



***Dear Researchers and Partners:***

The Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) of the Department of Science and Technology (DOST) launched its 2020 Call for Proposals (CFP) on 28 June 2019. Included in the said Call are the following:

1. Integrated and Intelligent Sensors and Actuators (IISA) for Intelligent Factories
2. Convergence of Philippine Technologies for Smarter City Development
3. Energy Storage Module
4. Renewable Energy and Energy-Efficient Technologies
5. Development of a Prototype for Ballast Water Treatment and Ships' Biofouling Control and Management

For those who are interested to submit proposals, the complete package of the Call and the Proposals Application Forms can be viewed at the PCIEERD website:  
<http://pcieerd.dost.gov.ph/e-forms/call-for-proposal-forms>

The following dates pertaining to the 2020 CFP shall be strictly observed:

Activities	Dates
Announcement of Call for Proposal	28 June 2019
Closing Date for Submission of Full-Blown Proposal	2 August 2019
Notification of Successful Applicants	On or Before 27 September 2019

Thank you.

Very truly yours,

  
**ENGR. RAUL C. SABULARSE**

Deputy Executive Director and  
Officer-in-Charge  
Office of the Deputy Executive Director

For:

**DR. ENRICO C. PARINGIT**  
Executive Director

Philippine Council for Industry, Energy and Emerging  
Technology Research and Development



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**Department of Science and Technology  
Philippine Council for Industry, Energy and Emerging  
Technology Research and Development  
(DOST-PCIEERD)**

**CALL FOR PROPOSALS 2020**

**I. R&D FUNDING OPPORTUNITY**

The Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) of the Department of Science and Technology (DOST) is ready to accept research and development (R&D)/science and technology (S&T) proposals for 2020. This Call for Proposals is for specific priority areas identified in the Harmonized National R&D Agenda (HNRDA) 2017 – 2022. Guided by the principle **“Science for the People”**, DOST – PCIEERD directs R&D and S&T initiatives that will improve the innovation system to leverage economic progress.

This funding opportunity encourages S&T collaboration and applied research among Higher Education Institutes (HEIs), government Research and Development Institutes (RDIs), non-profit S&T networks and organizations, private sector, and other proponents seeking funding for their R&D initiatives.

**A. Scope of R&D Work**

Proposals must be aligned with the following program areas for funding consideration.

**1. Integrated and Intelligent Sensors and Actuators (IISA) for Intelligent Factories**

PCIEERD, in line with its thrust to propel the Philippines to achieve its Industry 4.0 aspirations, is calling for research proposals to develop integrated sensor-actuator systems and technologies for sensor and actuator with decentralized controls and connectivity, sensor/actuator networks, streaming data analytics for optimal and adaptive manufacturing.

Partnership with an industry is required.

**2. Convergence of Philippine Technologies for Smarter City Development**

The cities of Cauayan, Iloilo, and Butuan were chosen as the pilot city of implementation. With the city’s rapid economic and industrial growth, as well as the local government’s enthusiasm and support in ushering innovation, the concept and development of smarter cities in said sites has great potential, and eventually, project as a good model to other cities.

This program can be outlined in three (3) components, namely, **City Development Strategy, Catalytic Projects, and Data Hub**.

### **3. Optimized and Novel Energy Design for Battery Energy Storage System (BEES)**

the Call aims to design and develop an electrochemical energy storage system using indigenous materials to reduce dependence from imported high density-based energy storage systems. The following materials for the energy storage system are prioritized with the respective performance charge/discharge cycle life targets:

- Advanced Lead-acid batteries - 2 times the cycle period of conventional lead-acid
- Nickel-iron Battery System - 5 times lower cycle period than lead-acid

### **4. Technology on Renewable Energy and Energy Efficiency for Micro, Small, and Medium Enterprises (RE4MSME)**

The call is in line with the PCIEERD thrust on Sustainable Energy and involves the Introduction of innovative renewable energy and energy-efficient technologies for Micro, Small, and Medium Enterprises (MSMEs) applications. These technologies should improve the energy utilization index, reduce energy consumption, and enhance product cost competitiveness of the MSMEs.

### **5. SHIP's Ballast Water and Biofouling Treatment Systems for Marine Vessels (SAILS) Program**

This call would like to address the need to develop efficient and cost effective ballast water treatment technologies to be used on board ships, and establish programs to develop, test, evaluate and approve the same in accordance with the Ballast Water Management Convention (BWMC), an International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.

Further details of each program areas are specified in the Annex of this Call document.

## **B. Expected Outputs, Outcomes, and Perceived Impact**

1. **Outputs** - Resulting academic outputs such as: publications, patents filed, products developed, facilities and partnerships established, people trained and graduated, public service provided, and science-based policies passed or prepared from the completion of projects. Effort has to be made to always cite or recognize the funding that was provided by DOST in all resulting outputs.
2. **Outcomes** - The effects or change directly realized from the delivery of research outputs beyond academic knowledge and project manpower

development.

3. **Impacts** - Direct or indirect changes in the economy, environment, or society beyond contributions to academic knowledge and manpower development that may still be attributed to the project.

