TERMS OF REFERENCE

Feasibility Study and Basic Design for

Combined Heat and Power (CHP) Gas Plant

and

Bitola District Heating Network Expansion

Bitola, Republic of North Macedonia

Contract MK-ESM-563220-CS-QCBS

Client	Elektrani na Severna Makedonija (ESM)
Financing	World Bank GFPP – Grant Facility for Project Preparation Grant No. TF0D2151
Procurement Method	QCBS – Quality and Cost Based Selection (International – Open)
Estimated Contract Value	USD 1,600,000
Expected Invitation	July 2026
Expected Contract Signing	December 2026
Expected Completion	December 2027

1. BACKGROUND AND CONTEXT

JSC Elektrani na Severna Makedonija (ESM) is the principal electricity generation company in the Republic of North Macedonia. The Republic of North Macedonia's electricity system remains heavily dependent on lignite-fired thermal power plants, complemented by hydropower, wind generation, and electricity imports. This structure necessitates diversification of the energy mix through the deployment of new generation capacities and a transition towards a more sustainable, reliable, and resilient energy system, consistent with decarbonisation pathways and ensuring long-term security of electricity supply.

The National Energy and Climate Plan (NECP) and the National Strategy for Energy Transition define binding trajectories for coal phase-out by 2030 and progressive reduction of greenhouse gas emissions. Simultaneously, the projected expansion of variable renewable energy creates a growing need for flexible, dispatchable generation capacity capable of balancing the power system. The National Energy and Climate Plan and the Energy Community Treaty obligations also define binding trajectories for progressive decarbonisation of the heating sector.

The development of the natural gas transmission network, including planned interconnectors and the ongoing Bitola district heating (DH) project, creates the conditions under which a Combined Heat and Power (CHP) plant in the Bitola region is technically feasible. The planned CHP plant presents a strategic opportunity to modernise and expand the Bitola DH system by supplying low-carbon, cost-competitive thermal energy from a high-efficiency cogeneration source. Natural gas is recognised as a transitional fuel with substantially lower CO□ and NOx emissions compared to coal, while also providing the operational flexibility required by a modern power system. The possibility of co-firing with hydrogen blends is additionally considered as a pathway toward longer-term decarbonisation.

Against this background, ESM, with financing from the World Bank Grant Facility for Project Preparation (GFPP) under the Trust Fund for "Project Preparation for Bitola Gas-Fired CHP Plant and District Heating Network Expansion", intends to prepare a comprehensive feasibility study covering both the CHP plant and the DH network expansion, together with a Basic Design for the preferred CHP configuration.

Under the approved GFPP Procurement Plan, this integrated preparation is covered by Contract MK-ESM-563220-CS-QCBS (Feasibility Study and Basic Design for CHP Gas Plant and Bitola DH Network Expansion), with an estimated contract value of USD 1,600,000 under QCBS International – Open procurement. The present document constitutes the Terms of Reference (ToR) governing that engagement. It will be incorporated in full into the Request for Proposals (RFP) issued by ESM under World Bank procurement procedures, in accordance with the World Bank Procurement Regulations for IPF Borrowers (Seventh Edition, September 2025).

Scope Delineation with the contract for the Environmental and Social Impact Assessment (ESIA) and ESF instruments: A separate contract is responsible for the Environmental and Social Impact Assessment (ESIA) and ESF instruments for both the CHP plant and the DH network expansion. The MK-ESM-563220-CS-QCBS Consultant shall provide the ESIA/ESF team with all confirmed technical information required for the ESIA, including preferred plant and network alignment, routing maps, land requirements, construction methodology, and phasing schedule. The MK-ESM-563220-CS-QCBS Consultant shall participate in at least one joint coordination meeting with the ESIA/ESF team and shall formally transmit the preferred alignment documentation as a trigger for ESIA boundary confirmation.

2. OBJECTIVES

The overall objective of Contract MK-ESM-563220-CS-QCBS is twofold:

(a) CHP Plant Feasibility Study and Basic Design: To evaluate the technical, economic, financial, and environmental feasibility of developing a gas-fired CHP plant in the Bitola region, and to

prepare a Basic Design for the preferred CHP configuration sufficient to underpin EPC or lot-based tender packages and permit applications.

(b) DH Network Feasibility Study and Technical Design: To determine whether the expansion of the Bitola DH network, supplied primarily by the planned CHP plant, is technically, economically, financially, and institutionally viable, and to prepare the technical design and procurement documentation required to bring the DH network expansion to implementation readiness.

