

CEE

Bankwatch
Network

Summary of the study: 'Identification and analysis of potential sustainable heating solutions in Pljevlja, Montenegro'

Full study by PlanEnergi, commissioned by CEE Bankwatch Network

Summary by CEE Bankwatch Network

September 2021



Context

The current heating supply for the municipality of Pljevlja is based on wood and lignite, and is reliant on stand-alone furnaces, a few microgrids, and outdated stoves with poor filtering systems. These contribute to a highly damaging pollution problem in the region. In 2018, 680 premature deaths in Montenegro were registered as caused by air pollution.¹ To address this problem, Montenegro's 2030 Energy Strategy proposes the development of district heating systems based on biomass.²

The current plan for refurbishing the existing coal power plant, however, envisages a future heat supply based on lignite, thereby locking Pljevlja's heating system into coal for many years to come. Furthermore, the Montenegrin government's June 2021 announcement that it will phase out coal by 2035 means that investing in a network of coal-based district heating that will operating for such a limited period would be not be economically sustainable.

To identify cost-effective and environmentally-friendly heating alternatives for the municipality of Pljevlja, CEE Bankwatch Network commissioned an analysis to explore and assess the most effective heating solutions. Focusing on key factors, including affordable heat prices for consumers, reducing carbon emissions, and decreasing dependence on biomass and fossil fuels, the analysis proposes that a transition to renewable heating and complete elimination of coal use in Pljevlja is possible and economically viable for customers.

To achieve the best climatic, environmental and social outcomes, a significantly reduced share of biomass use will be necessary. Adopting a diversified approach for renewable energy heating sources is recommended for Pljevlja, rather than relying on an increased share of biomass. One risk of relying solely on biomass is that poor forest management could result in accelerated deforestation of primary forests, which would significantly reduce CO₂ capture across the entire country. Using biomass as a large-share fuel has become controversial in many EU countries (i.e. Denmark), with negative impacts on biodiversity conservation and high-value forests preservation, even when sustainability criteria and forest certification standards are followed.

1 European Environment Agency, [Air Quality in Europe – 2020 Report](#), 159-160, 2020.

2 Montenegro Ministry of Economy, [National Energy Strategy until 2030](#), 63-64, 2014.



Potential alternative energy solutions

The starting point for decarbonising the heating supply systems in the Pljevlja Municipality is reducing levels of heating demand, on both the consumer side and across the heat-transmission infrastructure. With an aging building-stock and poor thermal insulation, the heat demand load averages 150 W/m^2 ,³ a level 2 to 3 times higher than the average heat demand load in western Europe of 50 to 70 W/m^2 .

Given that the entire housing stock should undergo building insulation improvements and the replacement of radiators, the overall peak heat-load of buildings in microgrids will decrease by an estimated 40 per cent, reducing the energy demand of the microgrids from 31 to 22 per cent. Current heating systems used in Pljevlja show poor efficiency, namely 65 per cent efficiency for buildings heated by small boilers, 69 per cent for those heated by larger boilers, and 50 per cent for individual homes heated by wood and lignite. Thus, the solutions proposed by the study are dependent on the implementation of good energy efficiency measures.

The study's methodology

To determine the most effective alternative heat supply technology for the town of Pljevlja, we divided the town's consumer groups into categories A, B and C, based on their specific heat loads.

Category A:

consumers burning biomass or lignite using small individual heating boilers

Category B:

consumers using larger boiler rooms, supplying 31 per cent of inhabitants connected to microgrids

Category C:

consumers that could be connected to a district heating network, which would improve the energy transmission and reduce fuel consumption as well as incorporate alternative heating solutions with high spatial requirements

³ Dencon d.o.o. Podgorica, *TOPLLOTNI KONZUM TOPLIFIKACIJE GRADA PLJEVLJA*, commissioned by the Municipality of Pljevlja – Directorate for construction and investments, 103, 2019.

Several scenarios were modelled and analysed to assess their relative feasibility for transforming Pljevlja's heating system.