## **II. FUNDING AWARD INFORMATION**

### **A. Fund Information**

The DOST - PCIEERD anticipates R&D award up to P10,000,000 per project. Programs and projects requiring larger budgets will also be entertained, subject to deliberation of the PCIEERD Management Team (PMT).

### **B. Partial Funding**

The DOST – PCIEERD may partially fund discrete portions or phases of proposed projects. If DOST – PCIEERD decides to partially fund a proposal, it will do so in a manner that does not prejudice any applicant or affect the basis upon which the proposal or portion thereof, was evaluated and selected for award, and therefore maintains the integrity of the selection process.

### **C. Deadline of Proposal Submission**

The closing date for the submission of full-blown proposals through the **e-Proposals** submission facility is on **2 August 2019**. A notification will be issued to eligible entities whose proposals have been evaluated and recommended for award on or before **27 September 2019**. A DOST - PCIEERD R&D Manager will then be assigned to each project proponent to provide guidance in finalizing their proposals.

### **D. Commencement Period for Approved Project**

The target commencement period for approved projects may start on **January 2020** or depending on the result of the evaluation and notice of award of successful applicants.

### **E. Type of Funding**

The funding for selected projects will be in the form of a research agreement under the DOST - PCIEERD Grants – In - Aid (GIA) Program. Research agreements permit substantial involvement of the DOST - PCIEERD designated R&D Managers and the selected applicants in the performance of the work supported. Although DOST - PCIEERD will negotiate precise terms and conditions relating to substantial involvement as part of the award process, the anticipated substantial Government involvement for this project will be:

- Close monitoring of the successful applicants' performance to verify the results reported by the applicant;
- Collaboration during performance of the scope of work;
- Review of the substantive terms of proposed contracts and review of

competitive procurement procedures (DOST - PCIEERD will not select contractors)

- Approval of qualifications of key program/project personnel (DOST - PCIEERD will not select employees or contractors employed by the award recipient);
- Review and comment reports prepared under the research agreement

## **F. Supplementary Information**

Demonstrations must involve new or experimental technologies, methods, or approaches, where the results of the project will be disseminated so that others can benefit from the knowledge gained in the demonstration project. A project that is accomplished through the performance of routine, traditional, or established practices, or a project that is simply intended to carry out a task rather than transfer information or advance the state of knowledge, however worthwhile the project might be, is not considered a demonstration project. Such projects/activities are not eligible for funding under this announcement.

## **III. ELIGIBILITY INFORMATION**

### **A. Eligible Entities**

Any Filipino, public or private entity with proven competence may apply for GIA support of DOST - PCIEERD and its grant - giving units, provided that projects fall under the specific research areas with overall goal to benefit Filipinos.

Preference will be given to public and private universities and colleges, Research and Development Institutes (RDIs), R&D Consortia, non-profit laboratories, other public or private non-profit S&T institutions located in the Philippines. Non-profit S&T organizations are those which: (1) are operated primarily for scientific, educational, service, or similar purposes in the public interest; (2) are not organized primarily for profit; and (3) use its net proceeds to maintain, improve, and/or expand its operations. Non-profit organizations engaged in lobbying activities are not eligible to apply.

### **B. Cost Sharing and Matching**

The Applicant should provide at least 20% counterpart funding. Only eligible and allowable costs may be used for counterpart fund and/or in-kind contribution (ex. utility costs, office space rental, among others), as determined by DOST – PCIEERD. The proposal must describe how the applicant will provide the counterpart fund/in-kind contribution and the role that DOST - PCIEERD funding will play in the overall project.

### **C. Threshold Criteria**

The following are requirements during proposal submission to ensure consideration for funding:

1. Only proposals from Eligible Entities that meet all of the criteria will be evaluated against the ranking factors in Section V of this announcement. Applicants found

ineligible for funding consideration as a result of the threshold eligibility review will be notified within 15 calendar days of the ineligibility determination.

2. Proposals to be submitted and/or funded under this announcement must demonstrate the advancement of Science and Technology (S&T), alignment to government's economic policy direction, and program areas identified in Section I.A.
3. Proposals (including all project documents submitted) must be written in English.
4. Proposals must comply with the proposal submission instructions and requirements set forth in Section IV of this announcement, otherwise these proposals will be rejected.
5. Proposals must be received by the DOST - PCIEERD on or before the proposal submission deadline specified in Section II.D of this announcement. Applicants are responsible for ensuring that their proposals reach the DOST - PCIEERD on the set deadline of submission.
6. Proposals received after the submission deadline will be considered late and returned to the sender without further consideration unless the applicant can clearly demonstrate that lateness was due to mishandling on the part of DOST - PCIEERD.

## **IV. PROPOSAL AND SUBMISSION INFORMATION**

### **A. Content of e-Proposals**

#### **1. Letter of Intent and Endorsement**

Together with the proposal, DOST - PCIEERD requires submission of a formal letter of intent from the applicant and an endorsement from the authorized head of organization. The authorized head of the organization will also be the principal signatory of their organization for the research agreement award.