2.1 CHP Plant Feasibility Study and Basic Design Objectives

The CHP Plant Feasibility Study shall specifically:

- Quantify the need for new flexible, gas-fired generation capacity within the Macedonian power system, taking into account planned Renewable Energy Supply (RES) expansion and coal retirement, and possibility for more efficient balancing of ESM's foreseen investments in electricity generation capacities (photovoltaic power plants and wind power plants) in the national grid.
- Identify and evaluate potential sites for the CHP Power Plant in the Bitola region, with emphasis on the potential re-use of existing TPP Bitola infrastructure (including land availability, grid connection, water supply, fuel access, and DH interface).
- Define the optimal installed capacity and technology configuration (CCGT with cogeneration/DH capability) with detailed reference to the main equipment and analysis of alternative solutions and suggest a first interface list.
- Assess the feasibility and economics of CHP operation, including options for connection of the new CHP plant with the main pipelines of AD ESM's ongoing investment Project Bitola DH system – (DHS Bitola) and detail review of the DHS Bitola project design, adaptation measures for compatibility, current heat consumption of the City of Bitola, future expansion of the consumption.
- Evaluate the availability and lead time of the critical components
- Evaluate long-term natural gas supply options and the potential for hydrogen production and blending with natural gas.
- Produce a comprehensive financial model and economic evaluation (CAPEX, OPEX, revenues, LCoE, NPV, IRR).
- Screen environmental and social impacts in accordance with the World Bank Environmental and Social Framework (ESF) and applicable EU Directives, including the Industrial Emissions Directive and the associated Best Available Techniques reference documents.
- Provide actionable recommendations on the preferred project scenario and a clear investment decision framework for AD ESM and its shareholders.
- Building on the Feasibility Study, the Basic Design shall produce all technical documentation required to form the basis for EPC or lot-based tender packages (FIDIC ready); support permit applications; and enable the transition to Detailed Engineering.

2.2 DH Network Feasibility Study and Technical Design Objectives

The DH Network Feasibility Study and Technical Design shall specifically:

- Validate and develop comprehensive heat demand analysis for all existing and potential consumers in the Bitola service area.
- Define and evaluate alternative network expansion scenarios, including routing options, phasing strategies, and connection prioritization.
- Determine the optimal network configuration and investment program, including heat source integration from the CHP plant.
- Prepare a technical design for the preferred network expansion scenario, including primary and secondary networks, substations, and metering infrastructure.
- Develop a comprehensive financial model and economic evaluation of the DH network expansion in integration with CHP heat supply.

- Prepare full procurement-ready (FIDIC ready) documentation for the DH network expansion, including technical specifications and bill of quantities.
- Provide actionable recommendations on the preferred investment scenario and a clear investment decision framework for ESM, the Municipality of Bitola, and their shareholders.

3. SCOPE OF WORK

The Consultant shall carry out the following tasks, grouped in two Parts. Part A covers the CHP plant feasibility study and Basic Design. Part B covers the DH network feasibility study and technical design. Given the integrated nature of the two investments, the Consultant shall ensure full consistency of assumptions, data, and findings across both Parts throughout the assignment.

PART A: CHP PLANT FEASIBILITY STUDY AND BASIC ENGINEERING DESIGN

Task A-1: Power System Analysis and Electricity Market Assessment

A-1.1 Power System Analysis

- Analyze current and projected market demand for electricity in North Macedonia (10-year horizon, three scenarios: low / base / high).
- Quantify the adequacy gap arising from expected coal retirement, accounting for committed RES additions (PV, wind, HPP Chebren) and existing hydropower capacities.
- Assess seasonal and intraday system flexibility requirements, including ancillary service needs (frequency regulation, spinning reserve, balancing, black start).
- Determine the role of the CHP Power Plant Bitola in the energy grid (baseload, mid-merit, or peaking) and quantify expected annual operating hours and capacity factors for each scenario.

A-1.2 Electricity Market Assessment

- Review the electricity market structure in South-East Europe (SEE), including regional price trends, cross-border trade, and the trajectory of market liberalization.
- Develop electricity price projections for the planning period (2030–2050) under three scenarios aligned with EU energy transition pathways.
- Assess Power Purchase Agreement (PPA) structures applicable in North Macedonia, including off-take risk and creditworthiness of potential off-takers.
- Conduct a risk assessment of market exposure, including price volatility, demand-side risk, and competitive supply dynamics.

Task A-2: Heat Demand Analysis and District Heating Integration

Scope Delimitation: Task A-2 is carried out for the purpose of providing input data required for CHP dimensioning, financial assessment, and technology selection. It is not a substitute for Part B of this Contract, which prepares the full DH feasibility study, detailed demand assessment, network routing, technical design, investment program, and procurement readiness. All assumptions and data limitations shall be fully documented and transparently provided as formal input to Part B. Ultimately, the findings of Part B of this Contract, including the Feasibility Study for the DH network, need to be considered for Part A.

- Review the main aspects of the existing Main Design of the DH System Bitola Project currently under construction; identify adaptation measures required to connect a CHP plant.
- Analyze current heat consumption in the City of Bitola: residential, commercial, public, and industrial facilities, including fuel mix, indicative consumption levels, costs, and emissions profiles.
- Develop connection rate scenarios and assess affordability and willingness of consumers to switch to DH.
- Develop heat demand projections for the planning period, incorporating energy efficiency improvements, building renovation trends, and population forecasts.

- Provide a climatic overview: heating degree days, average winter temperatures, and seasonal load profiles.
- Assess the existing DH infrastructure in terms of capacity, main consumers, tariffing, and contracting practices.
- Quantify the thermal power range to be covered by the CHP plant (analyse variants from 30 MWth to 100 MWth in 10 MWth steps) and the resulting impact on plant configuration and economics.
- Propose demand stimulation measures (connection subsidies, preferential tariffs, equipment co-financing) to increase consumer uptake.
- Collect and document site data relevant to heat integration: cadastral maps, existing DH station layout, distribution network, and land ownership documents.
- Identify low temperature heat sources that might provide heat for DH.

