sustainable cooling goals.

Therefore, it is important that, as a public bank, the ADB fully phases out fossil fuels and focuses its attention on renewable energy and energy efficiency solutions, in order not to increase potential stranded assets. It should stop prioritising investments in gas both for electricity and the district heating sector, and rather prioritise innovative

---

[12] ADB, *Review of the ADB Clean Energy Program*, 23, March 2020.
[13] ADB, *Solar District Heating in the People's Republic of China: Status and Development Potential*, July 2019.
[14] ADB, District Heating Business models and policy solutions: financing utilization of low grade industrial excess heat in the people's republic of China, December 2020.
[15] ADB, *Solar District Heating in the People's Republic of China: Status and Development Potential*, July 2019.
[16] Fourth and fifth generation district heating operate on lower temperatures (and thus higher efficiency), incorporate seasonal storage and allow for the use of various sources of low potential waste heat (sewage water system, computer centers, etc. In Europe, such clean heating and cooling solutions are increasingly being implemented. These innovative solutions are based on a decentralised system that integrates multiple renewable sources into the grid, operates at low temperatures, includes heat/cooling storage for peak times, and relies on a highly efficient pipeline network and on a high degree of energy efficiency on the end users' side (insulated buildings, heat metering, temperature control, etc.). In some cases, these systems use gas or biomass, but only as a backup option for peak times in winter when the heat demand is very high. However, the modular nature of such systems will allow for gas to be replaced with other sources during future peak seasons.

clean solutions that can be used in district or individual heating. In 2021, the ADB should ensure the phase-out of coal and gas for all energy operations, including district heating, and achieve zero-emissions targets and sustainability.

The Bank should support governments in conducting diagnostics of available renewable resources (including solar, geothermal and low-grade excess heat), support improvements to the legislation (like third-party access, the energy efficiency of buildings, transparency of heat network pricing, the competition of heat production and improving PPP concession bidding), and provide countries with multiple options for integrating the heat and power sectors so that the system costs and benefits can be better understood. This will support the development of the market with a scientifically sound analysis for improvement in the energy efficiency of district heating.

If the ADB greenlights fossil gas projects now, it will undermine any efforts to decarbonise the heating sector of Central Asia by 2050. Because of the long lifetime of fossil gas investments (e.g. power plants' lifetime may range from 30 to 50 years), these projects are likely to become stranded assets well before their lifetimes are over. Furthermore, financing new gas infrastructure instead of renewables may result in a delay of the implementation of renewable energy.

Fact sheet on sustainable heating and cooling systems

District heating is important for the decarbonisation of the energy sector. Phasing out coal and gas in district heating is necessary to achieve the zero-emissions target and other sustainability goals. However, often, decision makers and the public do not believe that sustainable heating solutions will work. Fossil fuel-based district heating systems are often considered ideal due to their economy of scale, efficiency and reduced greenhouse gas emissions in comparison with individual heating. However, there are numerous disadvantages to using district heating, including long construction periods for new systems or the expansion of existing systems, the difficulties faced when trying to cover everyone in a given municipality, network losses and inefficiency for older systems, and contributions to greenhouse gas emissions (if the system runs on fossil fuels or unsustainable renewables such as biomass).

Innovative, clean solutions that can be used in heating, whether district or individual, are largely based on fourth and fifth generation clean heating and cooling solutions that have been successfully implemented in Europe. They are based on a decentralised system that integrates multiple renewable sources into the grid, operates at low temperatures, includes heat/cooling storage for peak times, and relies on a highly efficient pipeline network and a high degree of energy efficiency on the end users' side (insulated buildings, heat metering, temperature control, etc.). In some cases, these systems use gas or biomass, but only as a backup option for peak times in winter when the heat demand is very high.

Renewable sources used in modern heating systems include solar thermal energy, geothermal energy (from big water surfaces like large rivers or sea water), or biomass (provided strict sustainability criteria are in place), in combination with technologies like heat pumps (which can use geothermal energy or electricity produced from wind) and heat recovery from industrial processes (surplus heat released by data/computer companies, big supermarkets or industry facilities). Such systems typically have storage (for instance, underground mines) so that the excess heat accumulated in the summer, from sources such as solar thermal panels, can be used in winter. As a result, such systems can achieve zero emissions.

Any measures aimed at introducing clean heating solutions need to be complemented with ambitious energy efficiency measures at the level of the grid (pipelines) and the end users (deep renovation of old buildings, obligations for energy efficiency standards for new buildings, introducing consumption-based billing, etc.).

