

R&D PROJECT PROGRESS REPORT DECEMBER 2022



Technical Optimization of a distributed small modular nuclear reactor-solar photovoltaics hybrid energy systems (DSMPV-HES) in Malaysia
(IAEA Research Contract No. 25174)

1 April 2022 - 30 April 2026

Presented by:

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PROJECT BACKGROUND:

- Malaysia is at a tipping point in the fight against the climate and biodiversity crises, as it steps up efforts and commitments to **transition to a low-carbon and climate-resilient economy**.
- **Malaysia's energy transition plans until 2040** will focus on its **power generation plan**. The **12 Malaysia Plan** has outlined Malaysia's path to **net zero emissions**, including achieving carbon neutrality **by 2050**.
 - **Phasing out coal**-powered energy generation.
 - **Renewable energy (RE)** generation is targeted to increase to **31%** of the total installed capacity in the country **by 2025**, as solar energy has the highest potential.
- However, **RE** sources facing issues such as **intermittent** in nature, require **large land** area, and also dependent on **geographic positions** and **climatic conditions**. Besides, **nuclear energy (NE)** is also having some limitations including **government policies** and **public apprehensions**.
- To overcome these hurdles, **the integration of these two carbon-free technologies** can be proposed and form a **nuclear-renewable hybrid energy system**. The hybrid energy system between NE and RE will offer a low-carbon energy technologies in terms of cleaner production to ensure the **energy transition to low-carbon system** is successful.



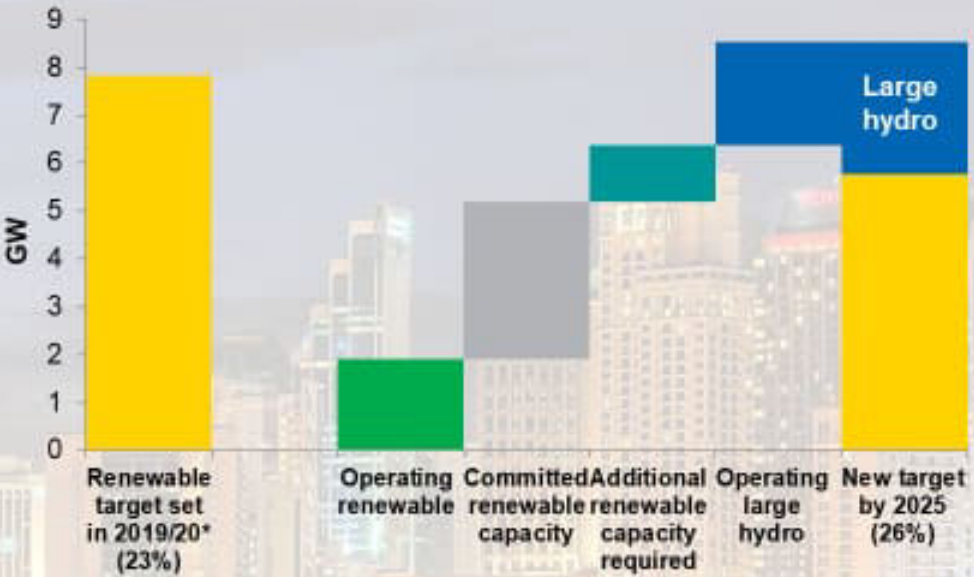
PROJECT BACKGROUND:



Malaysia energy transition plan's affordability concerns: Lower renewable additions and a coal phase out



Peninsular Malaysia renewable target



* Large hydro was NOT included in the previous target

Coal to gas transition



7GW coal retirement by 2033

Coal plants will be retired at the end of 25 years PPA term

0 new coal projects

Malaysia will not be building new coal power plants

60%~ gas demand increase

To replace the coal plants and serve the increasing demand

PROBLEM STATEMENT:

- Malaysia has set a goal of becoming **carbon-neutral by the year 2050**. To reach the aim, the energy transition plan will concentrate on its power generating strategy.
 - Phased-out the current 7000 MW of coal-fired PP in 2033
 - 31% RE in 2025, 40% RE in 2035
 - Current installed RE capacity: 7,995 MW (20%)
 - Expected to more than quadruple to 18,000 MW by 2035- mainly from solar PV
- However, **solar facing various challenges** need to be tackled and properly manage if the country decides not to depend on fossil fuels.
 - Intermittency
 - Vulnerability
 - battery storage
 - acquisition of land and materials
 - low efficiency of capacity factors
- There is a **need to support variable renewables (VRE)** with **long term energy storage** or **alternative**, flexible power sources because of the variability in the generation of renewable energy sources such as solar and the electricity demand.
- Since **nuclear energy is considered as one of the option for low carbon generating technologies** and able to **meet the base-load electricity demand**, there is an increased interest in exploring the **synergies of nuclear and renewable energy sources**.



PROJECT OBJECTIVES :

The overall objective and specific objectives of the project is revised based on the outcome from the 1st Research Coordination Meeting CRP I32012 on Technical Evaluation and Optimization of Nuclear-Renewable Hybrid Energy Systems, 12–15 December 2022, Vienna, Austria.



	Original	Amendment
Overall Objective:	To explore the potential economic and environmental benefits of a distributed small modular nuclear reactor solar PV(DSMPV) for electricity generation in Malaysia.	To explore an optimal distributed small modular reactor - solar hybrid energy system (DSMPV-HES) for efficient and sustainable utilization of renewable energy for national electricity generation.

PROJECT OBJECTIVES :

The overall objective and specific objectives of the project is revised based on the outcome from the 1st Research Coordination Meeting CRP I32012 on Technical Evaluation and Optimization of Nuclear-Renewable Hybrid Energy Systems, 12–15 December 2022, Vienna, Austria.



	Original	Amendment
Specific Objectives:	<ol style="list-style-type: none">To explore the potential area/ site of DSMPV hybrid system in Malaysia using MCDA analysis geographical area, current energy demand, population, etc.)To develop the potential design of the DSMPV hybrid system in Malaysia using HOMER software.To simulate and optimize the DSMPV hybrid systemTo study economic and environmental impact of the DSMPV hybrid system in Malaysia using LCIA and LCCA system.To determine the effects of technologies of SMR and solar PV using sensitivity analyses such as GHG emission, life span, return of investment (ROI), etc.	<ol style="list-style-type: none">To develop a conceptual design of a distributed hybrid energy system with small modular nuclear reactor, solar photovoltaics, and battery energy storage system (DSMPV-HES);To perform technical evaluation and optimization of the proposed DSMPV-HES for different technical and operational environments that support Malaysia's long-term renewable energy transition policies;To perform sensitivity analyses for the system to obtain more realistic and optimal design of proposed DSMPV-HES.

MILESTONE ACHIEVEMENT



No	Milestone Description	Completion Date		Achieved Yes/No
		Plan	Actual	
1	To develop a conceptual design of a distributed hybrid energy system with small modular nuclear reactor, solar photovoltaics, and battery energy storage system (DSMPV-HES). Software: DEMOLICA	Jan 2023 – Dec 2023	Jan 2023 – Dec 2023	In-progress
2	To perform technical evaluation and optimization of the proposed DSMPV-HES for different technical and operational environments that support Malaysia's long-term renewable energy transition policies. Software: DEMOLICA	Jan 2024 – Dec 2024	Jan 2024 – Dec 2024	Not started yet
3	To perform sensitivity analyses for the system to obtain more realistic and optimal design of proposed DSMPV-HES.	Jan 2025 – Dec 2025	Jan 2025 – Dec 2025	Not started yet