Task A-3: Site confirmation

Annex 1 presents the existing TPP Bitola, the proposed future site for the new CHP-Plant (1), the natural gas pipe line (2), the 110 kV switchyard (3), the installed district heating piping (4), the district heating interface to the existing TPP Bitola (5), the place for the water treatment plant for the DH (6), space reserved for a battery storage (7) and possible construction and laydown areas (8). This shall be considered as a starting point and has to be developed by the Consultant in the Feasibility Study:

- Confirmation and layout of the plant, including required site area, on the premises of ESM at the existing TPP Bitola area.
- Document proximity and connection capacity to the natural gas transmission network; proximity and connection capacity to the 400 kV / 110 kV transmission grid (MEPSO); availability and quality of cooling water supply; potential connection to the DH System Bitola transmission pipeline; and road access for construction logistics.

Task A-4: Technology Selection and Plant Configuration

- Review and compare applicable technology options, including OCGT, CCGT, and CCGT-CHP. Assess each option against system needs and heat demand.
- Compare the 4 top-ranked technical alternatives.
- Define CHP operational strategies (electricity-led, heat-led, and mixed operation modes) and assess their impact on plant sizing, efficiency, and revenues.
- For the preferred technology, specify the optimal plant configuration: number and rating of gas turbines, HRSGs, and steam turbines; HRSG configuration (pressure levels, steam extraction from steam turbine, DH heat exchanger in HRSG); flexible operation envelopes (minimum stable load, ramp rates, start-up times); gross and net electrical output; useful thermal output; net electrical efficiency (LHV basis); and emissions performance for NOx, CO, particulate matter and greenhouse gas emissions; and demonstrate compliance with the Law on Industrial Emissions Control, applicable BAT Conclusions and BAT-AELs for Large Combustion Plants, and relevant Energy Community requirements..
- Develop a load case table for the proposed best plant configuration.
- Analyze operation modes across seasons for varying heat demand levels and gas price scenarios.
- Describe technical readiness for the use of a hydrogen blend of up to 20% by volume, with higher shares assessed only at a conceptual level. Consider space for later hydrogen retrofit. Define minimum requirements for hydrogen readiness of the CHP plant.
- Assess technical feasibility and conditions for hydrogen blending in the CHP plant (blending ratios, material compatibility, burner adaptation, safety systems).
- Describe the technical requirements for black start.
- Describe the technical requirements for electrical grid support.
- Plan for keeping warm and auxiliary electrical supply during standstill period.

- Benchmark the proposed configuration against at least three comparable recently commissioned gas CHP projects in Europe.

Task A-5: Natural Gas Supply Assessment

- Review existing gas infrastructure in North Macedonia and the Bitola region (national transmission system, existing pipelines, proximity to the potential project site, identification of the nearest feasible connection point, required extensions or upgrades).
- Assess planned gas interconnectors relevant to North Macedonia and their expected commissioning timelines.
- Determine the need for additional gas supply pipelines to ensure security of supply.
- Identify and evaluate all technically feasible alternatives for long-term natural gas supply to the CHP plant, including gas price forecast scenarios.
- Assess reliability and diversification of supply alternatives over a 20-year horizon; define supply scenarios (base, stress, supply disruption).
- Specify required gas connection infrastructure: Measuring and Regulation Station (MRS) parameters, required inlet pressure, and required capacity (Nm^3/h) for the preferred plant variant.
- Specify the gas supply pressure the CHP can expect.
- Develop gas price projections for the planning period (three scenarios aligned with IEA and EC published outlooks).
- Provide a brief summary of the regulatory and institutional framework governing gas supply and licensing with support of ESM.
- Identify and evaluate potential risks (supply disruption, infrastructure delays, price volatility, regulatory changes) and provide mitigation strategies.

Task A-6: International Best Practices Review (CHP)

- Review and document international best practices in CHP project development relevant to the Bitola context: technology selection and major equipment procurement; CHP integration with DH networks; EPC contracting strategies and risk allocation; Cost-Benefit Analysis methodologies; and risk management frameworks.
- Identify specific practices and contractual provisions that ESM should adopt to optimize the risk profile and cost-effectiveness of the project.
- Propose a recommended EPC contract strategy for the project, with rationale.

Task A-7: Environmental and Social Screening (World Bank ESF)

The E&S screening must be conducted in accordance with the World Bank ESF (ESS1–ESS10 as applicable). Task A-7 represents a conceptual-level screening, the sole purpose of which is to (a) determine the likely ESF risk classification of the project and (b) define the scope of the full ESIA to be conducted under a separate contract. It does not replace or overlap with the separate ESIA/ESF contract that will produce a full ESIA, ESMP, SEP, RPF, RAPs where applicable, and Labor Management Procedures. All findings and assumptions shall be structured to facilitate continuation under the separate ESIA/ESF contract.

- Conduct an E&S scoping in accordance with World Bank ESF (ESS1–ESS10 as applicable) and applicable EU Directives, identifying key environmental and social risks and impacts.
- Assess compliance obligations under EU IED 2010/75/EU and applicable BAT Conclusions for Large Combustion Plants, and Energy Community environmental obligations.
- Assess applicability of relevant World Bank Environmental and Social Standards (ESS1, ESS2, ESS3, ESS4, ESS5, ESS6, ESS10).
- Quantify projected air emissions (NOx, CO□, SO□, PM) and compare against IED emission limit values and BAT-AELs.

