CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

CTCN Technical Assistance
Request Submission Form

Please fill in the form in the grey spaces, by following the instructions in italic.

Requesting country:	*Republic of Serbia*

Request title:	*Modernization of the district heating (DH) system and improvements in energy efficiency of buildings in the City of Belgrade*

Contact information:

{Please fill in the table below with the requested information. The request proponent is the organization that the request originates from, if different from the National Designated Entity (NDE).}

	National Designated Entity	Request Applicant
Contact person:	*Vladica Bozic, PhD*	
Position:	*National Designated Entity (NDE)*	
Organization:	*Ministry of Agriculture and Environmental Protection*	*The City of Belgrade*
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Technology Needs Assessment (TNA):

{Select one of the three boxes below:}

☐ *The requesting country has conducted a TNA in .... (please insert date of TNA completion)*
☐ *The requesting country is currently conducting a TNA*
☒ *The requesting country has never conducted a TNA*

{If the requesting country has completed a TNA, please indicate what climate technology priority this request directly relates to. Please indicate reference in TNA/TAP/Project Ideas.}

CTCN Request Incubator Programme:

{Please indicate if this request was developed with support from the Request Incubator Programme:}

☐ *Yes*
☒ *No*

Geographical focus:

{Select below the most relevant geographical level for this request:}

☐ *Community-based*
☒ *Sub-national/City*
☐ *National*

☐ *Multi-country*

{If the request is related to the sub-national or multi-country level, please indicate here the areas concerned (provinces, states, countries, regions, etc.)}

City of Belgrade.

Theme:

{Select below the most relevant theme(s) for this request:}

☐ *Adaptation to climate change*

☒ *Mitigation of climate change*

☐ *Combination of adaptation and mitigation to climate change*

Sectors:

{Please indicate here the main sectors related to the request. e.g. energy, industry, transport, waste, agriculture/fisheries, forestry, water, ecosystem/biodiversity, coastal zones, health, education, infrastructure/human settlement, tourism, businesses, early warning/disaster reduction, institutional design and mandates, cross-sectorial}

Energy (efficiency of a municipal district heating system and building efficiency).

Problem statement *(up to one page):*

{Please describe here the difficulties and specific gaps of the country in relation to climate change, for which the country is seeking support from the CTCN. Please only provide information directly relevant to this request, and that justifies the need for CTCN technical assistance.}

According to the First Biennial Update Report of the Republic of Serbia under the UNFCCC (2016), emissions from the energy sector amounted to 49,661.06 Gg CO_2eq, or 79.4% of total GHG emissions in 2013. Since 2010, emissions have decreased by 2.6%, mainly as a result of lower consumption of diesel and gasoline in road transport and fuel consumption in manufacturing industries and construction. However, gross final energy consumption is expected to increase by 12.9% by 2020 compared to 2009, without the application of energy efficiency measures. The bulk of gross final energy consumption is related to the heating and cooling sector, which is projected to increase to the share of 45.5% in 2020[1]. As such improving energy efficiency in the heating and cooling sector is a national priority for Serbia. Furthermore, electricity consumption is relatively high, primarily due to the use of electricity for household heating and the low energy efficiency of buildings (mainly built in the 1970s and 1980s).

District heating (DH) systems exist in 59 cities in Serbia with a total heat production capacity of 6,700 MW which provides heating to buildings via district or city-wide distribution networks[2]. DH systems are used for heating of residential and office space covering approximately 305,000 apartments (of average surface 66 m^2).

The projections of GHG emissions within the First Biennial Update Report, show emission reduction will be 11% compared to "business as usual" by 2020 if basic measures are applied, and 18% if additional mitigation measures are applied. The energy sector and in turn heating companies would be responsible for a significant share of this reduction, however significant financial resources will be required to undertake these measures.

