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Terms of Reference
for
Assessing Wind Energy Potential for WASH (WEP-WASH) in Yemen

LOCATION/DURATION

Duration:	3 months
Location:	Yemen Country Office WASH Section
Estimated Start Date:	October 2023
Estimated end Date:	December 2023
Reporting to:	Chief of WASH/WASH Specialist

Background

Over 17.8 million people lack access to basic WASH services in Yemen putting them at heightened risk of water borne diseases, malnutrition and other life-threatening conditions. It is estimated that some 29 per cent of people internally displaced in Yemen do not have access to safe drinking water and 47 per cent do not have sanitation facilities. UNICEF collaborates with the Ministry of Water and Environment in Yemen providing technical and financial support to Local Water and Sanitation Corporations (LWSC) aimed at ensuring sustainable access to at least basic water services by women and children in IDPs, urban and rural areas. This hasn`t been easy due to the internal conflict for the past 8 years which has led to the destruction of WASH infrastructure and energy sources. As such UNICEF has been providing fuel to operate water supply systems, construction and rehabilitation of water supply systems. Recognizing the need for sustainability and to reduce reliance on fossil fuels, UNICEF and the government jointly established a committee tasked with developing a fuel exit strategy. This committee conducted comprehensive technical assessments of 23 local water and sanitation councils, evaluating their capacity to operate and maintain water supply systems, their technical proficiency, the feasibility of sustainable water tariffs, and energy consumption patterns. The committee's findings strongly recommended the integration of renewable energy sources, such as solar and wind energy, to complement existing electricity and diesel fuel sources. According to the mapping and WASH projects database updating project aimed at assessing operational capacities of rural water supply projects conducted by the General Authority for Rural Water Projects (GARWP), 24% of the 4390 water supply systems visited were not operational. One of the many reasons was lack of fuel and capacity to pay for electricity. As such, UNICEF has already started the installation of large-scale solar systems on some water supply schemes. However, UNICEF is still providing significant financial support to LWSCs for fuel hence the desire to explore the possibility of using wind energy to complement the existing energy sources. Yemen is blessed with a geographical location that offers high wind speeds, especially in its coastal regions. According to a study by the World Bank, Yemen has a wind power potential of approximately 40 gigawatts (GW), enough to power the entire country and still have surplus energy for export yet, this vast potential remains largely untapped, with wind power currently accounting for a negligible portion of Yemen's energy mix. UNICEF strongly believes that investing in wind energy is cost effective, reduces environmental pollution from the use of fossil fuels and has the potential to stimulate the economy by attracting direct foreign investment. As a first step, UNICEF wishes to conduct a detailed analysis of the wind energy potential in Yemen with a focus on powering Water, Sanitation, and Hygiene (WASH) systems.

Objectives of the assignment

The primary objective of this project is to conduct a detailed analysis of the wind energy potential in Yemen with a focus on powering Water, Sanitation, and Hygiene (WASH) systems. Specifically, the project aims:

- To conduct a comprehensive analysis of energy requirements for diverse water supply systems in Yemen, including rural, peri-urban, urban, IDP camps, schools, and healthcare facilities, by evaluating current energy sources, identifying challenges and gaps, and determining the potential for integrating wind energy to enhance sustainability.
- To perform a detailed feasibility study assessing the availability of wind resources in the identified target areas within Yemen, utilizing an extensive review of existing research and analyses conducted by academic institutions, government departments, development organizations, international financial institutions, and UN agencies, with a focus on suitability for powering WASH systems.
- To propose and outline appropriate wind energy technologies, such as wind water pumps and wind energy generators (WEG), customized for the diverse settings mentioned above, offering detailed specifications including power capacity, physical dimensions, and layout plans to ensure efficient integration within each context.
- To assess the financial and technical resources required for the project, encompassing a thorough analysis of costs related to wind turbine procurement, installation, ongoing maintenance, and operational expenses, with the goal of providing a clear financial framework for the successful implementation of wind energy solutions in support of water supply systems across Yemen.
- To evaluate the current wind energy regulatory framework and the potential for public-private partnerships (PPPs) in implementing wind energy projects in Yemen. This will consider the roles and responsibilities of each party, financing models, and risk-sharing mechanisms.