- Conduct a CIBAM (Cumulative Impact and Benefits Assessment Matrix) screening identifying cumulative impacts alongside other planned developments in the Bitola region, including the DH network expansion.
- Recommend an ESF risk classification for the project (High / Substantial / Moderate / Low) with justification.
- Define the scope of the full ESIA required for permitting and World Bank appraisal; provide a preliminary list of studies, surveys, and consultations.
- Outline the permitting pathway and estimated timeline for all required authorizations.
- Assess the impact of the CBAM (Carbon Border Adjustment Mechanism).

Task A-8: Contribute to the Risk Assessment (CHP)

- Contribute to the project risk assessment in at least two risk assessment workshops (political and regulatory risk; natural gas supply risk; construction risk - CAPEX overrun, schedule delay, contractor performance; market and offtake risk; technical and performance risk; environmental and social risk; and geopolitical risk).

Task A-9: Reflect Information from the Early Market Engagement in Feasibility Study and Basic Engineering Design

ESM will carry out early market engagement (EME) before and during the preparation of the Feasibility Study to proactively interact with prospective suppliers, with the objective to communicate the technical requirements, understand market capacity and trends, and identify the optimal procurement strategy. After the completion of the EME process, ESM will share with the Consultant the information and comments received, and the Consultant will carry out the following activities:

- Analysis of all information received, comments and recommendations from economic operators and other participants in the EME process.
- Preparation of a report with an assessment of the results of the EME, identified technical, commercial and market aspects, as well as their impact on the project.
- If needed, updating of the technical assumptions, parameters and solutions in the Feasibility Study in accordance with the results of the EME.
- Updating the technical specifications and recommendations for the procurement of the main equipment for the gas power plants, taking into account market opportunities, available technologies and information received.
- Revising the estimated investment costs (CAPEX), operating costs (OPEX), the timeframe for implementation and the risk analysis, if the results of the EME indicate a need for this.
- Updating the economic and financial analysis, if the changed technical and commercial parameters have an impact on the results.
- Preparing a final revised version of the Feasibility Study, which will incorporate all relevant results and recommendations from the EME process, and presentation of the Feasibility Study to ESM.

Task A-10: Time Schedule

- Define and describe a realistic detailed time schedule for implementation of the proposed investments, including timeframes for preparation of technical specifications, design, manufacturing, construction/installation, and commissioning.
- Prepare a Gantt chart for all project phases and main activities: project preparation and permitting; procurement; detailed engineering; manufacturing and delivery; civil works and installation; commissioning and testing; and Commercial Operations Date (COD).
- Identify project milestones like ToR finalization and consultant mobilization; ESM tender decision; EPC/lot tender launch; ESM investment decision; EPC/lot contract award; Financial Close; First Fire; Synchronization to grid; and COD.
- Show the critical path in the time schedule and the float of each activity.

- Identify all interdependencies between decision taking, procurement, permitting, engineering, and financing activities. Clearly define the interface between the Basic Design (Task A-12) and the subsequent EPC or lot-based tender preparation, specifying which Task A-12 deliverables are prerequisite inputs to the tender package.

Task A-11: Basic Engineering Design

Building on the findings of the Feasibility Study, the Basic Engineering phase constitutes the next stage of project development for the Bitola CHP. The Basic Design shall produce all technical documentation required to: (i) form the basis for EPC or lot-based tender packages; (ii) support permit applications; and (iii) enable the transition to Detailed Engineering. Annex 2 describes the deliverables related to this task in more detail.

The Consultant shall develop a comprehensive, high-performance plant design, including:

- Thermal flow diagrams, load case tables, component lists, and site layout plans.
- Technical integration with the electricity grid, gas network, and DH network.
- Provisions for future hydrogen co-firing capability.
- Compliance with applicable environmental, fire safety, explosion protection, and occupational health regulations.
- A cross-disciplinary CAPEX estimate benchmarked against at least three comparable realized projects factoring in price increases.

General Services

- Project Management: establishing a Document Management System (DMS) and submitting a project schedule (bar chart in MS Project) within four weeks of commissioning.
- Meetings: organizing bi-weekly progress meetings with ESM and relevant authorities, and conducting a mandatory two-day kick-off workshop.
- Quality Assurance: performing internal quality checks and adhering to ESM's planning and execution guidelines. Applying the KKS power plant identification system across all documentation.
- 3D Modelling: developing a 3D model of the plant up to defined interface boundaries.