The energy policy of the Republic of Serbia focuses on increased use of renewable energy through: energy rehabilitation of buildings; building-level renewables (mainly public buildings); and development

[1] National Action Plan for Renewable Energy Sources, 2013
[2] Air Quality Plan in Belgrade Agglomeration, February 2016

and expansion of DH systems based on renewables and Combined Heat and Power (CHP). Specific measures include development of 1,000 MW of small biomass boilers; introduction of heat metering systems and consumption based tariffs in DH systems and an increase in renewables such as biomass geothermal and solar[3]. Heat metering for DH customers is a requirement of the EU Directive on Energy Efficiency[4], Article 9 and this Directive is especially relevant for Serbia due to the current EU approximation process, where it is required that the country aligns their policies and regulations to the EU standards.

The DH system in Belgrade is the largest in Serbia and one of the largest in Europe with a total network length of 1,420 km and a capacity of over 2,800 MW, almost half the total capacity in the country. PUC "Beogradske elektrane" (BE) manages the DH system which consists of three principal components: heat production plants, a distribution network for transporting heat and 8,700 energy transfer stations to transfer heat to buildings' central heating systems. The average age of the distribution network is 25 years. BE supplies heat to approximately 50% of households in Belgrade (over 305,000 households[5]) and also maintains approximately 150 boilers in schools, kindergartens and social institutions[6].

The majority of the network is run on natural gas boilers (85% of capacity) and fuel oil boilers (13% of capacity) with no waste heat from cogeneration or other sources being used and very little renewables (0.75% of capacity). The primary energy efficiency of the system is estimated to be 72%. Energy efficiency of the building stock is quite low, and the intensity of energy consumption is high. The city needs harmonised approaches to efficiency. Belgrade's publicly owned DH operator BE has identified that the required level of capital investment, which is based on the expected cost of replacement of parts of heating network is approximately EUR 380 million to be allocated for life span of 25 years, giving an annual level of required investments in the amount of EUR 15,232,000. The operator has also identified the need for fuel substitution and is considering conversion to renewable energy (away from natural gas) for various parts of its operations.

One third of buildings in Belgrade that are not connected to the DH system use electricity for heating, and the remaining two thirds use solid (coal and firewood), liquid or gaseous fuels[7]. According to the Belgrade Air Quality Plan (2016), air quality (SO_2) is significantly worse during the winter season in areas using individual heating solutions. Recently, the soot content of the air has decreased after a series of measures, the most important being: the expansion of DH system, switching to gas in power stations and the closing of boilers for solid and fuel oil.

Drivers for modernisation of the system include: security of supply (natural gas and fuel oil are imported); expansion of the network to reduce air pollution; improved efficiency of DH and buildings; reduced CO_2 emissions from the DH network; and improved quality of heat supply to consumers. The city will benefit from technical assistance that assesses the DH system relative to international best practice and with an understanding of these drivers. The technical assistance can support the Republic of Serbia through analysis of national regulations and policies and assessments of Belgrade being made available to other cities in the country.

Past and ongoing efforts *(up to half a page):*

{Please describe here past and on-going processes, projects and initiatives implemented in the country to tackle the difficulties and gaps explained above. Explain why CTCN technical assistance is needed to complement these efforts, and how the assistance can link or build on this previous work.}

[3] National Action Plan for Renewable Energy Sources, 2013
[4] DIRECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
[5] Number of households in Belgrade in 2011 was 606,433 (Census 2011)
[6] Air Quality Plan in Belgrade Agglomeration, February 2016
[7] Belgrade Development Strategy, 2011

In general, the level of integration of climate change issues in the sectoral and the general development strategies, the level of knowledge, institutional and individual capacities, the available technology and, above all, the financial resources are not sufficient for effective and prompt response to climate change and to combat its impacts and effects. The country still lacks a comprehensive national climate change strategy.

The National Climate Change Strategy with action plan is currently being developed and it will provide a clear framework of activities in the fight against climate change in the period between 2020 and 2030, as well as the framework for 2050. Strategy will include all relevant sectors taking into account climate change and possibilities of their adaptation to the climate change conditions.

