**WASTE-TO-ENERGY (WTE) TEST-BEDDING AND DEMONSTRATION**

**FUNDING INITIATIVE**

**REQUEST FOR PROPOSALS (RFP) ON WTE**

**TEST-BEDDING AND DEMONSTRATION PROJECTS**

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| **Areas for test-bedding and demonstration** | To request for proposals to test-bed or demonstrate technologies related to the thermal waste treatment processes that can potentially be deployed in or be used to complement large scale WTE plants in Singapore to maximise WTE conversion efficiency and resource recovery. The areas include but are not limited to the following:   1. System integration of components or sub-systems to reap energy recovery synergy 2. On-site production of oxygen enriched air (to above 35% concentration by volume) using novel gas separation techniques 3. Upgrade and utilisation of synthesis gas (syngas) from the waste gasification process for energy generation, fuel or chemical feedstock production 4. Low grade heat recovery techniques to improve overall energy recovery efficiency 5. Novel high efficiency methods for treatment of flue gas, e.g. neutralisation of acidic salts, dioxins and furans, etc. 6. Treatment and/or utilisation of by-products such as flue gas, fly ash and slag generated from WTE process   Please check for updates at the website: <https://www.nea.gov.sg/programmes-grants/grants-and-awards/wte-testbed-demo-initiative> |
| **Publication Date** | 10 Dec 2019 |
| **Closing Date and Time** | 10 Mar 2020, 11.00 am (Singapore time) |
| **Proposal Submission** | Please email your completed application using the format provided in the **“(2) Instructions and Templates for Applicants”** to NEA via WTE\_TD\_FI@nea.gov.sg by the closing date.  You should source for and secure the necessary premises/facilities for the test-bedding or demonstration before submitting the proposal to us.  Applicants who wish to use the Nanyang Technological University (NTU) WTE Research Facility (WTERF) (See **“Annex A”** in this document) shall first consult NTU to assess the technical feasibility of using the plug-and-play features and the extent of interfacing works required to execute the project, and to clarify on the usage charges, other costs and end-user requirements. Applicants who intend to seek funding support from the test-bedding and demonstration funding initiative are to incorporate this information into the proposal to be submitted to NEA. |
| **Instructions and Format of Submission** | Please refer to the above-mentioned website. |

**WTE TEST-BEDDING AND DEMONSTRATION FUNDING INITIATIVE**

**RFP ON WTE TEST-BEDDING AND DEMONSTRATION PROJECTS**

**BACKGROUND**

1. Singapore has limited land for solid waste management and is facing rising waste volume over the years. To overcome these challenges, we decided to adopt mass burn incineration as one of our key solid waste management strategies some forty years ago. Today, incineration reduces the volume of solid waste by about 90 percent and produces enough electricity to meet about 2 to 3 percent of Singapore’s electricity demands. With advancement in waste-to-energy (WTE) technology, we are striving to harness more energy from the thermal treatment of solid waste and turn the residues into useful materials which can be recirculated into our economy. Research and development (R&D) in WTE and waste-to-resource (WTR) conversion are paramount in advancing technological solutions that are land-efficient and cost-effective so that Singapore can continue to manage our solid waste sustainably. An important phase of the R&D works includes the test-bedding and demonstration of the solutions developed in actual operational settings. Our long-term goal is to achieve an overall electrical efficiency of commercial-scale WTE plants to 27% or higher.

**SCOPE OF RFP**

1. This RFP is open to test-bedding and demonstration projects for improving technologies associated with the waste thermal treatment processes, e.g. mass burn or gasification or any other thermal treatment technologies. Applicants are to propose novel and promising technologies, techniques or processes, at component or sub-system level that are ready for test-bedding or demonstration. Proposed projects should be aimed at improving engineering design of future WTE plants to maximise the energy efficiency and resource recovery, and at commercial deployment in the waste management sector.
2. Applicants shall provide theoretical calculations to illustrate how the proposed solutions could increase the energy efficiency of a WTE plant, including showing quantitative improvements to the key parameters. The applicants are required to provide sufficient drawings and details of the proposed solutions to be tested to the extent necessary for a reasonable understanding of how the solutions could improve the efficiency of a WTE plant. The applicants should define clear and objective measurement indicators, and set performance target(s) and/or benchmark(s) to be achieved.
3. Applicants are strongly encouraged to seek industry collaborators and work with them to scope out their proposals to ensure the projects are of interest and relevance to the industry. Proposals that have secured industry spending and participation, especially those with proofs of collaboration agreements, will be viewed more favourably, all other things being equal.