Technical Disciplines

The Consultant shall produce engineering documentation across the following disciplines:

- Process and Mechanical Engineering: load case table, heat balance diagrams for all load cases and process flow diagrams (PFDs); equipment dimensions and load specifications; a provisional system list identifying all main and auxiliary systems; and provisions for future hydrogen co-firing capability.
- Electrical Engineering: single-line diagrams for main and auxiliary power supply; grid connection concept; black start concept; and earthing and lightning protection concepts.
- Instrumentation and Control (I&C): Distributed Control System (DCS) architecture and control room concept; automation, redundancy, and maintenance concepts; IT security and cybersecurity concept; and emissions monitoring concept.
- Civil and Layout: site layout plans covering underground facilities, emission sources, cable and pipe routing, and rescue and escape routes; soil investigation; architectural concepts; building plans; and structural load calculations.
- Building Services: HVAC, plumbing, drainage, and fire-fighting water concepts.
- Communications and Safety: fire and gas alarm systems; access control; video surveillance; explosion protection zone plans; and occupational health and safety requirements.
- Cost Estimate: Providing a cross-disciplinary capital cost estimate (CAPEX), with annual cost allocation across the construction period and a clearly documented contingency provision.

PART B: DISTRICT HEATING NETWORK FEASIBILITY STUDY AND TECHNICAL DESIGN

A recently completed investment has installed a DH transmission pipeline from the coal-fired Bitola TPP to the Bitola region with a capacity of 100 MWth. Several consumers, mostly public buildings, have been connected to the DH distribution network with an estimated consumption capacity of about 36 MWth. This is expected to start operating in the heating season 2027/2028.

Task B-1: Review of Existing Documentation and Heat Demand Findings from Task A-2, and Confirm Scope

- Review relevant documentation on the existing DH system and expansions plans in the Bitola region and provide a summary.
- Systematically review all heat demand analysis outputs produced under Task A-2, including heat consumption data, demand projections, climatic data, existing network assessment, and integration assumptions.
- Identify data gaps, methodological limitations, or scope clarifications required before commencing the full DH feasibility study.
- Confirm, and describe in the inception report, the agreed study boundary, list of consumer categories, network segments to be included, and the work plan for Part B.
- Establish a data-sharing protocol to ensure consistent assumptions across the two Parts of this Contract and the separate ESIA/ESF contract.

Task B-2: Heat Demand Assessment and Demand Projections

The heat demand assessment shall cover all existing and potential consumers in the Bitola municipal area, including those not currently connected to the DH network. It shall extend and validate the preliminary assessment from Task A-2, not duplicate it. Primary data collection shall be conducted where Task A-2 data is insufficient.

- Develop a methodology for heat demand assessment and demand projections
- Conduct a heat demand survey covering (potential) DH consumers (residential, commercial, public, industrial) within the existing DH network and the proposed expansion area.
- Characterize the existing building stock into heat demand categories based on, e.g., construction period, building type, insulation standards, and renovation potential under national building renovation programs.
- Develop heat demand projections for the planning period (2027–2050) under three scenarios (low / base / high), incorporating energy efficiency improvements, building renovation trends, population and economic growth forecasts, and the planned coal phase-out.
- Assess competing heating options, including heat pumps and biomass. Analyze current heating systems used by buildings that would switch to DH. Analyze demand for domestic hot water.
- Provide a detailed climatic characterization: heating degree days (HDD), design outdoor temperatures, seasonal load duration curves, and peak load estimates.
- Define and map areas where DH is feasible and has potential to expand the consumer base, and map areas suitable for individual heating.
- Quantify the thermal power range to be supplied by the CHP plant for each scenario and network configuration variant.
- Assess and recommend demand stimulation measures (e.g., connection subsidies, preferential tariffs, co-financing of internal installations) and their impact on demand uptake and project economics.

Task B-3: Network Expansion Scenarios and Routing Analysis

The Consultant shall develop and evaluate a minimum of three network expansion scenarios of varying ambition (conservative, base, ambitious) and, within each scenario, assess a minimum of two routing alternatives for new primary pipelines. The preferred scenario and routing shall be recommended based on a multi-criteria analysis documented in the deliverables.

- Define the study area boundary and identify all candidate consumer zones for DH network extension, prioritized by heat density, proximity to existing infrastructure, and connection feasibility.
- For each scenario, define: target consumer connections; new primary and secondary pipeline length and diameter; required heat substation upgrades and additions; and the phasing program (up to 2050).
- For each candidate routing, assess: alignment with existing infrastructure corridors; land ownership and right-of-way requirements; construction constraints (road crossings, railway crossings, archaeological zones); urban planning restrictions; heat loss profile and hydraulic performance; and estimated construction cost.
- Conduct essential field research for all feasible routes and document findings with photographs and GIS mapping.
- Recommend the preferred expansion scenario and routing with a clear, documented rationale; define the preferred phasing program.
- Assess and recommend options for apartment-level metering and billing.

Task B-4: Technical Design of the Preferred DH Network Expansion

The technical design shall be at feasibility level (Class 4, concept screening accuracy ±20–30%), sufficient to underpin the financial model, procurement readiness, and ESIA boundary confirmation for the separate ESIA/ESF contract. It does not constitute detailed engineering design.