The letter of Intent and Endorsement Letter should be addressed to:

**Dr. Enrico C. Paringit**

Executive Director

Philippine Council for Industry, Energy and Emerging Technology Research  
and Development (PCIEERD)

Department of Science and Technology (DOST)

5<sup>th</sup> Level, Science Heritage Building, DOST Compound,

Gen. Santos Ave., Bicutan, Taguig City 1630

#### **2. Narrative Proposal**

Applicants are advised to download all applicable DOST – PCIEERD GIA Forms from the [PCIEERD website](#) or the [e-Proposals website](#) and completely

accomplish these forms. Aside from the Frequently Asked Questions (FAQs) in the e-Proposals website, Guidelines for Uploading Files can be viewed once the applicant registers and logs on in the system. Instructions for the e-Proposals submission and forms are available from the PCIEERD website.

The narrative proposal work plan must explicitly describe the following in the downloaded forms.

**a. Project Rationale and Description**

Describe the project rationale and significance of the proposed project to the current needs of the country. It may include novelty, potential for publication/IP, and success/failure ratio.

**b. Project Objectives**

State the specific purpose to be addressed by the project on the problem areas identified.

**c. Review of Literature**

Summarize related research/activities that had been conducted. Include the state – of – the – art of current technology/information/services from which the proposal will take off. It may include the advantages of the technology over existing technologies, market need, field testing requirements, and user engagement.

**d. Methodology**

Summarize approaches on how the associated work products, processes, information and services will be implemented, developed and acquired.

**e. Work Plan**

Describe specific activities and/or methods to be undertaken and estimated timeline for each task.

**f. Project Outputs, Expected Outcome, and Perceived Impact**

Identify the expected project outputs and how the progress towards achieving the outputs will be tracked and measured. Identify the expected quantitative and qualitative outcomes of the project; including what measurements will be used to track the progress towards achieving the outcomes and how the results of the project will be evaluated.

Indicate the specific products, processes, or services which the project is expected to produce and quantify possible socio - economic benefits, co - investment, profitability, environment impacts and contribution towards the advancement of S&T which can be derived from the project.

### **g. Financial Budget Requirement Work Plan**

Indicate the estimated funding amounts for each work component/task, which should be consistent with the Line - Item - Budget (LIB).

### **h. Line - Item – Budget (LIB)**

Provide the total budget requirement for the project reflecting the counterpart of the Applicant using DOST - PCIEERD Form A. Applicants must itemize the costs related to personnel, travel, equipment, supplies, other direct costs, and total costs. Equipment and other large expense items should be supported with justification. Estimation for the rates of project personnel should be in accordance with the prescribed rates for Honoraria and hiring of DOST - GIA Personnel.

### **i. Attachments**

Applicants may attach documents to the Narrative Proposal. These may include related information on the proposed program/project like, resumes or curriculum vitae, support letters from relevant agencies/organizations, market supply/demand projections, among others. Below are explanations of required information, which should be attached in the narrative proposal. These can be submitted through the e-Proposals submission facility of DOST - PCIEERD for this CFP.

**a. Roles of the Applicant and Partners**, if there is any.

#### **b. Institution's Track Record**

Description of the applicant's organization and experience related to the proposed project.

#### **c. Project Team Information**

Short description of the roles of each project staff, expertise/qualifications, and staff knowledge using DOST - PCIEERD Form J. The Applicant may want to expound on how the manpower resources can be obtained to successfully achieve the goals of the proposed project.

#### **d. Past Performance**

Programmatic Capability: Submit a list of government funded assistance agreements or foreign equivalent assistance agreements similar in size, scope and relevance to the proposed project that your organization performed within the last three (3) years (no more than five (5) projects agreements, and preferably PCIEERD/DOST agreements) and describe (i) whether, and how, you were able to successfully complete and manage those agreements and (ii) your history of meeting the reporting requirements under those agreements including submitting acceptable final technical reports.



## B. e-Proposals Submission

Applicants are **REQUIRED** to submit proposals through the DOST – PCIEERD **e-Proposals** submission facility before the Closing Date on **2 August 2019**. Applicants will receive automatic reply through email confirming receipt of proposals.

## C. Pre-Proposal Assistance and Communication

DOST - PCIEERD Project Managers are available to provide appropriate assistance to potential applicants interested in competing for this Call for Proposals. This may include assistance to potential applicants in determining eligibility of the applicant or the applicant's proposed project for funding, questions about administrative issues relating to the submission of a proposal, and clarifications on the announcement.

### Contacts:

#### **Energy Storage Module and Renewable Energy and Energy Efficient Technologies:**

Engr. Nonilo A. Peña  
(+632) 837-2935; [nilo\\_pcierd@yahoo.com](mailto:nilo_pcierd@yahoo.com)

#### **Development of a Prototype For Ballast Water Treatment and Ships' Biofouling Control and Management:**

Engr. Niñaliza H. Escorial  
(+632) 837-2926; [ninaescorial@gmail.com](mailto:ninaescorial@gmail.com)

#### **Integrated and Intelligent Sensors and Actuators and Smarter City Programs:**

Ms. Edna C. Nacianceno  
(+632) 837-2071 to 82 local 2106; [ednacionceno@gmail.com](mailto:ednacionceno@gmail.com)

## V. EVALUATION CRITERIA

Only those proposals that meet the threshold criteria in Section III Part C will be evaluated according to the criteria set forth below. Applicants should directly and explicitly address these criteria as part of their proposal submission. Each proposal will be rated using point system, with a total of 100 points.

