



## USAID Vietnam Urban Energy Security

### Scope of Work

#### Demonstrating a Harmonic Filter System

#### BACKGROUND

As Vietnam experiences steep increases in energy demand and rising air pollution challenges, there is growing recognition that cleaner, more reliable sources of energy are needed and greater capital investment is necessary. USAID Vietnam Urban Energy Security (the Project) works closely with target cities (*Danang and Ho Chi Minh City - HCMC*) to improve enabling frameworks, mobilize investment, and increase the adoption of innovative solutions for advanced, distributed energy.

The overall goal of the Project is “advanced, distributed energy solutions deployed to improve urban energy resilience and energy security” in Vietnam. At its completion, the Project expects to achieve the following high-level results:

1. At least 400 megawatts (MW) of advanced, distributed energy systems deployed in the selected cities.
2. At least \$600 million in public and private investment mobilized for advanced, distributed urban energy systems.
3. At least 20 innovative solutions to address urban energy and environment issues demonstrated and/or commercialized.

To achieve the third high-level expected result, the Project is implementing a range of activities: innovative pilots/ demonstrations are being funded through a competitive Innovation Challenge Fund (ICF); innovative solutions are being identified and piloted/ demonstrated outside the ICF process through discussions with city-level private and government stakeholders and research by the Project’s technical team; and select innovators will receive tailored support to scale and/ or commercialize.

Innovators registered in Vietnam with solutions in the form of new technologies, practices, and business or financing models are being supported through the above activities. Solutions fall within the following categories: transportation, building efficiency, electricity generation, electricity delivery and management, and water efficiency. They must be piloted/ demonstrated in Danang and/ or HCMC.

#### HARMONIC FILTER SYSTEMS AND DISTRIBUTED ENERGY SOURCES - THE POTENTIAL

In electrical distribution systems, harmonic distortion is a standard voltage and current variation resulting from frequency changes. The presence of harmonics in the power system is not a new issue. However, with the current development of distributed energy resources, particularly inverter equipment, the presence of harmonics in the distribution system is increasing significantly.

The presence of harmonics in the distribution system causes power losses and a negative impact on power quality. Harmonic distortion stresses the electrical network and potentially damages equipment. Harmonics may disrupt normal operation of devices and increase operating costs. Symptoms of problematic harmonic levels include overheating of transformers, motors and cables, thermal tripping of protective devices and logic faults of digital devices.

Total harmonic distortion (THD) is a measurement that indicates how much of the distortion of a voltage or current is due to harmonics in the signal. THD should typically be as low as possible. Circular No. 39/2015/TT-BCT (2015) and 30/2019/TT-BCT (2019) by Vietnam’s Ministry of Industry and Trade (MOIT) requires the following voltage harmonic:

- THD at all medium voltage and low voltage connection node  $\leq 6.5\%$ .

- Single step harmonic distortion  $\leq 3.0\%$ .

Some utility companies in Vietnam impose a Power Factor (PF) penalty. If there are significant non-linear loads in the system such as inverters, rooftop solar (RTS) or other renewable energy sources, the demand for complying with power quality standards can lead to compulsory installation of the harmonic filter.

Harmonic filters are series or parallel resonant circuits designed to shunt or block harmonic currents. They reduce the harmonic currents flowing in the power system from the source and thereby reduce the harmonic voltage distortion in the system.

## **HARMONIC FILTER SYSTEM – THE TECHNOLOGY**

Harmonic filter systems are available and in use in Vietnam, but with the increase in urban distributed energy sources, such as RTS, and the threat of PF penalties, they are not receiving the attention they deserve. The belief is that this innovative solution can reduce harmonics intensified by distributed energy sources and improve power quality, but scaling has been slow because:

- there is a need to demonstrate the solution to assess its performance at a site where power quality is negatively impacted because of distributed energy sources such as RTS.
- There is a need to further document evidence of the solution's costs and benefits at sites negatively impacted because of distributed energy sources.
- There is a need to showcase/ demonstrate and promote the solution for the market.

To support HCMC and Danang achieve their energy efficiency targets using distributed energy, whilst simultaneously offering high quality power to support industry, the Project seeks an offeror to demonstrate this innovative solution in Danang or HCMC (preferably the latter).