- Prepare a hydraulic analysis and design for the preferred network expansion, including: pipe sizing for primary and secondary networks; operating pressure and temperature parameters; flow rates per network segment; and pump station sizing and locations.
- Specify the pipeline technology: pre-insulated steel pipes in accordance with EN 253 standards; define insulation class, pipe series, and joint requirements.
- Design heat transfer stations (substations) for new consumer connections: indirect connection via plate heat exchangers; control and metering requirements; and connection to existing building heating systems.
- Specify the heat metering and remote monitoring infrastructure, including smart metering requirements and SCADA integration.
- Design the CHP plant heat connection pipeline: routing from CHP plant boundary to DH primary network; required parameters (pressure, temperature, flow); and hydraulic integration with existing heat sources.
- Prepare a Bill of Quantities (BoQ) for the preferred scenario, broken down by network segment, pipe diameter class, substation type, and civil works category.
- Develop a construction methodology and phasing plan, including traffic management, trench restoration, and coordination with other utilities.
- Prepare GIS-based technical drawings for all network components (A1 format), including plan view, longitudinal profiles for key routes, and substation layouts.

Task C-1: Economic and Financial Evaluation (CHP)

C-1.1 Capital Cost Estimation (CAPEX)

- Develop a Class 4 (concept screening) CAPEX estimate for CHP and for the preferred DH network expansion. For the CHP, broken down by: main process equipment; civil works; electrical works and instrumentation; grid connection; gas connection and infrastructure; water supply and wastewater; connection to the DH System Bitola transmission pipelines; EPC

costs; owner's costs; environmental and social management costs; and contingencies. For the DH expansion, broken down by: primary network pipelines (by diameter class and route); secondary network; heat substations; metering infrastructure; CHP connection pipeline; civil and reinstatement works; project management and supervision; and contingency

- State all assumptions, unit cost benchmarks, and the accuracy range of the estimate (expected: ±30%).
- Compare cost estimate to three recently realised comparable projects in Europe.

C-1.2 Operating Cost Estimation (OPEX)

- Develop an annual OPEX model covering: fuel costs; electricity consumption for pumping, fixed and variable O&M; staffing; insurance; water and consumables; carbon costs; waste management; metering/billing costs, and administrative costs.
- Assess the implications of transport tariffs and balancing costs for gas and electricity; and system reserve and system services for heating.

C-1.3 Revenue Model

- Model annual revenues from electricity sales and heat sales for each operational scenario. Calculate LCoE and LCoH, where applicable.
- Assess the applicable DH tariff structure in Bitola and evaluate cost-recovery adequacy.

C-1.4 Economic and Financial Model (World Bank Standards)

- Assess the current financial capacities of ESM to support operations of the proposed CHP and finance the project, including analysis of ESM's annual budget for the past three years and debt profile.
- Develop a detailed, dynamic financial model in Microsoft Excel covering the full project life (30 years post-COD), including: annual cash flows; financing structure; applicable taxes and depreciation; NPV; IRR (project and equity); DSCR; and payback period.
- The economic analysis shall follow World Bank guidelines, including preparation of an Economic Rate of Return (ERR in addition to the Financial IRR). Quantify CO_2 emission reductions attributable to the DH network expansion (displacement of individual coal, gas, and electric heating) for each scenario and planning horizon. Quantify local air quality improvements ($PM_{2,5}$, PM_{10}, NOx, SO_2) resulting from the replacement of individual combustion heating with CHP district heat, including health impact valuation where feasible.
- Run the model for three scenarios (base, optimistic, pessimistic) with sensitivity analysis for, inter alia, varying gas price, electricity price, CAPEX, carbon price (EU ETS forward curves, World Bank shadow price, IEA projections, CBAM), and capacity factor.
- Assess project bankability under conditions satisfying appropriate DSCR and debt tenor.

4. DELIVERABLES AND REPORTING SCHEDULE

The Consultant shall produce the following deliverables. All deliverables shall be submitted in English in editable formats (MS Word / MS Excel). The final deliverables, after acceptance by ESM, shall be translated to Macedonian and submitted in PDF format. A printed and bound hard copy (x2) shall be provided for deliverables D-A8, D-A10, D-B7, and D-B9. **At the deadline, the documents must be quality-assured and agreed with ESM.**

Part A Deliverables: CHP Feasibility Study and Basic Engineering Design

No.	Deliverable	Task(s)	Format	Deadline (weeks from NTP)
D-A1	Inception Report (CHP): work plan, data gaps,	All A tasks	PDF+DOCX	Week 3

	methodology confirmation			
D-A2	Power System & Market Analysis Report	A-1	PDF+DOCX	Week 6
D-A3	Heat Demand & DH Integration Report	A-2	PDF+DOCX	Week 7
D-A4	Site Evaluation Report (incl. recommended site)	A-3	PDF+DOCX+GIS	Week 4
D-A5	Technology Selection & Plant Configuration Report	A-4	PDF+DOCX	Week 8
D-A6	Natural Gas Supply Assessment Report	A-5	PDF+DOCX	Week 12
D-A7	Draft CHP Feasibility Study (all Part A tasks integrated)	All A	PDF+DOCX+x2 bound	Week 17
D-A8	Comments Response Matrix – CHP Feasibility Study	All A	PDF+DOCX	Week 19
D-A9	Report on the results of the EME, including overview of information received and the manner of their consideration	A-9	PDF+DOCX	Week 19
D-A10	Final CHP Feasibility Study Report	All A	PDF+DOCX+x2 bound	Week 20
D-A11	Executive Summary Presentation – CHP (Board-level)	All A	PPTX+PDF	Week 20
D-A12	Time Schedule (Gantt Chart)	A-10	MSP+PDF	Week 20
D-A13	Basic Engineering Design Package (all disciplines)	A-11	PDF+DWG+native	Week 20