- 0** *Business as usual*: no changes to Pljevlja's existing heating systems or existing heat supply methods, and no change in the proportion of individual heaters or microgrids.
- 1** *Refurbishment of technologies, no district heating*: Replacing of housing and boiler-room technologies, but without change to the district heating infrastructure or heating distribution systems in the houses.
- 2** *Connecting microgrids in the centre to district heating network* (town-centre, Zone 3): replacing old boilers and connecting the town-centre's microgrids to an enlarged town-centre (Zone 3) district heating grid, supplied by a larger heating unit.
- 3** *Complete coverage of district heating* (wider town-centre, Zones 3, 6 and 7): further expansion of the existing microgrids across the town centre; connecting individually heated dwellings to district heating, and replacing all supply technologies.
- 4** *Complete coverage of district heating* (including Pljevlja's largest suburbs, Zones 3, 4, 6, 7, 8 and 9): all buildings, irrespective of their former supply, are connected and supplied centrally by district heating.

The study's main findings

The study results show that when no subsidies for renewable energy technologies are provided, the investment costs do not justify that a district heating network should be set up, and existing heat distribution, based on individual heaters and microgrids, should remain (scenario 1, *Refurbishment of technologies, no district heating*). This assumes, however, that economic factors such as net present value (NPV) and heat costs for customers are prioritised over carbon emission reduction goals.

Advantages of scenario 1 include a low development risk, minimised disruption, and a high cost-effectiveness level if no subsidies are provided. However, given the high share of biomass involved, pollution levels would continue, and the sustainability of wood supply remains unresolved.

When compared to *Business as usual* (scenario 0), scenario 1 along with the other scenarios demonstrate a positive NPV and payback time below 10 years. The transition towards a sustainable heating supply is feasible, in principle.

If an 80 per cent incentive is provided for investments in heat pumps, solar thermal, and seasonal storage, *Complete coverage of district heating* (scenario 3) is the most promising. It is also the preferred solution when CO₂ taxes at different price levels across fossil-fuel consumers and a 22 per cent or higher subsidy level for the investment cost for solar thermal technologies and heat pumps are included in the analysis. CEE Bankwatch Network recommends conducting a follow-up feasibility study for this scenario to assess in detail the construction phasing, the supply share of solar energy, and the placement of technologies and district heating expansion in line with local geological and planning conditions.

Scenario 3 (see figure 1), which establishes a district heating grid in Zones 3, 6 and 7 near the centre of town and keeps the distribution system in the other zones unchanged, rates as better than scenario 1 (*Refurbishment of technologies, no district heating*) if at least 22 per cent of the investment cost for solar thermal technologies and heat pumps are subsidised. Key advantages include a higher CO₂ reduction level; low operation intensity; and a short, simple payback period. Such investment support facilitates finding the right balance between an acceptable heat tariff level, cutting emissions, and reducing Pljevlja's biomass fuel dependence.