## **OBJECTIVES**

The Project seeks a technology developer/ provider to demonstrate a harmonic filter system at a suitable location preferably in HCMC or Danang. The ideal location will:

- be experiencing poor power quality (measured by THD) caused by harmonic distortion from distributed energy sources, namely RTS.
- likely experience improvements in power quality resulting from the installation of a harmonic filter system.
- Be representative of other locations where power quality is negatively impacted by distributed energy sources that are likely to benefit from the solution in future.

The demonstration will be of interest to multiple stakeholders including local government and the private sector e.g. Vietnam Energy, MOIT, Department of Industry and Trade in HCMC and Danang, power consumers etc. The demonstration of the solution aims to:

- demonstrate that the harmonic filter system can improve power quality, negatively impacted by distributed energy sources i.e. RTS.
- demonstrate that the harmonic filter system can help improve protection of equipment.
- demonstrate that the harmonic filter system represents a good investment.
- demonstrate that the harmonic filter system can save energy and reduce emissions.

Performance of the harmonic filter system will be tested. The implementation process, lessons, achievements, and challenges will be documented. The findings will be shared with appropriate stakeholders, including local authorities and potential customers. If the innovation is deemed to be appropriate for scaling and commercialization, then the Project will support this through a separate process.

## ANTICIPATED ACTIVITIES

The selected offeror is expected to carry out the following activities:

- Through desk research, on-site data collection and power system analyses, develop a list (minimum three) of potential demonstration sites. This will be conducted with the concurrence of the Project and findings will be presented in a report format.
- Select one site where the solution will be demonstrated and agree terms and conditions with the site owner. The specifications of the site location are outlined above.
- Develop a technical proposal and agree its content with the site owner and Project.
- Design and implement a harmonic filter system that is appropriate for the selected site.
- Collect data (pre and post installation), monitor and report against a set of key performance indicators e.g. related to power quality (power loss and THD) and emissions saved, performance of the equipment etc. The indicators will be agreed with the Project and will be reflected in a Monitoring & Evaluation plan.
- Document lessons and results, including successes and challenges. Support the Project's independent MEL firm<sup>1</sup> and share information with the Project to document the implementation process, lessons, achievements, and challenges. Prepare progress and final reports.
- Support the Project to share the findings of the demonstration with relevant stakeholders e.g. by featuring in promotional materials and attending a limited number of workshops and exchange visits. Stakeholders at workshops are likely to include USAID, GVN, DOITs, and potential customers of the technology from HCMC and Danang.
- On an as-needed basis, provide inputs to the preparation of communications materials developed by the Project team, and organize site visits for high-level stakeholders and at the request of the Project.

## TARGET BENEFICIARIES

The demonstration aims to benefit the following stakeholders:

- Power generation, transmission and distribution companies e.g. Vietnam Electricity (EVN) and independent power producers (IPP), that have a mandate to deliver power to customers without distortion.
- Technology providers interested in marketing their harmonic filter systems and increasing sales revenues.
- Industrial facilities/ zones – that may be experiencing harmonic distortion caused by distributed energy sources.
- Department of Science and Technology in HCMC – mandated with promoting scientific and technological development (in Ho Chi Minh City).
- Department of Industry and Trade – mandated with supporting industry and economic growth.

## EXPECTED TIMELINE AND DELIVERABLES

Implementation is expected to start in May 2023, for a maximum period of up to nine (9) months subject to the Project extension by USAID. The offeror should propose a timeline and sequence of activities that aligns with their proposed technical approach. Deliverables will include:

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<sup>1</sup> I) an independent Monitoring, Evaluation and Learning service provider

- A report documenting the results/analysis of survey findings related to identification of the potential demonstration site.
- A clear agreement detailing the terms and conditions with the site owner of the demonstration site (including but not limited to a description of the demonstration, the demonstration activities with tentative implementation timeline).
- A technical proposal that includes an executive summary, a need statement, i.e. what is the issue being addressed and why it matters, activities, methodology and expected outcomes i.e. financial (IRR, NPV over 5 years), energy savings, emissions reductions; evaluation plan; and budget.
- A report detailing the installation and commissioning at one appropriate location.
- Bi-monthly progress narrative and financial progress reports as per an agreed template (number and timing of reports to be agreed with the Project).
- A completion report documenting activities, successes, lessons as per an agreed template.
- Guideline/ manual (in English and Vietnamese) for suppliers (and their agents) to promote and scale the technology in the future. This manual will detail the steps involved, the challenges and ways to resolve these challenges (based on experience with the demonstration).

All documents will be in English. If the agreement with the owners (and city authority, if any) of the demonstration site is in Vietnamese, the main body of the agreement must be translated into English.