PROJECT ALLOCATION : € 7 500

Installment	Payment Schedule	Amount in Euro
1	An initial installment to be paid within thirty (30) days from the entry into force of this Contract	€ 2 500 (Two Thousand Five Hundred)
2	Installment to be paid upon the certification by the appropriate officer of the IAEA for the Research Project that the progress report required under Article 3 (“Implementation of the Research Project and Reporting”) of this Contract has been received in due time and accepted by the IAEA	€ 2 500 (Two Thousand Five Hundred)
3	Installment to be paid upon the certification by the appropriate officer of the IAEA for the Research Project that the progress report required under Article 3 (“Implementation of the Research Project and Reporting”) of this Contract has been received in due time and accepted by the IAEA	€ 1 250 (One Thousand Two Hundred Fifty)
4 Final Payment	A final installment to be paid upon the completion of the Research Project and on the certification by the appropriate officer of the IAEA for the Research Project that the final report required under Article 3 (“Implementation of the Research Project and Reporting”) of this Contract has been received in due time and accepted by the IAEA.	€ 1 250 (One Thousand Two Hundred Fifty)



PROJECT ALLOCATION :

2022-2026: Euro 7500.00

2022-2023: RM11,113.52



VOT	Year	RM	EXPENDITURE(RM)
R25174: Potential and optimization of a distributed small modular reactor-solar PV(DSMPV) for electricity generation in Malaysia	2022-2023	11,113.52	-
		TOTAL	-

PROJECT OUTPUTS

(PRODUCTS/PROCESS/SOFTWARE/IP/PUBLICATION)



1. IAEA Technical document for CRP project
2. Technical Report entitled Potential of distributed small modular nuclear reactor-solar photovoltaics hybrid energy systems (DSMPV-HES) in Malaysia.
3. Two publications.
4. One PhD student.

ISSUE/PROBLEM & RECOMMENDATION



1. The overall objective and specific objectives of the project is revised based on the outcome from the 1st Research Coordination Meeting CRP I32012 on Technical Evaluation and Optimization of Nuclear-Renewable Hybrid Energy Systems, 12–15 December 2022, Vienna, Austria.
2. Realignment of the project. Starting from 2023-2026.
3. Inclusion of a new project member from UNITEN.



Thank You

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UNTUK KELULUSAN	UNTUK PERAKUAN	UNTUK PEMAKLUMAN
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CADANGAN MELAKSANAKAN PROSES PELAWAAN BAGI CADANGAN (RFP) UNTUK PEMASANGAN TIANG LAMPU JALAN SOLAR/LED DI KAMPUS BANGI UNIVERSITI KEBANGSAAN MALAYSIA

1.0 TUJUAN

Kertas ini bertujuan untuk memohon perakuan dan kelulusan Mesyuarat Pengurusan Universiti (MPU) bagi cadangan melaksanakan proses RFP untuk pemasangan tiang lampu jalan solar/LED di kampus Bangi Universiti Kebangsaan Malaysia (UKM).

2.0 LATAR BELAKANG

- 2.1 Teknologi dan amalan tenaga yang boleh diperbaharui masa kini semakin rancak dalam kehidupan harian. Lebih-lebih lagi kecekapan penggunaan lampu solar/LED mampu menyediakan pencahayaan berkualiti tinggi.
- 2.2 UKM komited terhadap kelestarian tenaga hijau untuk masa depan yang mampan, mengurangkan jejak karbon dan menjadi penyelesaian inovatif kepada industri tenaga. Oleh itu, cadangan melaksanakan pemasangan tiang lampu LED solar telah diambil kira untuk menyahut kelestarian tenaga hijau tersebut.

3.0 TEMPOH MASA PELAKSANAAN (*TIME FRAME*)

- 3.1 Cadangan tempoh masa pelaksanaan bagi pemasangan tiang lampu jalan solar/LED adalah seperti di **Lampiran 1**.

4.0 ULASAN PENTADBIRAN

- 4.1 Tenaga solar merupakan salah satu sumber yang boleh diperbaharui. Dengan kewujudan matahari, tenaga ini akan sentiasa dihasilkan sekaligus membawa kepada penjimatan.
- 4.2 Tenaga solar kini menjadi suatu keperluan yang boleh digantikan dengan tenaga elektrik. Tenaga lampu solar adalah jauh lebih jimat berbanding tenaga elektrik. Penjimatannya adalah bergantung kepada saiz dan jenis lampu solar yang digunakan.