Part B Deliverables: DH Network Feasibility Study and Technical Design

No.	Deliverable	Task(s)	Format	Deadline (weeks from NTP)

D-B1	Inception Report (DH): scope confirmation, data gaps, methodology, coordination protocol with Part A and part B	B-1	PDF+DOCX	Week 3
D-B2	Heat Demand Assessment Report: validated demand data, survey results, demand projections (3 scenarios)	B-2	PDF+DOCX	Week 7
D-B3	Network Expansion Scenarios and Routing Analysis Report (incl. recommended scenario and routing)	B-3	PDF+DOCX+GIS	Week 10
D-B4	Technical Design Report for Preferred Scenario (hydraulic design, technical specs, BoQ, GIS drawings)	B-4	PDF+DOCX+GIS	Week 14
D-B5	Draft DH Feasibility Study (all Part B tasks integrated, incl. institutional assessment and risk register)	All B	PDF+DOCX+x2 bound	Week 17
D-B6	Comments Response Matrix – DH Feasibility Study	All B	PDF+DOCX	Week 19
D-B7	Final DH Feasibility Study Report	All B	PDF+DOCX+x2 bound	Week 20
D-B8	Executive Summary Presentation – DH (Board-level)	All B	PPTX+PDF	Week 20

Part C Deliverables: CHP and DH Network

D-C1	Financial Model (working Excel file) and Summary	C-1	XLSX+DOCX+PDF	Week 14

NTP = Notice to Proceed (date of contract signature). ESM will circulate D-A8 and D-B7 to the World Bank Task Team for parallel review. ESM and the World Bank will provide consolidated review comments within 10 business days of receipt of each draft. The Consultant must incorporate all comments in the final reports; unresolved comments shall be documented in the respective Response Matrices. The Consultant shall formally transmit the preferred DH alignment documentation from D-B4 to the MK-ESM-563436-CS-QCBS Consultant as a trigger for ESIA boundary confirmation.

5. KEY EXPERT REQUIREMENTS

The Consultant shall provide adequate staff in terms of expertise and time allocation, [as well as the equipment needed] to complete the activities required under the scope of work and to finally achieve the objectives of the project in terms of time, costs, and quality.

The numbers and person-months for all staff shall be included in the technical proposal and the costs in respect of these personnel are to be included in the financial proposal.

Proposal of organizational and functional schedule of the Consultant, i.e., Consultant's team composition and planning of number of people per positions, is a subject of the Consultant's Proposal.

Company profile and qualification criteria:

To the assignment a team of experts with relevant experience and qualifications in their subject area as indicated further below can be engaged as a Consulting Firm. The Consulting firm may associate with other Consulting firm(s) in the form of a joint venture or of a sub-consultancy to complement their respective areas of expertise, strengthen the technical responsiveness of their proposal, and avail themselves to a broader pool of experts.

The qualification requirements of the Consulting firm are summarized as follows. The Consultant shall be a firm or a group of firms with the following qualifications:

General Qualifications:

- At least 10 years of experience in engineering and consulting services. As a proof of compliance, the consultant shall provide a copy of valid business license from country of origin (if such activity is subject to licensing in the consultant's country) and copy of the registration certificate (issued not earlier than 2 years prior to the proposal submission deadline);
- At least 50% of the key experts must have employment status with the Consulting firm for more than five (5) years. As a proof of compliance with this requirement the consultant shall provide a signed and stamped staffing table;
- The average annual turnover of the consultant must be at least EUR 500.000 equivalents in the last 5 (five) years (Year 2020 until Year 2025). As a proof of compliance with this requirement, the consultant shall provide audited balance sheets, audited income statements, cash flow statements or verified financial statements covering the required period.

Specific Qualifications relevant for the assignment:

- At least two (2) completed assignments for preparation and submission of a Feasibility Study for CHP or CCHP plant with a minimum installed capacity of 150MW, or equivalent projects financed by an International Financial Institution (IFI), such as a completed assignment for preparation and submission of a Feasibility Study for conversion of old power plant (coal or HFO) to Combined gas power plant with minimum installed capacity of 150MW as a Project Leader or a member of a Joint Venture (JV) with a minimum participation of 60% during the last ten (10) years starting 1 January 2016 and the deadline for submission of proposal, evidenced by signed and stamped references from the previous clients/employers;
- Regional experience in the SEE and Western Balkans, in terms of minimum one (1) completed assignment for preparation of a Feasibility study for CHP or CCHP plant with a minimum installed capacity of 100MW, evidenced by signed and stamped references from the previous clients/employers.

It is required to provide examples of assignments of similar nature. Similarity is based on the scope, nature, and value of the assignment. The credibility of the specific experience shall be presented in a reference list with description of services provided including information on contract value, contracting entity/client, project location, period of providing the services, value of investment, percentage carried out by consultant in case of association of firms or subcontracting and main activities.

In accordance with World Bank QCBS (Quality and Cost Based Selection) procedures, the Consultant must propose a team of Key Experts (KEs) with qualifications adequate for the complexity of this assignment. The following minimum qualifications are mandatory eligibility requirements. Consultants may propose sub-consultants or form joint ventures/consortia to strengthen their team.