Justification

UNICEF and the MoWE established a Joint Technical Team that recommended the use of renewable energy sources, such as solar and wind energy, to complement existing electricity and diesel fuel sources as part of the fuel exit strategy. As such, UNICEF has already started the installation of large-scale solar systems on some water supply schemes. However, UNICEF is still providing significant financial support to LCWS for fuel hence the desire to explore the possibility of using wind energy to complement the existing energy sources. As a first step, UNICEF wishes to conduct a detailed analysis of the wind energy potential in Yemen with a focus on powering Water, Sanitation, and Hygiene (WASH) systems. This requires someone with:

- Skills and in-depth knowledge of renewable energy technologies, with a specific focus on wind energy systems used in water supply applications.
- Expertise in wind resource assessment and wind turbine technology, including the ability to evaluate wind speed data and understand wind patterns in Yemen.

- Strong data analysis skills to process and interpret wind speed, wind direction, and other relevant meteorological data for wind energy potential assessment.
- Experience in evaluating the technical feasibility and suitability of wind energy solutions, including wind turbine selection and sizing for specific applications.
- Proficiency in conducting energy system assessments, including load profiling and energy consumption analysis for different water supply systems (rural, peri-urban, urban, etc.).

All the above highlighted skills are not currently available within the Yemen WASH team, hence the neat for external support.

Specific Tasks – Position Description

Overall, the Wind Energy Expert (WEE) from the SBP will conduct a detailed analysis of the wind energy potential in Yemen with a focus on powering Water, Sanitation, and Hygiene (WASH) systems. Specifically, the WEE will:

- Analyze the energy requirements of various water supply systems in different settings (rural, peri-urban, urban, IDP camps, schools, and healthcare facilities), considering current energy resources, challenges, gaps, and the potential to complement them with wind energy.
- Conduct a feasibility study to assess the availability of wind resources in the identified target areas, including a review of existing research and analyses conducted by academic institutions, government departments (e.g., Ministry of Energy), development organizations, international financial institutions (e.g., World Bank), and other UN agencies.
- Propose suitable wind energy technologies, such as wind water pumps or wind energy generators (WEG), for the different settings mentioned above. This includes detailed specifications regarding power capacity, size, and layout plans.
- Assess the funding and technical resources required for the project, including the cost of wind turbines, installation, maintenance, and operational expenses.
- Recommend optimal energy hybrid systems for various settings, considering cost-effectiveness, value for money, and overall efficiency. This will involve an evaluation of wind, solar, and diesel-powered systems.
- Explore the potential for public private partnerships between ministry of water and local/international private wind energy companies
- Review the current energy regulations/policies in Yemen identifying any barriers or support mechanisms for the adoption and use of wind energy, with a focus on key areas for advocacy with the government.
- Assess the potential for public-private partnerships (PPPs) in implementing wind energy projects in Yemen. This will consider the roles and responsibilities of each party, financing models, and risk-sharing mechanisms.

Deliverables

- **Deliverable 1: Wind Energy Feasibility Study Report**
  This report will present the findings of the detailed feasibility study assessing the availability of wind resources in target areas within Yemen. It will include an extensive review of existing research and analyses conducted by academic institutions, government departments, development organizations, international financial institutions, and UN

agencies. The report will focus on the suitability of these wind resources for powering WASH systems.