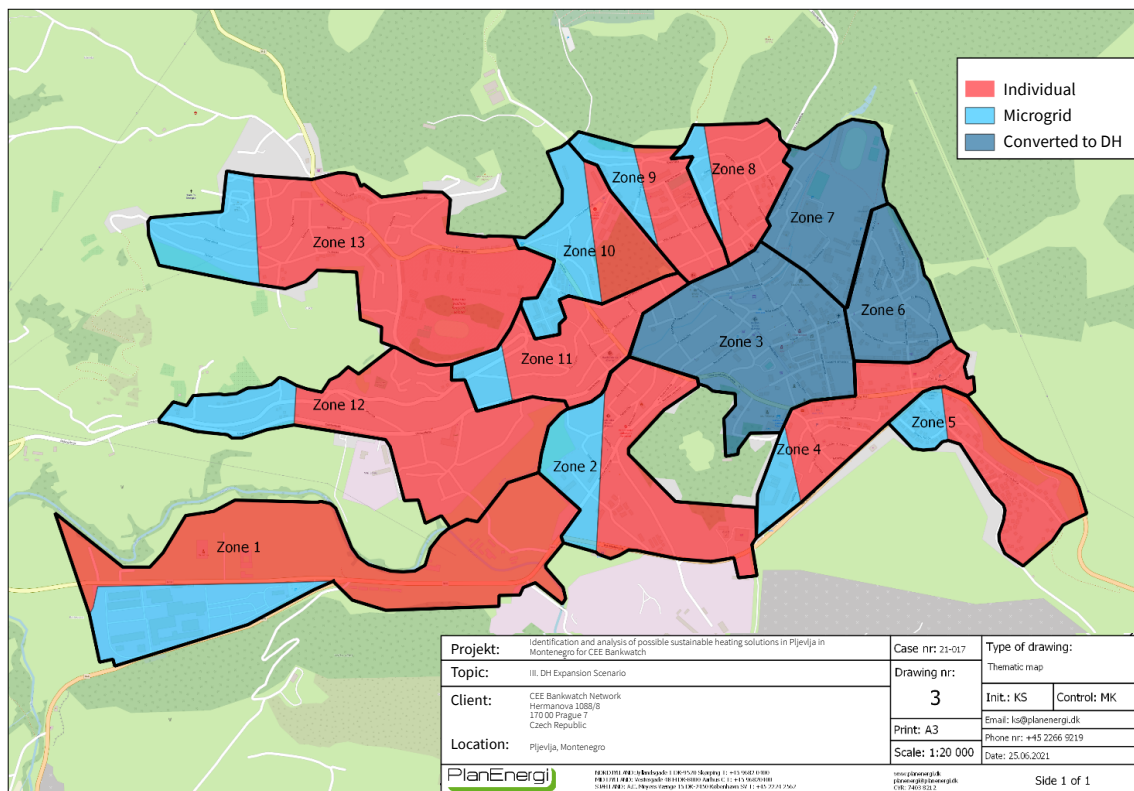


Figure 1: Spatial drawing of expansion scenario 3

To support an extended DH grid (as proposed in scenarios 3 and 4), solar thermal collectors outside of town, in combination with a large thermal seasonal storage system, seems the best supply source. Fuel independence, complete CO₂-neutrality, and low operation intensity are key benefits in using these technologies.

Scenarios 4 and 2 are not considered ideal by the study, for both practical and economic feasibility reasons.

Optimal technologies (based on different scenarios and consumers groups)

Another critical question, relevant for all the scenario options, is the technologies that are used to optimise Pljevlja's renewable supply solution. We examined and assessed biomass boilers, solar heating and heat pumps.

For microgrids (scenario 2), the study proposes using medium air-to-water pumps, since this is a mature technology that does not require any specific spatial conditions.

For individual buildings, new biomass boilers are the most suitable technology, assuming that houses connected to microgrids would be retrofitted faster than others. With old radiators that require high flow temperatures, biomass boilers can deliver most efficiently.

The study's assessment makes it clear that the same technologies can be considered for every scenario, across each consumer group. For consumer group C, solar thermal rooftop can only be used in scenario 2, not in scenario 3. The demand of the large district heating grid in scenario 3 cannot be supplied by a solar storage system alone, as the available rooftop area is insufficient for the high demand. New medium-sized biomass boilers would need to cover the remaining demand.

Using solar thermal panels in consumer group B (microgrids, scenarios 1, 2 and 3), means only buffer storage will be available – thus, there is no assurance that the installed capacity can be fully used, nor that during times with high demand the capacity can be effectively utilised to cover the full demand (given the unpredictability of weather conditions). Biomass technologies are therefore needed to ensure a stable supply, independent of weather conditions. Small air-to-water heat pumps and biomass boilers can be combined, with the pumps contributing 60 per cent and the boilers 40 per cent to overall heat production.

Conclusion

By implementing large solar thermal collector fields and further reducing the use of biomass, scenario 3 provides the greatest environmental improvements and reductions of CO₂ emissions. District heating under this model provides great benefits, including supplying more houses with heat from a common source and increasing the households that are a part of the existing microgrid system. This scenario furthermore has 25 per cent less biomass than scenario 1, which can significantly improve Pljevlja's pollution.

The full study (September 2021) can be found [here](#)

CEE

Bankwatch
Network

Author Full study by PlanEnergi, commissioned by CEE Bankwatch Network
Summary by CEE Bankwatch Network

Design Peter Slingiert

Cover image Pljevlja, Montenegro
Photograph by Dario Bajurin, via Adobe Stock



This publication has been produced with the financial assistance of Sida and the European Union. The content of this publication is the sole responsibility of CEE Bankwatch Network and can under no circumstances be regarded as reflecting the position of Sida or the European Union.