Energy policy, as the key factor for GHG emission reduction, is defined in the following strategies: Draft Energy Development Strategy until 2025 with projections to 2030 (2015), based on the energy balances (which Government adopts on an annual basis), Second Energy Efficiency Action Plan of the Republic of Serbia for the period from 2013 to 2015 (2013), National Renewable Energy Action Plan of the Republic of Serbia (2013), Decree on Incentive Measures for Privileged Energy Producers – Decree on feed-in tariffs (2013). Draft Energy Development Strategy until 2025 with projections to 2030 is analysing the climate change issue in a direct way (as separate chapter), while the implementation of the remaining documents would have direct impact on reducing GHG emissions. However, Serbia still does not have a Technology Needs' Assessment.

The Energy Development Strategy (EDS) of Belgrade has been drafted in 2008, but has not been adopted yet. Nevertheless, the implementation of the measures and achievement of the goals of EDS is being monitored, while the Strategy determines strategic development directions of BE. First goal of EDS is energy efficiency increase, then increase in supply security, thirdly, environmental protection, further on, decrease of dependence on imported energy and increased investment in energy sector. Furthermore, one of the goals of EDS is to reduce the required heat energy for heating buildings by 1% per year. However, the Strategy does not give clear indications on DH systems.

One of the main priorities of the Strategy for Energy Development of Serbia (2015) is reduction of pressures on environment and increase in use of RES to up to 27% (formerly 20.1%). It sees biomass and hydro potential as one of the main sources of RES.

Additionally, Decree on Energy Efficiency in Buildings (2011) sets the minimum energy requirements for new buildings, but also reconstruction, recovery and adaptation of the existing buildings.

City of Belgrade was selected to be one of four pilot cities of the District Energy Systems Initiative of Sustainable Energy for All (SE4ALL) and the global GEF project 'Increasing Investments in District Energy Systems in Cities – a SE4All Energy Efficiency Accelerator'. Over the next three years, this Initiative will support more than 31 other cities to develop, expand and modernise district energy systems through technical assessments, capacity building and training. As a pilot city of the Initiative, the City of Belgrade will be vital to demonstrating best practice technology applications, policies and financing mechanisms to be replicated in the region. City of Belgrade has also recently joined the SE4ALL Building Efficiency Accelerator Partnership Platform, that will assists the City government in improving the energy efficiency of buildings in their jurisdiction through multi-sectoral collaboration, which could help facilitate action on building efficiency policies and projects. The District Energy in Cities Initiative has already begun work in partnership with international partners such as State of Green, Danfoss and IFC to identify key technical, regulatory and policy developments that could be achieved in Belgrade and has gained support from the city and country for national and local technical and policy recommendations.

Assistance requested *(up to one page):*

{Please describe here the scope and nature of the technical assistance requested from the CTCN and how this could help address the problem stated above and add value vis-à-vis the past and on-going efforts. Please note that the CTCN facilitates technical assistance and is not a project financing mechanism.}

The City of Belgrade is requesting the technical assistance of the CTCN in order to prepare a comprehensive Rapid Assessment of Belgrade's DH network and building envelope efficiency. The objectives of this Rapid Assessment is to report on the current status of DH and building efficiency in Belgrade and provide a high-level assessment of combined options for DH modernisation and building efficiency improvements.

After the CTCN assistance is completed, this Rapid Assessment will direct and provide first-stage analytical input to: demonstration project development and feasibility studies; new local policy and regulation recommendations; energy strategy development; long-term city-wide energy planning; national and international replication of best practice; and capacity building programmes.

The Rapid Assessment will contribute significantly to reduced energy costs, improved energy security, improved energy efficiency of DH, improved building efficiency (insulation and heat meters), fuel switching to environmentally friendly sources, incorporation of waste heat including from cogeneration, operational improvements in DH, comprehensive energy planning and strategy.