- **Deliverable 2: Energy Requirements Analysis Report**
  This report will include a detailed analysis of average energy requirements for various water supply systems in Yemen, covering rural, peri-urban, urban, IDP camps, schools, and healthcare facilities. It will identify the current energy sources, assess challenges and gaps, and provide recommendations on where integration of wind energy makes financial sense and is possible.
- **Deliverable 3: Wind Energy Technology Proposal**
  This deliverable will consist of a proposal outlining appropriate wind energy technologies, such as wind water pumps and wind energy generators (WEG), customized for various agreed settings in Yemen, including rural, peri-urban, urban, IDP camps, schools, and healthcare facilities. The proposal will provide detailed specifications, including power capacity, physical dimensions, and layout plans to ensure efficient integration within each context.
- **Deliverable 4: Financial and Technical Resource Assessment Report**
  This report will assess the financial and technical resources required for the project. It will encompass a thorough analysis of costs associated with wind turbine procurement, installation, ongoing maintenance, and operational expenses. The report will aim to provide a clear financial framework for the successful implementation of wind energy solutions to support water supply systems across Yemen.
- **Deliverable 5: Wind Energy Enabling Environment Assessment Report**
  This comprehensive report will provide an in-depth analysis of the enabling environment for wind energy adoption in Yemen, with a particular focus on government policies and regulatory frameworks. This will involve a detailed examination of existing government policies, regulations, and incentives related to wind energy adoption in Yemen, covering aspects such as licensing, permits, tariffs, and incentives for renewable energy projects. The report to also highlight the public private partnership potential for sustainability.

Expected background, Experience and competencies

To be able to conduct a comprehensive analysis and assessment of wind energy potential for powering water supply systems in Yemen, the WEE should possess the following technical skills, expertise, and experience. Here are the key qualifications and competencies required:

- **Wind Energy Specialization and renewable energy expertise:** Expertise in wind resource assessment and wind turbine technology for use in WASH, including the ability to evaluate wind speed data and understand wind patterns in Yemen.
- **Technical Assessments and energy system analysis proficiency:** Experience in evaluating the technical feasibility and suitability of wind energy solutions, including wind turbine selection and sizing for specific applications.
- **Data Analysis Skills:** Strong data analysis skills to process and interpret wind speed, wind direction, and other relevant meteorological data for wind energy potential assessment.
- **Knowledgeable about Hybrid Energy System Integration:** Knowledge of integrating wind energy with existing energy systems, including solar, diesel generators, and electricity grids, to create efficient hybrid systems.

- **Policy and Regulatory Knowledge:** Familiarity with the regulatory environment for renewable energy projects in Yemen, including understanding policies and incentives related to wind energy adoption.
- **Competent in conducting Environmental Impact Assessments:** Ability to conduct on-site assessments to identify suitable locations for wind energy installations, considering terrain, accessibility, and proximity to water sources and capacity to conduct environmental impact assessment of wind energy projects, including potential effects on local ecosystems and communities.
- **Project Management:** Project management skills to plan, coordinate, and execute the assessment project, including budgeting and timeline management.
- **Report Writing and Communication:** Strong communication skills, both written and verbal, to prepare clear and concise reports, present findings, and engage with project partners.

Education:

- The Wind Energy Expert must have a **foundational Bachelor's Degree** in Renewable Energy Engineering, Electrical Engineering, Mechanical Engineering, Environmental Engineering, Energy Engineering,
- Additionally, the WEE must have a **master's degree** in Renewable Energy, Sustainable Energy, Energy Management, Environmental Management or any other related program from a reputable academic institution.
- **Ph.D. (Optional):** While not typically required, a Ph.D. in a relevant field will be an advantage
- **Additional Certifications:** holding relevant certifications from international organisations such as International Renewable Energy Agency (IRENA), or equivalent international bodies is an advantage.

Experiences

- At least 5 years previous experience in conducting wind energy potential assessments for water supply systems or similar projects, particularly in developing countries or conflict-affected regions.
- Knowledge of security protocols and situational awareness, given the geopolitical challenges in Yemen.
- Cultural awareness and sensitivity to effectively work in Yemen and collaborate with diverse communities.
- Experience in interdisciplinary approaches combining technical expertise with an understanding of social, economic, and environmental factors influencing project success.
- Ability to engage with various stakeholders, including government agencies, local communities, and international organizations like UNICEF, to ensure project alignment and support.

Language:

- Excellent communication and interpersonal skills
- Excellent analytical and management skills
- Excellent knowledge in Information Management System related with water resource management
- Fluency in English
- Fluency in Arabic language will be considered as an asset