Key Experts are defined as professionals whose skills, qualifications, knowledge, and experience are critical to the performance of the assignment. Their CVs shall be evaluated as part of the technical proposal. Key Experts may not be substituted after contract award except in cases of force majeure and only with the Client's and World Bank's prior written approval.

5 Key Experts

Position	Minimum Qualifications (Mandatory)	Indicators for Technical Scoring
KE-1 Team Leader / Project Manager for Part 1 and 2	Advanced university degree in engineering, energy systems, economics, or related field. Minimum 15 years of professional experience in energy projects. Minimum 3 assignments as Team Leader for feasibility studies of power plants ≥ 100 MW (at least 1 CCGT/CHP) in the last 12 years.	Number of CCGT feasibility studies led.
KE-2 Senior Mechanical / Process Engineer	University degree in mechanical or electrical engineering. Minimum 10 years of experience in CCGT/CHP power plant design, engineering, or feasibility. Minimum 2 completed CCGT/CHP projects ≥ 100 MW in a technical/engineering role in the last 10 years.	Number of CCGT projects as lead engineer. Experience with CHP / DH integration.
KE-3 Electricity Market Analyst	University degree in economics, finance, electrical engineering, or energy studies. Min. 8 years of experience in electricity market analysis and forecasting. Min. 2 electricity market or power system studies for SEE markets in the last 8 years.	Number of electricity market or power system studies for SEE markets.
KE-4 Financial and Economic Modelling Expert	University degree in finance, economics, or related field. Minimum 10 years of experience in financial modelling for energy or infrastructure projects. Minimum 2 bankable financial models for power generation projects ≥ EUR 100 million in the last 8 years. Experience with financial models used in World Bank, EBRD, EIB, or other IFI financed projects.	Professional qualification (CFA, ACCA, or equivalent). CCGT-specific financial modelling experience.
KE-5 Environmental Specialist	University degree in environmental science, engineering, or related field. Min. 7 years of experience in E&S impact assessment for industrial/energy projects. Min. 2 completed EIA/ESIA studies for thermal power plants in the last 8 years. Demonstrated familiarity with World Bank ESF and IFC Performance Standards.	ESIA studies conducted under World Bank ESF or IFC PS. Experience with permitting in Western Balkans. Professional EIA accreditation or certification.

KE-6 Senior Electrical Engineer (Basic Engineering)	University degree in electrical engineering. Min. 10 years of experience in electrical engineering for power generation facilities. Min. 2 completed assignments on CCGT/thermal plants above 100 MW covering HV/MV single-line design, grid connection studies, and earthing/lightning protection design.	Experience with transmission grid connection requirements. Experience with auxiliary power supply design for combined heat and power facilities.
KE-7 Senior I&C / Automation Engineer (Basic Engineering)	University degree in electrical engineering. Min. 10 years of experience in I&C and automation engineering for thermal power plants. Min. 2 completed assignments on CCGT or large industrial plants covering DCS architecture design and cybersecurity provisions.	Experience with the major DCS platform. Experience with integration of plant monitoring and continuous emissions monitoring system (CEMS) into the DCS architecture. Knowledge of IEC 62443 or equivalent industrial cybersecurity standards.
KE-8 Senior Civil / Structural Engineer (Basic Engineering)	University degree in civil or structural engineering. Min. 10 years of experience in civil and structural engineering for industrial or power generation facilities. Min. 2 completed assignments on thermal power plants or large industrial facilities covering site layout, structural load calculations, and foundation design.	Experience with civil design for CCGT or gas-fired plants in European markets.
KE-9 District Heating Expert	University degree in mechanical or thermal energy engineering. Min. 10 years of relevant experience in DH project development or engineering. Min. 3 completed DH feasibility studies or network expansion projects.	Number of DH feasibility studies led. Experience in CHP-DH integration projects. Chartered engineer or professional certification.
KE-10 Heat Demand Expert	University degree in economics, statistics, energy engineering, or related field. Min. 5 years of professional experience in a relevant field. At least 3 completed heat demand analyses or DH tariff assessments in the last 10 years.	Experience with household surveys on heating. DH tariff reform experience in transition economies. Proficiency in demand forecasting tools and models.

7. CONTRACT TYPE AND PAYMENT ARRANGEMENTS

The assignment will be contracted under the World Bank Standard Form of Contract for the Selection of Consultants (Lump-Sum remuneration), included in the Standard Request for Proposals (SRFP) for the Selection of Consultants

7.1 Contract Duration

The contract is expected to be implemented during January 15, 2027 and September 30, 2027. The NTP date is the date on which the signed contract.

7.2 Confidentiality and Intellectual Property

All data, information, reports, models, and drawings produced under this assignment are the exclusive property of ESM upon final payment. The Consultant shall sign a Non-Disclosure Agreement (NDA) at contract signature. The Consultant may not reference the project or ESM in any marketing materials without prior written consent.

7.3 Key Expert Availability and Substitution

Key Experts committed in the proposal may not be substituted during the assignment except in cases of force majeure (illness, resignation, death). Any proposed substitution must be approved in writing by ESM. The replacement must meet or exceed the qualifications of the original expert. Unauthorized substitution may result in contract suspension or termination.