The Rapid Assessment should undertake the following:

- High-level technical assessment of the current DH system including status of heat plants, network and substations and the status of building envelope efficiency in the city;
- Assessment of existing investment plans and feasibility studies of the DH network and ongoing building efficiency programmes;
- Analysis of existing fuel supply and fuel reduction options including insulation of heated spaces and improved metering;
- Assessment of potential to switch to alternative cheaper energy sources from natural gas on the DH network (including biomass, cogeneration, solar, geothermal and hydropower);
- Identify for future deeper analysis potential short, medium and long-term investments in the DH network and building envelopes including: heat generation facilities, buildings within specific zones of the city, network expansions, etc.
- Undertake a socio-economic and environmental benefit analysis of potential investments including resulting reductions in CO_2 emissions, improved air quality and improved thermal comfort;
- Assessment of local and national barriers to DH modernisation and building efficiency measures (including regulations, policy, finance, customer awareness, local capacity)
- Identify and assess realistic policy/regulatory changes to improve operation of DH and improve building efficiency including analysis of the DH tariff system, planning policies, building standards and certification.
- Identify capacity building and training needs for local and national policymakers, city planners, DH utility staff, local building developers, etc.
- Recommend city-wide studies such as pollution studies, aerial assessments of DH network efficiency, heat metering, thermal analysis of buildings, waste heat mapping; and
- High-level assessment of the current business models used for DH and building efficiency programmes, including the possibilities to connect to the nearby thermo power plant "Nikola Tesla".

The value added of this approach is that it will be a holistic assessment of both the DH system and building envelopes in Belgrade which globally are often assessed separately despite the need for integrated approaches that as a system can deliver low-cost, environmentally friendly and secure thermal services.

Expected benefits *(up to half a page):*

{Please outline here the medium and long-term impacts that will result from the CTCN technical assistance, including how the assistance will contribute to mitigate and/or adapt to climate change.}

In the medium term, CTCN's assistance will contribute to the following:

- Ensure the continuity of operation of Belgrade's DH system, a system which provides the City with the highest potential for energy efficiency improvements and renewable heating and will be critical to the City's continued efforts to reduce dependence on imported fuel.
- Reduction in the use and procurement cost of natural gas for Belgrade's DH system helping the City to reduce losses and retaining wealth in the local economy encouraging local job development.
- The replacement of up to 10% of the city's DH distribution network and interconnection of heat sources.
- The mainstreaming of insulation techniques and the subsequent reduction of the building stock's energy usage
- The development of a new energy tariff system and its application at City level to improve efficiency, protect fuel efficiency and ensure business model is sustainable and attractive to the private sector.
- Subject to feasibility results and availability of funds, the installation of heat cost allocators and heat meters in residential and commercial buildings, which could save up to EUR 30 million and EUR 60 million, respectfully and 330,000 tCO_2 emissions annually.
- Reduce heat loss to 5% in the medium-term, saving EUR 6-7.5 million annually

In the long term, CTCN's assistance will contribute to the following:

- Diversification of energy sources (from natural gas to biomass, solar, waste energy, hydropower and/or geothermal) and the development of co-generation DH facilities leading to significant emission reductions.
- A reduction in overall energy requirements and associated GHG emissions stemming from the City's space and water heating operations.
- Decoupling of local heat market from international fossil fuel markets increasing local wealth retention, jobs and the financial stability of the DH system.
- Integrated policies, support mechanisms and building standards for building efficiency and DES that priority system efficiency rather than only building efficiency or DH efficiency
- Introduction of metering system and billing on the basis of measured consumption in DH systems in Belgrade, which could save up to 6.5 million tonnes of CO_2^{eq} (in 20 years)

Post-technical assistance plans *(up to half a page):*

{Please describe here how the results of the CTCN technical assistance will be concretely used by the applicant and national stakeholders, to pursue their efforts of resolving the problems stated above after the completion of the CTCN intervention (list specific follow-up actions that will be undertaken).}

The results of the CTCN technical assistance will support the City of Belgrade to:

- Significantly increase the energy efficiency and cost-effectiveness of DH company operations by implementing the recommendations of the Rapid Assessment in the short and medium/long term. This will contribute to reducing heat losses in the network, developing building efficiency measures complementary to DH development, ensuring metering of consumers is optimal for energy conservation and switching from natural gas to cheaper and local market alternatives such as biomass, geothermal or other.
- Establishing a new tariff system which will ensure economically and financially sustainable heat supply to consumers and help attract private investment in the DH system.
- Implement recommendations of the Rapid Assessment, while enabling environment for private investors that is replicable in other cities in the country and region.
- Where possible, technical lessons from CTCN's work in Belgrade will be applied elsewhere in the

country and region and policy and regulatory recommendations developed through the project and the Rapid Assessment applied elsewhere in the country to ensure replication potential in Serbia.
- Begin process of attracting private sector investment in the City, which has been identified as crucial to the longevity of the DH system. Transfer lessons learned from this to other cities in the country and region that require private sector investment and expertise.