The advantage of these solutions is that they do not need to be designed as a single large-scale district heating system. Another big advantage is that these solutions can be used for both heating and cooling. In places where the construction of a district heating system is not justified (because of low population density, mild winters, long and complex construction processes, etc.), the focus should be on alternatives to a district heating system and meeting the needs for individual heating and cooling.

In Asia, there is already experience with the use of heat pumps for cooling. This can be one of the solutions promoted widely at the individual level, as heat pumps can help meet both heating and cooling needs – for instance, there can be a set of decentralised heat pumps for one neighbourhood. All of the other solutions mentioned above (solar, geothermal, etc.) can be implemented at the individual level or on a very small scale. For instance, a large building can use geothermal energy for its heating and cooling needs. The focus of governments and financial institutions should be on promoting efficient appliances for individual objects or neighbourhoods, based on the specific local potential (for solar, for geothermal, wind, etc.), and on providing suitable financial incentives/subsidies to users to implement those solutions.

Examples of financial incentives can be found in the EBRD's energy sector strategy[17] which supports investments in renewables for heating, both in district heating networks (including in the Western Balkan countries) and in individual heating.

There are many operational fourth (and even fifth) generation district heating and cooling systems in Europe that use no fossil fuels at all, or use them only as a backup, and rely primarily on renewable sources and innovative technologies. Such systems can be found primarily in Denmark and other northern European countries, pioneers when it comes to advanced heating and cooling solutions, but are also found throughout Europe.

These are some specific examples:

- ***Marstal, Denmark***. Renewables-based district heating: 50-55% comes directly from solar heat collectors, 40% from a wood chip boiler, 2-3% from a heat pump (wind power). Solar heating system covers almost 20,000 m^2. Seasonal storage of solar heat in soil deposits. Financing: the locals, available subsidies and funding programmes (including EU funds), and the Danish funding programme[18].

- ***Paris Orly Airport***. Geothermal power plant for heating its buildings. Two wells are dug in the Dogger, a 1.8 km-deep aquifer. The water comes up at 74°C. Geothermal energy reduces carbon dioxide emissions by 9,000 tonnes each year[19]. (See Aéroport de Paris – Orly | GEODH).

- ***Ferrara, Italy***. Geothermal source in an integrated system for district heating and cooling, together with the heat produced in a biomass plant for solid waste and methane gas boilers as back-up. Uses gas only as a backup option, not as the primary source. The district heating supplies about 320 buildings with heat and about 85 buildings with sanitary hot water[20].

- ***Middelfart, Denmark***. The district heating system utilises excess industrial heat as the main heat source (77% of total heat production), and there is a reserve capacity of 48 MW, that utilises natural gas or fuel oil (23%). On average, the supply temperature is 65 degrees and return temperature is 40 degrees. Serves around 15,000 inhabitants[21].

- ***Helsinki, Finland***. Integrated district heating and cooling system in a larger city that is undergoing gradual transition to eliminating fossil fuels and replacing them with clean and advanced solutions. About 95% of the city (600,000 residents) use district heating. The world's largest heat pump plant, Katri Vala, produces heating and cooling from the waste energy of purified wastewater. In the winter, the heat is recovered and reused as district heating. In the summer, the thermal energy is obtained from the return water in district cooling, with the heat pumps producing simultaneously district heating and cooling. Three CHP plants (fossil fuels) and 10 heating plants are used for peak hours in winter (gas, pellets and fuel oil). Different projects are under construction to gradually replace fossil fuels: biomass (wood chips) heat plant; heat pumps (data centres); heat storage.[22]

An example of a location where the transformation of the heating system from coal-based heating toward fourth generation heating is underway is a case Bankwatch has been working on in Slovakia. There was a study done to

---

[17] EBRD, Energy Sector Strategy 2019-2023, 36-37.

[18] Co2mmunity.eu, Fact Sheet, Marstal Fjernvarme – a solar district heating plant on the island of Ærø, Denmark, 2019.

[19] GEODH, Case Study, Airport de Paris – Orly, GEODH, 2008.

[20] Upgrade DH, Case Study Ferrara and Bologna, Italy, 2017.

[21] Upgrade DH, Case Study Middelfart, Denmark, 2017.

[22] Euroheat & Power, Case Studies, Helsinki's Combined District Heating & Cooling, 2015.

propose alternative solutions for the heat provided to the nearby small towns from the coal-based CHP plant Novaky, scheduled to shut down by the end of 2023. The study's proposed solution is to prioritise energy efficiency through savings in buildings and in the distribution network, and to combine several renewables, based on the local potential, including geothermal, solar energy, heat pumps, and biomass (from the CHP plant), together with seasonal heat storage. This is a process that will take several years, and currently a fourth generation system is being planned for one of the region's villages as a first step.