### A. Evaluation Criteria

Criteria	Points
<b>1. Project Approach:</b> The DOST - PCIEERD will evaluate the following factors: 1.1 Strategies of implementation for addressing all of the requirements in Section I 1.2 Technical soundness of the proposal	30

<p>1.3 Reasonable timeframe for the execution of the tasks associated with the project</p> <p>1.4 If proposal includes a commitment for the involvement of partner institution or a private cooperator to utilize the technology, services and or eventual transfer of results of the project.</p>	
<p><b>2. Outputs and Outcomes:</b></p> <p>2.1 Extent and quality to which the proposal describes the evaluative component of the project, including how the applicant's success in achieving the expected project outputs and outcomes for addressing the requirement in Section I Part B;</p> <p>2.2 How results can be quantified, tracked and measured, as mentioned in the Project Results of the Narrative Proposal Section.</p>	30
<p><b>3. Track Record of Applicant:</b> The DOST - PCIEERD will evaluate the applicant's technical ability to successfully complete and manage the proposed project taking into account the following:</p> <p>3.1 Track record in successfully completing and managing equivalent funded assistance agreements (assistance agreements include government and/or foreign equivalent grants and agreements) similar in size, scope, and relevance to the proposed project performed within the last 3 years,</p> <p>3.2 History of meeting reporting requirements under government and/or foreign equivalent funded assistance agreements (assistance agreements include government and/or foreign equivalent grants and agreements) similar in size, scope, and relevance to the proposed project performed within the last 3 years and submitting acceptable final technical reports or the equivalent under those agreements, and</p> <p>3.3 Institution's existing facility/capability to carry out similar project towards achieving the expected outcomes and outputs (e.g., results) under government and/or foreign equivalent funded assistance agreements performed within the last 3 years.</p> <p><b>NOTE:</b> <i>In evaluating applicants under this criterion, the PCIEERD may also consider relevant information from other sources including agency files and prior/current grantors (e.g., to verify and/or supplement the information supplied by the applicant). Applicants with no relevant or available past performance or reporting history will receive a neutral score for these elements. A neutral score is half of the total points available in a subset of possible points. If no response is provided for these items, the applicant may receive a score of 0 for these factors.</i></p>	15
<p><b>4. Staff Expertise/Qualifications:</b></p> <p>4.1 Project Personnel expertise/qualifications to successfully achieve the goals of the proposed project, and</p> <p>4.2 Description of the applicant's organization and experience relating to the proposed project.</p>	15
<p><b>5. Budget/Resources:</b></p> <p>5.1 Proposed project budget is reasonable/justifiable to accomplish the proposed goals, objectives, and measurable project outputs and outcomes</p>	10

5.2 Applicant's counterpart to complement the PCIEERD funding as a requirement in Section III Part B. Extent on how the applicant will allocate the use of PCIEERD funding with other sources of funds to carry out the proposed project(s).	
<b>TOTAL</b>	<b>100</b>

## B. Review and Selection Process

A review team will evaluate each proposal using the evaluation criteria described above. Each proposal will be given a numerical score and will be ranked accordingly. Preliminary funding recommendations will be forwarded to the Approving Authorities based on this ranking.

## C. Other Factors

The Approving Authorities, based on the rankings and preliminary recommendation of the DOST - PCIEERD evaluation team, will make final funding decisions. In making the final funding decisions, the Approving Authorities may also consider programmatic priorities and geographic diversity of grants.

## VI. AWARD ADMINISTRATION

### A. Award Notices

Following the evaluation of proposals, all applicants will be notified on the status of their proposals.

Proposal Notifications.

- DOST - PCIEERD will notify the *successful* applicant, via telephone, electronic or postal mail on or before **27 September 2019**. The notification informs the Applicant that his/her Proposal has been successfully evaluated and recommended for award.
- This notification is **NOT** an authorization to begin implementation. The award notice signed by the DOST - PCIEERD Executive Director is the authorizing document and will be used for the execution of the project through a Memorandum of Agreement (MOA) among parties.
- DOST - PCIEERD will also notify the *unsuccessful* applicant(s) via electronic or postal mail on or before **27 September 2019**.

### B. Administrative and DOST GIA Policy Requirement

The Grants – In – Aid (GIA) award shall be governed by the DOST GIA Guidelines.

### C. Reporting Requirement

Quarterly progress reports summarize technical progress, planned activities for

the next quarter, summary of expenditures, and a detailed final report will be required. The final report shall be completed within 90 calendar days after the completion of the period of performance. Required forms are downloadable from the PCIEERD website and may be provided by the PCIEERD upon the awarding of the agreement to eligible applicants.