The results of the Rapid Assessment will provide inputs to activities undertaken as part of the UNEP-led District Energy in Cities Initiative and the Building Efficiency Accelerator Partnership Platform through their long-term support to the city of Belgrade as a pilot city of these Initiatives.

Key stakeholders:

{Please list in the table below the main stakeholders who will be involved in the implementation of the requested CTCN technical assistance, and what their role will be in supporting the assistance (for example, government agencies and ministries, academic institutions and universities, private sector, community organizations, civil society, etc.). Please indicate what organization(s) will be the main/lead counterpart(s) of CTCN experts at national level, in addition to the NDE.}

Stakeholder	Role to support the implementation of the assistance
PUC Beogradske elektrane	Provide for institutional capacity, technical knowledge, data and information.
City of Belgrade, Secretariat for Environmental Protection	Ensure compliance of the project activities with the city environment protection strategies and other related programs and plans regarding environmental protection and climate change. Ensure the involvement of all the relevant stakeholders to the process, including strengthening of an institutional framework.
City of Belgrade, Secretariat for Energy	Ensure compliance of the project activities with the city energy strategy. Ensure the involvement of all the relevant stakeholders to the process, including strengthening of an institutional framework.
Ministry of Agriculture and Environmental Protection	Serve as the National Designated Entity (NDE) and focal point for the CTCN. It will ensure that: • the request reflects national circumstances and priorities; manage the national CTCN technical assistance request; • support provided by CTCN is coordinated with other processes that address climate change at national level; • relevant ministries, UNFCCC focal point, private sector, civil society, and academia representatives are involved in the process.
Serbian Environmental Protection Agency	Support the project implementation in providing data on air quality in the City of Belgrade; participate in developing recommendations that will have an impact to reduction of air pollution from heating sources.
Ministry for Mining and Energy	Ensure compliance of the project activities with the energy efficiency strategy on the state level. Ensure the involvement of all the relevant stakeholders to the

	process, including strengthening of an institutional framework.
Secretariat for Communal and Housing Affairs	Ensure compliance of the project activities with the city energy efficiency strategy. Ensure the involvement of all the relevant stakeholders to the process, including strengthening of an institutional framework.

Alignment with national priorities *(up to half a page):*

{Please demonstrate here that the technical assistance requested is consistent with documented national priorities (examples of relevant national priorities include: national development plans, poverty reduction plans, technology needs assessments (TNAs), LEDS, NAMAs, TAPs, NAPs, sectorial strategies and plans, etc.). For each document mentioned, please indicate where the priorities specifically relevant to this request can be found (chapter, page number, etc.).}

National priorities and strategies relevant to this project include:

1. **First Biennial Update Report under the UNFCCC (February 2016),** [source: http://www.klimatskepromene.rs/uploads/useruploads/Documents/E-version_FBUR-engleski-2016.pdf].

- Part 6: Mitigation measures to reduce GHG emissions, Chapter 6.1 Energy sector, Table 6.5. NAMA projects – infrastructural projects in the Energy sector, pp. 76

  Measure NS-32 – Introduction of metering system and billing on the basis of measured consumption in district heating systems in Serbia

2. **National Renewable Energy Action Plan of Republic of Serbia (2013)** [source: https://www.energy-community.org/pls/portal/docs/2144185.PDF]

- Chapter 1: Summary of National Renewable Energy Policy, pp.8 (in Serbian)

  The objectives of the energy policy of the Republic of Serbia related to the greater use of renewable energy are to be achieved through implementation of the following activities:
  1) the construction of new facilities that meet the requirements in terms of energy efficiency and use of renewable energy;
  2) energy rehabilitation of buildings and the introduction of renewable energy in the building sector (mainly in the public sector);
  3) replacement of crude oil, coal and natural gas used for heating with biomass and other renewable energy sources;
  4) the introduction of district heating systems based on the use of renewable energy sources and combined production of electricity and heat;
  5) replace the use of electricity to produce hot water by solar energy and other renewable energy sources;
  6) production of electricity from renewable energy sources;
  7) the introduction of biofuels and other renewable energy sources in the transport sector;
  8) the development of the distribution network for the connection of small electricity producers.