**REQUIREMENTS OF PROPOSAL SUBMISSION**

1. All proposals submitted for the RFP shall minimally include the following information:
2. Detailed description of the objective, scope and the scientific principles of the proposed technology;
3. Market potential of the developed solution;

1. Details of the proposed technology such as scientific theories/principles, bench-test/laboratory results, chemical and physical properties of the material(s) used, processes involved, and the advantages compared to prevailing material(s) and/or technologies;
2. Technology readiness level (TRL) of the project should be at TRL 6 and above. The technology can be a proven technology elsewhere but not in Singapore due to the need to customise it to local conditions. All proposals must be a test-bed / demonstration (i.e. technologies that have yet to be adopted at broad level or commercialised) (See **“Annex B”** in this document for TRL definitions);
3. Key challenges to overcome, including the necessity to customise the technology to suit local conditions if the technology has been successfully applied outside Singapore;
4. Information on how the requirements in the **“Scope of RFP”** in the preceding segment are to be fulfilled;
5. Project deliverables and timeline showing the milestones to be achieved, including timelines for submission of interim progress and final reports;
6. Clear and objective measurement indicators, and performance target(s) and/or benchmark(s) to be achieved.
7. Proposed budget and payment schedule, with explanations;
8. Deployment and commercialisation plan including the licensing of any intellectual property created;
9. Research capabilities and relevant experience of the project team members; and
10. Information on letter of support, collaboration agreement, in-kind services, funding, tangible contributions or any other kind of commitment by industry partners/collaborators or any other partner/collaborators towards the Proposal, if any. In-kind services include labour, materials, and other services such as loaning of equipment, facilities and space.

**PROJECT DURATION**

1. The project duration shall endeavour to be completed within two years, and shorter timelines are preferred. The reasonableness of the duration of the project proposed will be taken into consideration during the evaluation stage on a case-by-case basis.

**ELIGIBILITY OF FUNDING SUPPORT**

1. This RFP is extended to all Institutes of Higher Learning (IHLs), public sector agencies, Singapore-registered companies and research organisations.
2. IHLs, public sector agencies and not-for-profit organisations may qualify for funding support of up to 100% of the approved qualifying direct cost items.[[1]](#footnote-2)1 Singapore-registered companies and for-profit organisations may qualify for funding support of up to 70% of the approved direct qualifying costs
3. Only IHLs, public sector agencies and not-for-profit entities are eligible for funding support for Indirect Costs.[[2]](#footnote-3)2 The Indirect Cost items include Overheads (up to 20% of approved qualifying direct costs excluding exceptional items[[3]](#footnote-4)3).

**EVALUATION CRITERIA**

1. Proposals will be evaluated against the following criteria:

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| **S/N** | **Evaluation Criterion** | **Weightage (%)** |
| 1 | Contribution to the WTE Programme goals | 30 |
| 2 | Commercialisation or deployment plans after the test-bedding or demonstration | 25 |
| 3 | Technical expertise of project team | 25 |
| 4 | Cost effectiveness, and reasonableness of budget and project duration | 20 |
| **Total Score** | | **100** |

**CONTACT**

1. For enquiries pertaining to this RFP, please email WTE\_TD\_FI@nea.gov.sg.
2. The evaluation of proposals may take 5 months from the close of this RFP, and thereafter the notification of award will be issued to the successful applicant(s).

**ANNEX A: WASTE-TO-ENERGY RESEARCH FACILITY (WTERF)**

1. The National Environment Agency (NEA) has co-funded Nanyang Technological University (NTU) to develop a high temperature slagging gasification WTE Research Facility (WTERF). NTU contracted JFE Engineering Corporation (JFE) to design and build the Facility at 18 Tuas South Street 11, Singapore (636898). The WTERF is the first of its kind facility dedicated to the test-bedding and demonstration WTE technologies in Singapore. The WTERF is operated and maintained by NTU.
2. Please refer to NTU’s **“WTERF Catalogue”** for further details.

**ANNEX B: DESCRIPTION OF TECHNOLOGY READINESS LEVELS (TRL) 1 TO 9**

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| **TRL** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **TRL** | **Basic principles observed and reported** | **Technology concept and/or application formulated** | **Analytical and experimental critical function and/or characteristic proof of concept** | **Component and/or breadboard validation in laboratory environment** | **Component and/or breadboard validation in relevant environment** | **System/subsystem model or prototype demonstration in a relevant environment** | **System prototype demonstration in an operational environment** | **Actual system completed and qualified through test and demonstration** | **Actual system proven through successful mission operations** |
| **Description** | Lowest level of technology readiness. Scientific research begins to be translated into applied R&D. Examples might include paper studies of a technology’s basic properties. | Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies. | Active R&D is initiated. This includes analytical studies and laboratory studies to physically validate the analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative. | Basic technological components are integrated to establish that they will work together. This is relatively “low fidelity” compared with the eventual system. Examples include integration of “ad hoc” hardware in the laboratory. | Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment. Examples include “high-fidelity” laboratory integration of components. | Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology’s demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in a simulated operational environment. | Prototype near or at planned operational system. Represents a major step up from TRL 6 by requiring demonstration of an actual system prototype in an operational environment (e.g., in an aircraft, in a vehicle, or in space). | Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation (DT&E) of the system in its intended weapon system to determine if it meets design specifications. | Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation (OT&E). Examples include using the system under operational mission conditions. |

Source: US Department of Defence, Technology Readiness Assessment (TRA) Guidance, April 2011

1. 1 Please refer to the document “(2) Instructions and Templates for Applicants” for the guidelines on qualifying direct cost items. [↑](#footnote-ref-2)
2. 2 Indirect costs in research are those costs that are incurred for common or joint objectives and therefore cannot be identified readily and specifically with a particular sponsored research project, but contribute to the ability of the entities to support such research projects (e.g. providing research space, research administration, utilities), and not through the actual performance of activities under the sponsored research projects. [↑](#footnote-ref-3)
3. 3 Examples of Exceptional items are research scholarships. [↑](#footnote-ref-4)