## **VII. PCIEERD CONTACT**

For further inquiries, the applicant may contact:

Department of Science and Technology - Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST - PCIEERD)

**ATTN: MS. GRACE F. ESTILLORE**

Chief SRS, Policy Coordination and  
Monitoring Division (PCMD)

4<sup>th</sup> Level Science Heritage Building  
DOST Complex, Gen. Santos Ave.

Bicutan, Taguig City

[gfestillore@gmail.com](mailto:gfestillore@gmail.com)

(+632) 837 - 2071 to 82 Local 2107

All questions or comments must be communicated in writing via postal mail, facsimile, or electronic mail to the above contact person.

### **Timetable**

<b>Activities</b>	<b>Dates</b>
Announcement of Call for Proposal	28 June 2019
Closing Date for Submission of Full-Blown Proposal	2 August 2019
Notification of Successful Applicants	On or Before 27 September 2019

## Annex A

### Details of the Call for Proposals

#### **Integrated and Intelligent Sensors and Actuators (IISA) for Intelligent Factories**

Sensors and actuators are key building blocks of an intelligent industry – particularly in the manufacturing sector or so-called “Smart Factory”. In modern industries, IoT applications, distributed sensors gather information about a system, which is then processed to form the basis for issuing commands to actuators that in turn, drive the system and processes. With faster computers, smarter machines, smaller sensors, cheaper data storage and transmission could make production segments and products smarter to communicate with and learn from each other through use internet-of-things (IoT) devices, Artificial Intelligence (AI) and Data Analytics techniques. Sensors and actuators technology, therefore have complementary roles in enabling manufacturing industries to attain efficiency, reduce errors and increase productivity. These innovations will transition traditional manufacturing processes founded on hierarchical automation systems, to self-organizing cyber-physical production system to allow flexible mass custom production and flexibility in production quantity.

PCIEERD, in line with its thrust to propel the Philippines to achieve its Industry 4.0 aspirations, is calling for research proposals to develop integrated sensor-actuator systems and technologies for sensor and actuator with decentralized controls and connectivity, sensor/actuator networks, streaming data analytics for optimal and adaptive manufacturing. The proposed project should be able to set up an *intelligent, agile or reconfigurable and fully networked production line* or subline that integrates physical input objects, machines, smart sensors, and demonstrate the application of manufacturing data analytics across the boundaries of organization.

Proposed projects must develop technologies on:

- a. Sensors (biosensing, biophotonic, chemical, optoelectronics, mechanical, thermal, micromechanics, magnetics. Sensor and sensor-array chemometrics, microarray)
- b. Nano- or micromechanics and microcontrols; actuators, structures, integrated sensors-actuators, microsystems, and other devices or subdevices ranging in size from millimeter to sub-micron- levels, nanomotors, microfluidic components) nanomotors
- c. Systems and controls: Interface electronics, chip-based detection devices i.e. biochips, lab-on-a-chip
- d. Machine vision  
Acting as the ‘eyes’ of the factory, image processing systems based on industrial cameras can compute information that was previously gathered and analysed by humans. It aids in the intelligent exchange of information among sensors, devices and machines

e. Industrial Internet of Things, AI and Data Analytics

Basis for issuing commands to actuators that in turn, drive the system. With faster computers, smarter machines, smaller sensors, cheaper data storage and transmission could make production segments and products smarter to communicate and learn from each other through the use of internet-of-things (IoT) devices, Artificial Intelligence (AI) and Data Analytics techniques.

Other Applications

e. Energy management in manufacturing setting

f. Additive materials: *Please refer to the Amcen Call for R&D Proposal on additive manufacturing to be announced later*

The program area should present a novel concept or mechanism and should have an immediate application. Researchers should also collaborate with an industry or government partner therefore, it is required to have specific needs or requirements to be addressed through R&D. Further, preference is given to a research organization able to obtain a firm commitment and partnership from a small or medium enterprises (SMEs) to support the project as a pilot and as an eventual adaptor when successful.