Development of the request *(up to half a page):*

{Please explain here how the request was developed at the national level and the process used by the NDE to approve the request before submitting it (who initiated the process, who were the stakeholders involved and what were their roles, and describe any consultations or other meetings that took place to develop and select this request, etc.)}

A delegation from the City of Belgrade participated in a joint workshop entitled "Private Sector Participation in District Heating," organised by the IFC and the District Energy in Cities Initiative in Tallinn, Estonia, on April 27, 2015, where they were informed about CTCN and met with the UNEP delegation to discuss potential opportunities for the City of Belgrade to benefit from the CTCN and other initiatives. Following the workshop, several meetings were held between the City, DH company and UNEP (DTIE, Regional and Country offices), which included discussions on potential CTCN assistance. The City of Belgrade, in collaboration with the NDE of the Republic of Serbia, has been discussing and drafting the proposal and as a consequence the NDE is submitting this request.

Expected timeframe:

{Please propose here a duration period for the assistance requested.}

Assistance is requested for a period of 6 months.

Background documents:

{Please list here relevant documents that will help the CTCN understand the context of the request and national priorities. For each document, provide web links if available, to attach to the submission form while submitting the request. Please note that all documents listed/provided should be mentioned in this request in the relevant question(s), and that their linkages with the request should be clearly indicated.}

1. Mission Report on District Heating, Tallinn, Estonia (2015)
2. Energy Sector Development Strategy of the Republic of Serbia for the period by 2025 with projections by 2030 (2016), http://www.mre.gov.rs/doc/efikasnost-izvori/23.06.02016%20ENERGY%20SECTOR%20DEVELOPMENT%20STRATEGY%20OF%20THE%20REPUBLIC%20OF%20SERBIA.pdf
3. Energy Development Strategy of City of Belgrade (2008), in Serbian http://www.beograd.rs/lat/beoinfo/1376749-strategija-razvoja-energetike-grada-beograda/
4. First Biennial Update Report under the UNFCCC (2016), http://www.klimatskepromene.rs/uploads/useruploads/Documents/E-version_FBUR-engleski-2016.pdf
5. Air Quality Plan for the Agglomeration of Belgrade (2016)
6. City of Belgrade Development Strategy (2011), Official gazette of the city of Belgrade, No 21/2011 (draft: http://www.palgo.org/files/knjige/strategy%20low%20english.pdf)
7. Belgrade Environmental Protection Programme (2015), in Serbian http://www.beograd.rs/images/data/dc72debaee84a80db897f8f25c060799_3937923785.pdf
8. Climate Change Adaptation Action Plan and Vulnerability Assessment of City of Belgrade (2015), http://www.beograd.rs/images/data/c83d368b72364ac6c9f9740f9cda05ed_6180150278.pdf
9. Draft Strategy of PUC "Beogradske elektrane" (in process)

Monitoring and impact of the assistance:

{Read carefully and tick the boxes below.}

☒ By signing this request, I affirm that processes are in place in the country to monitor and evaluate the assistance provided by the CTCN. I understand that these processes will be explicitly identified in the Response Plan in collaboration with the CTC, and that they will be used in the country to monitor the implementation of the CTCN assistance.

☒ I understand that, after the completion of the requested assistance, I shall support CTCN efforts to measure the success and effects of the support provided, including its short, medium and long-term impacts in the country.

Signature:	
NDE name:	*Vladica Bozic, PhD*
Date:	19.08.2016
Signature:	

THE COMPLETED FORM SHALL BE SENT TO THE CTCN@UNEP.ORG
Need help? The CTCN team is available to answer questions and guide you through the process of submitting a request. The CTCN team welcomes suggestions to improve this form.
>>> Contact the CTCN team at ctcn@unep.org