- 4.3 Penggunaan tenaga solar ini akan membantu UKM dalam mencapai *Sustainable Development Goals* (SDG) bagi bahagian SDG 7 iaitu *Affordable and Clean Energy* dan seterusnya menaikkan kedudukan UKM dalam ranking berkaitan dengan Kelestarian (*Sustainability*) seperti *UI GreenMetric World University Rankings*, *QS World University Rankings: Sustainability* dan *Times Higher Education (THE) Impact Rankings*.
- 4.4 Penggunaan lampu solar juga tidak memerlukan banyak penyelenggaraan berbanding dengan tenaga elektrik. Perbelanjaan penyelenggaraan lampu solar/LED adalah jauh lebih rendah. Jangkaan hayat bateri bagi lampu solar adalah sekitar tiga (3) hingga lima (5) tahun.
- 4.5 Antara jenis kuasa lampu yang dicadangkan adalah 50 watt, 60 watt dan 90 watt memandangkan penggunaan tenaga secara bulanan untuk setiap kuasa adalah berbeza.
- 4.6 Untuk jenis kuasa lampu yang lebih tinggi, pemasangannya akan difokuskan kepada beberapa tempat yang terlibat.

5.0 SYOR

- 5.1 JANA@UKM mengesyorkan proses RFP dilaksanakan untuk cadangan pemasangan tiang lampu solar/LED di dalam Kampus Bangi, UKM atas sebab yang berikut:
 - i) Memperoleh penjimatan dari segi bil elektrik; dan
 - ii) Memperoleh penjimatan kos (kos ditanggung oleh syarikat bagi aktiviti pemasangan dan penyelenggaraan).

6.0 PERAKUAN

- 6.1 Mesyuarat Pengurusan Universiti (MPU) dengan segala hormatnya dimohon untuk meneliti kertas cadangan ini dan seterusnya memperaku dan meluluskan:
 - i) Cadangan melaksanakan proses RFP bagi pemasangan tiang lampu solar/LED di Kampus Bangi UKM; dan
 - ii) Memperakukan JANA@UKM untuk merundingkan terma-terma yang terbaik dengan kerjasama Pejabat Penasihat Undang-Undang (PPUU) dan Jabatan Pembangunan Prasarana (JPP).

Disediakan oleh:

Pusat Pengurusan Penjanaan UKM (JANA@UKM)

Tarikh: 27 Julai 2023

Tempoh Masa Pelaksanaan Pemasangan Tiang Lampu Jalan Solar/Led Di Kampus Bangi UKM

Bil	Keterangan Aktiviti	BULAN																								
		Ogs				Sep				Okt				Nov				Dis				Jan 2024				
		Minggu	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Kelulusan MPU untuk melaksanakan RFP		■																							
2	Penyediaan Dokumen RFP			■	■																					
3	Lantikan JK Penilai			■	■																					
4	Iklan kepada pembida berpotensi					■	■	■	■																	
5	Sesi taklimat dan lawatan tapak								■																	
6	Tarikh buka pembelian dokumen RFP								■	■	■															
7	Penyediaan kertas cadangan oleh syarikat									■	■	■	■													
8	Tarikh tutup penyerahan kertas cadangan												■													
9	Mesyuarat JK pembuka RFP													■												
10	Sesi temu bual/pembentangan pembida														■											
11	Mesyuarat pemilihan pembida berjaya															■										
12	Penyediaan dan semakan kertas kelulusan ke MPU																■									
13	MPU Kelulusan Pembida Berjaya																	■								
14	Hebahan pembida berjaya																		■							
15	Tandatangan SST																			■						
16	Penyediaan Kontrak Perjanjian																			■	■	■	■	■	■	■
17	Menandatangani kontrak perjanjian																							■		
18	Pelaksanaan Projek																				■	■	■	■	■	■