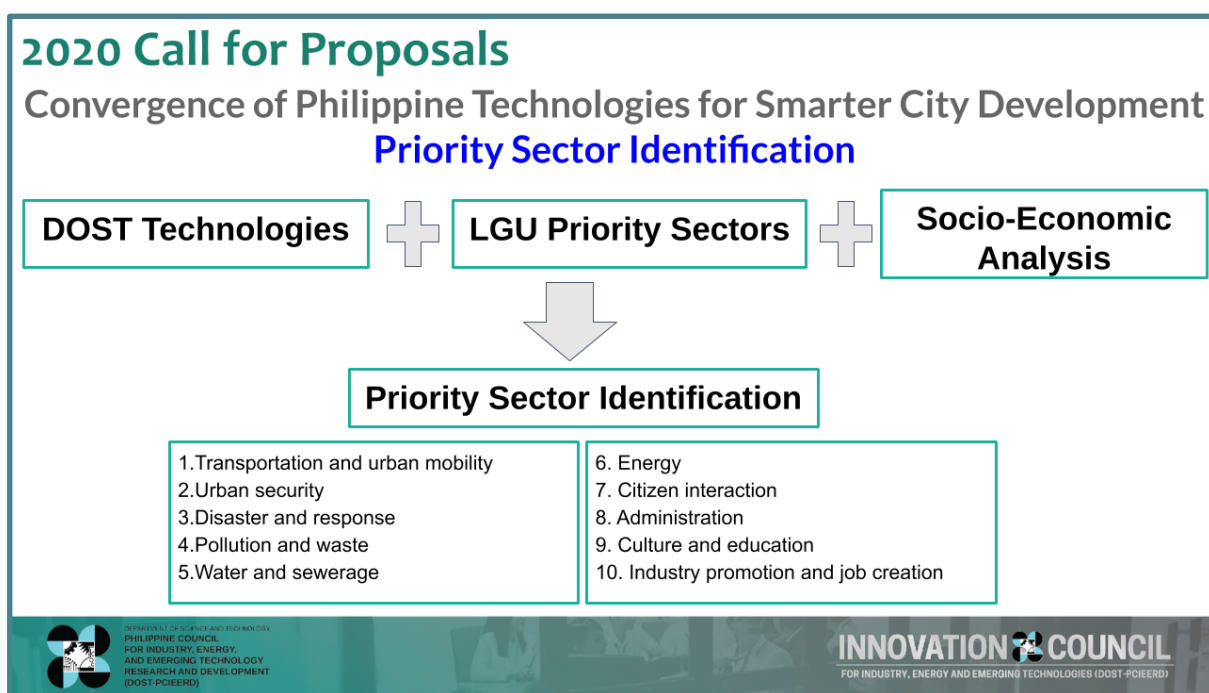
## Convergence of Philippine Technologies for Smarter City Development

The concept of smart cities have long been the subject of global discussions and exchanges, with countries undertaking their own efforts and initiatives in furthering connectivity, collaboration, and quality of living. This involves the effective and efficient management and use of data to make better, evidence-based decisions in the localities. However, one must remember that in order for this to be possible, a city must have the necessary infrastructure and mechanisms that will support its activities.

Putting the Philippines in context, every city possesses different strengths and capabilities that it can capitalize on in order to progress; and with this comes varying levels of readiness of the city infrastructure and its people to support development. The issues including electricity shortage, high electricity costs, and lack of basic infrastructure hinder PH cities from efficiency of everyday decisions. However, irrespective of these differences, each city must first ensure the following aspects that are crucial for future and much bigger improvements: mobility of its individuals, basic waste management, and the availability of open public spaces.

CFP 2020 chooses the cities of Cauayan, Iloilo, and Butuan as its pilot cities of implementation. With the city's rapid economic and industrial growth, as well as the local government's enthusiasm and support in ushering innovation, the concept and development of a smarter cities in these sites has great potential, and eventually, project as a good model to other cities in the Philippines.

An inventory of the current technologies developed by DOST and available technologies being used by the Local Government Unit combined with socio-economic analysis can help identify which of the ten (10) smart city sectors can be addressed through the program, as illustrated in the figure below.



This program can be outlined in three components, namely, **City Development**

**Strategy, Catalytic Projects, and Data Hub.** Further discussion of the components follows:

- **City Development Strategy**

This phase essentially focuses on effective land use planning. Areas of the city must be carefully assessed to know whether a particular site is for residence, commercialization, or protection. The goal is to provide a sustainable layout for the city that can support its people, as well as the provision of their citizens' basic needs, services, and infrastructure. Such a layout will be crucial in identifying the challenges that the city faces, providing evidence-based solutions that address the identified issues, and ultimately achieving sustainability and efficiency. Partnerships with different governmental, social, and educational institutions will be essential in the achievement of the goals of this phase.

- **Catalytic Projects**

Once the urban layout is undertaken, what needs to be identified first and foremost is the kind of economic activity that will fuel the accomplishment of the city's programs and projects. This is an exercise of knowing what the current capabilities of the city are, and having the understanding to utilize these capabilities to usher in more developmental opportunities for the local government.

Private and public sectors will be identified as to who will be putting investments in these areas for development, and how much it will contribute to local gross domestic product. A detailed engineering & architectural design is then needed to support the highlighted economic activity, which should be in accordance with the city development strategy set out in the previous phase.

This phase recognizes the fact that the Philippine national government has limited budget to accommodate ambitious projects such as this one, so the commitment coming from the local governments to a fiscal responsibility is crucial in the achievement of the city's goals and objectives.

- **Data Hub**

The key to a smarter city is the ability to leverage on the collection, processing, and use of data to make more effective and efficient everyday decisions. The establishment of a data hub is important to ensure an evidence-based planning and decision-making approach for the city executives, as they are guided by a facility that can monitor the impacts, externalities, and progress of the city under its projects.

Through the data hub, data is basically devolved and localized to the city governments for use in support & guidance of their local planning and decisions. Broadening our perspectives, the concept of a smart city really revolves around making better and more informed decisions through careful assessment and use of data.



Moreover, this includes impact assessment and continuous monitoring of the projects implemented so as to provide a basis for their continuity and success.

The call focuses on the following targeted themes:

**Economic opportunity:** residents are supported by a thriving local economy. Examples of outcomes in this area could include: increased employment opportunities; reductions in processing times for business permits; improvements in skill levels in the local labor force.

**Empowerment and inclusion:** residents are supported and given the opportunity to participate in the community. Examples of outcomes in this area could include: reduced homelessness rates; reductions in the number of institutionalized children and youth; better integration of newcomers, refugees, youth, seniors, visible minorities, etc. in the community; opportunities to participate in, and to be informed about, the democratic process/decisions affecting the community.

**Environmental quality:** residents are able to enjoy a healthy environment. Examples of outcomes in this area could include: reduced greenhouse gas emissions; reductions in environmental contaminant levels; habitat preservation or renewal; water treatment facility.

**Healthy living and recreation:** residents are able to live an active and healthy life. Examples of outcomes in this area could include: increased access to recreational programming; availability of remote health services; reduction in adverse health outcomes.

**Mobility:** residents can move freely within their community. Examples of outcomes in this area could include increased accessibility to public transportation; reduced first mile/last mile gaps; reduction of congestion.

**Safety and security:** residents live in a safe and secure community. Examples of outcomes in this area could include reduced crime rates; increased safety for women; improved emergency response times.

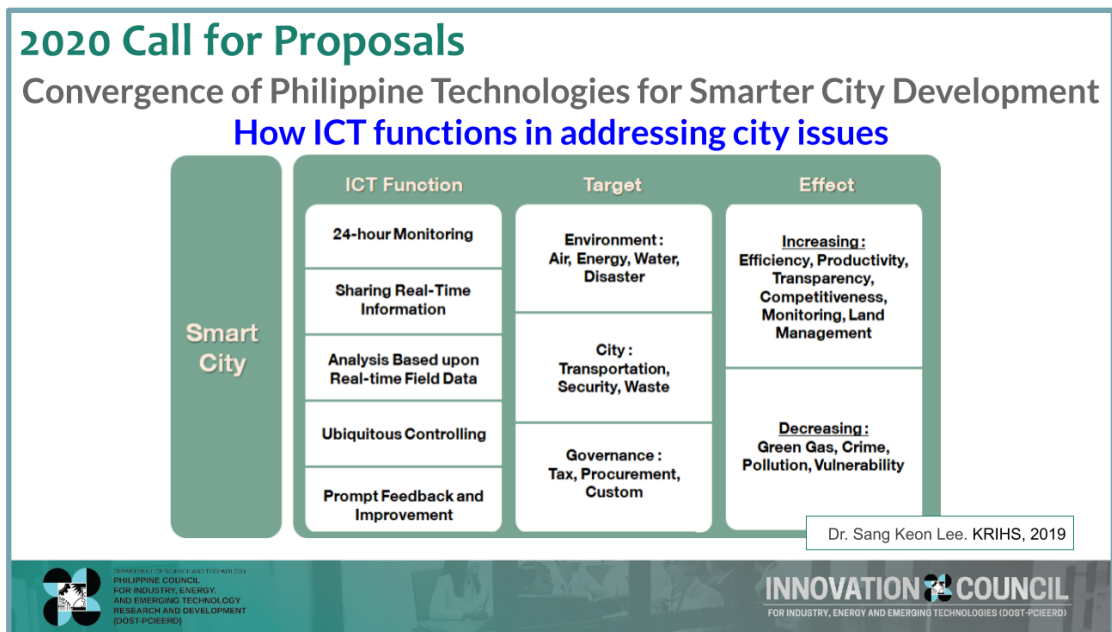
The program area should present a novel concept or mechanism and should have an immediate application. The program integrator/proponent must also come from the pilot cities identified in partnership with other proponents from Higher Education Institutions. Further, collaboration with the local government unit, an industry or government partner is required

There is no limit to the number of technologies that may be used. PCIEERD is interested in understanding the range of technologies that communities are considering as part of their applications to achieve perceived outcome(s).

- Artificial intelligence (AI)
- Augmented reality (AR) or Virtual reality (VR)
- Big data analytics
- Cloud computing

- Enterprise solutions
- Environmental monitoring
- Geospatial / GIS or Remote Sensing
- Internet of Things (IoT)
- Mobile applications
- Networks
- Open data platforms
- Payment platforms
- Sensors and actuators
- Wearables
- Advanced materials
- BIM Construction technology
- Other: please specify

As an example, the box below summarizes how ICT functions in addressing city issues.



## **Optimized and Novel Energy Design for Battery Energy Storage System (BESS)**

Battery energy storage is a system that stores energy thru the use of a battery technology for it to be used at a later time. BESS is commonly applied for power quality improvement, load shifting, peak power shaving, uninterrupted power supply, intermittency mitigation, and frequency regulation. In addition, BESS is also applied for hybrid renewable energy system and commercial buildings backup power source.

The first power plant that used battery energy storage system for peak power shaving is the Masinloc Coal Power Plant owned by San Miguel Corporation. It has a 10 MW BESS capacity using lithium-ion batteries. The lithium-ion batteries are outsourced abroad and being provided by a third-party contractor.

Currently there is no manufacturing plant for lithium-ion batteries in the Philippines. In the global supply chain of lithium-ion batteries, the Philippines supplies the largest part of raw nickel for processing into cathode materials to other countries such as China, Japan, and Korea, which constitutes of 85% of the total lithium-ion battery production.

In terms of lead-acid battery production, Ramcar Technologies is the only company in the country that produces lead-acid batteries (Motolite) in varying product lines with significant market share in Southeast Asia and Australia.

For materials-level research and development, the DOST has funded several researches on graphene-based and indigenous textile-based supercapacitors, solid electrolyte development for solid state rechargeable Li-ion battery, and direct ethanol fuel cell for power generation. Other local funding agencies such as CHED-PCARI funded the development of polymer-based fuel cell and solid-state-based electrolyzer system studies in University of the Philippines Diliman, while National Academy of Science and Technology (NAST) funded a redox-flow battery research in De La Salle University.

For systems-level, a private local company funded a system hybridization of battery chemistries (i.e. lead-acid + lithium-ion) study and prototype deployment in Guimaras. The DOST also funded its national fuel cell testing facility in University of Santo Tomas.

In line with the thrust on Sustainable Energy, the Call aims to design and develop an electrochemical energy storage system using indigenous materials to reduce dependence from imported high density-based energy storage systems. The following materials for the energy storage system are prioritized with the respective performance charge/discharge cycle life targets:

- 1) Advanced Lead-acid batteries - 2 times the cycle period of conventional lead-acid
- 2) Nickel-iron Battery System - 5 times lower cycle period than lead-acid

The proponent should partner with a local battery manufacturer as possible commercial producer.

## **Technology on Renewable Energy and Energy Efficiency for Micro, Small, and Medium Enterprises (RE4MSME)**

Micro, small and medium enterprises (MSMEs) comprise 90% of the country's enterprises and play an important role in developing the Philippine economy. The sector still faces various constraints and the use of renewable energy and energy-efficient technologies offer opportunities for MSMEs to realize their full growth and potential

Results of energy study conducted by WattSmart Philippines under the PCIEERD-GIA project show that the 3 major energy intensive MSME sectors are Food, Fabricated Metals, and Wood. Significant energy users attributed to cooling, heating, lighting, motor, other CO, process – cooling, and welding.

The call is in line with the PCIEERD thrust on Sustainable Energy and involves the Introduction of innovative renewable energy and energy-efficient technologies for Micro, Small, and Medium Enterprises (MSMEs) applications. These technologies should improve the energy utilization index, reduce energy consumption, and enhance product cost competitiveness of the MSMEs. These include projects on:

- monitoring and control systems for energy management
- energy sensors/actuators
- efficient thermal systems
- energy efficient prime mover systems
- cost-competitive applications of renewable energy systems, i.e. thermal applications using agri-wastes or solar.

The proponent should select an MSME partner for the actual installation and demonstrate the techno-economic advantages of these technologies. Baseline parameters should be indicated in the proposal, such as energy utilization index and the target improvements.

## **SHIP's Ballast Water and Biofouling Treatment Systems for Marine Vessels (SAILS) Program**

### **Background**

One of the important regulatory issues that confronts all ship owners of the Philippine registered marine vessels is compliance to the International Ballast Water Management (BWM) Convention (2004).

### **Current State in the Philippines**

The Maritime Industry Authority (MARINA), the lead agency for verifying compliance of BWM or specifically regulations pertaining to the management of ships' biofouling and ballast water management in the country, issued notices to all concerned stakeholders if they implement the said International Convention as far back as 2004. There is a compelling need therefore to the position of the MARINA that comply with Reg. D-2 discharge standards by installation of approved ballast water management systems.

### **Alignment in PCIEERD thrusts**

The Council in coordination with the MARINA and stakeholders has agreed to develop technologies such as projects to address the Ballast Water Management Convention (BWMC). Furthermore, this issue was also identified as one of the priorities of the PCIEERD's S&T Water Environment Roadmap under the Harmonized National R&D Agenda.

### **List of technologies on which proponents must focus on**

This is a call for submission of proposal that will address the following R&D concerns:

- Assess/characterize ballast water in board ships
- R&D on biofouling (micro and macro) control, and;
- Develop efficient and cost-effective ballast water treatment technologies
- Establish management operation protocols/systems derived from the above concerns
- Promotion of the technologies resulting from the project

The abovementioned concern will have to include in general, observation, measurement, sampling, evaluation and analysis of the effectiveness of any technology or methodology as well as including those caused by the organisms and pathogens that are present through ships' ballast.

### **Recommendation on partnership and collaboration**

Commitment letters from the concerned agencies shall be available prior to the evaluation of the successful proposals. Applications that will work with an industry partner are preferred. The research proposal should be implemented not more than two (2) years and a maximum budget of P15M.