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The National Battery Research Institute “Powering Indonesia Battery’s Revolution”

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Abstract. Batteries are a key technology to achieve Paris Agreement and support the United Nation Sustainable Development Goals (UN SDGs). As the fourth largest populations in the world, Indonesia has to prepare the energy transition from fossil fuels to the renewable energy in order to reduce the CO₂ emission. Given the situation, the existing of a consortium that focus on the strategic planning of battery and renewable energy is urgently required. Therefore, a National Battery Research Institute (NBRI) is founded. NBRI is Indonesia's independent institute for electrochemical energy storage science and technology, supporting research, training, and education. The Institute aims to contribute to the overall research capacity and training environment in Indonesia in battery and renewable energy research. NBRI is a platform that brings together scientists, academicians, industry partners, the government and all stakeholders that focus on battery and renewable technology. The main goal of NBRI is to encourage and support a battery manufacturing industry using locally resources, which will enable Indonesia to be independent in energy. NBRI was legally established on 17th December 2020 as The Center of Excellence Innovation of Battery and Renewable Energy Foundation. The NBRI establishment was supported by the Global Challenge Research Fund (GCRF), UK, through the cooperation with Queen Mary University of London (QMUL), UK. Prof. Dr. Evvy Kartini and Prof. Dr. Alan J. Drew became a Founder and a Co-Founder of NBRI, respectively. **Keywords:** *The National Battery Research Institute (NBRI), Global Challenge Research Fund (GCRF), Center Excellence Innovation, Sustainable Development Goals (SDGs), Battery manufacturing industry, Renewable Energy, Local resources.*

INTRODUCTION

Grand Design of NBRI

Batteries are a core technology to realize the energy transition and broaden energy access around the world. Batteries are also a key technology to achieve the UN Sustainable goals. The decarbonization through the application of electric vehicles is one of the examples. However, Development of lithium-ion batteries will play an important role in achieving innovative sustainable energy. After the Paris Agreement at the COP in 2015, the Indonesian government has released a Presidential Decree No.55/2019, namely the acceleration of battery electric vehicles transportation. In order to reduce the production cost of such batteries, the Indonesian government has a strategy to use local resources. Since battery technology is crucial, therefore, it should be part of the National Industrial Strategic Plan. Due to these reasons, a National Consortium on Lithium-Ion Battery for Solar Street Lamp was formed in 2016 and it was supported by the Ministry Research Technology and Higher Education through the National Innovation System (INSINAS) [1]. Its aims to gather the researchers working on battery research into one renewable energy program, with the main goal to provide a solution for energy storage. Furthermore, the goal was to build the National Battery Research Institute (N-BRI), that can provide solutions for battery science and technology

from research straight into application. Therefore, the NBRI has to be established as one of new strategic planning for Indonesia to reach the goal of independency on energy. The emerging of battery research in Indonesia even has been earlier discussed and presented at the International Conference Women in Physics in Canada 2014 [2].

The original concept of National Battery Research Institute (NBRI) was founded by Prof. Dr. rer nat Evvy Kartini in 2014, as shown in Figure 1. As a consortium, NBRI has various and strong members related to energy storage. Bringing together expertise from universities and industry, as part of the national Battery Challenge, the NBRI endeavours to make Indonesia the go-to place for the research, development, manufacture and production of new electrical storage technologies for both the electronics, automotive industries and the wider. Not only Indonesia, NBRI members and partners include researchers and institutions from the United Kingdom's (UK), Australia, Japan, Singapore, etc.

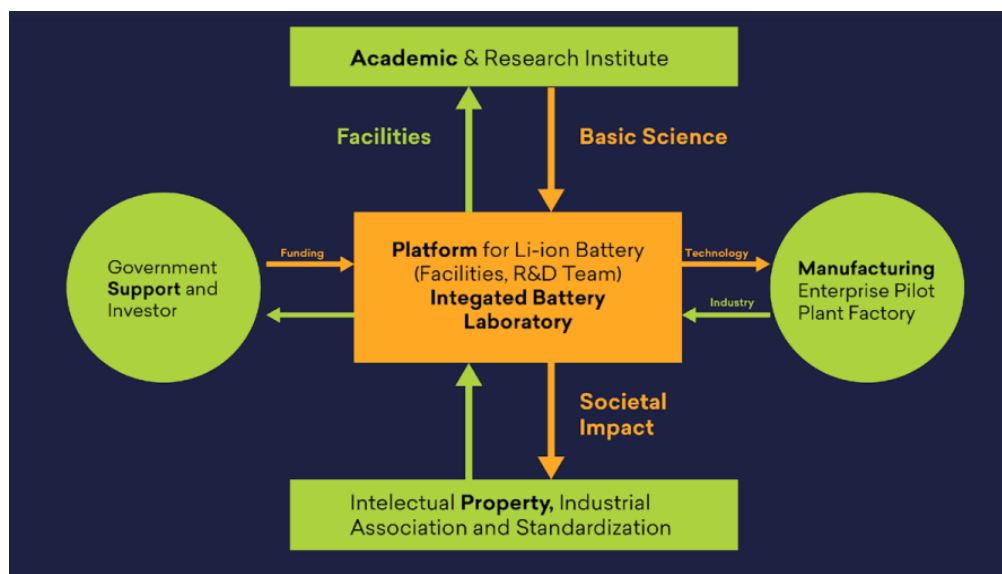


FIGURE 1. The original concept of NBRI founded by Prof. Dr. Evvy Kartini

In 2020, NBRI become Indonesia's independent institute for electrochemical energy storage science and technology, supporting research, training, and education. NBRI aims to contribute to the overall research capacity and training environment in Indonesia in Battery and Renewable Energy Research. We bring together scientists and industry partners on research projects to reduce battery cost, weight, and volume; to improve performance and reliability; and to develop whole life strategies including recycling and reuse. NBRI was legally established on 17th December 2020 as The Center of Excellence Innovation of Battery and Renewable Energy Foundation. The NBRI establishment was supported by the Global Challenge Research Fund (GCRF), UK, through the cooperation with QMUL. Prof. Dr. Evvy Kartini and Prof. Dr. Alan J. Drew became a Founder and a Co-founder of NBRI, respectively.

NBRI History

NBRI is a spin-off of the Material Research Society Indonesia (“MRS-INA”) which was established on April 15, 2011. The goals of MRS-INA are to promote the materials research activities in Indonesia into the International forum by representing the materials research societies in Indonesia to the International Union of Materials Research Society (IUMRS). Another goal is to open national and international networking in the field of materials research, and to promote its applications in various areas of industries. MRS-INA is also responsible to educate and train young researchers or students about the materials knowledge and characterizations. MRS-INA now has more than 400 members from industry, government, academia and research laboratories, who meet regularly to discuss recent technological developments of functional materials. The International Conference on Materials for Advanced Technology and International Conference on Multidisciplinary Research (ICAMT-ICMR) was held in Sentul, Indonesia, October, 2019. During the conference, the National Battery Research Institute (NBRI) was launched as a battery consortium in Indonesia, with the aim is to gather all stakeholders on battery research and development [1].

This idea was later captured by Prof. Alan J.Drew who later became interested in realizing the form of the NBRI (Figure 2). After the conference was over and as a form of implementation of the MoU between MRS-INA and QMUL, Prof. Alan and Prof. Evvy submitted a GCRF proposal funding to establish NBRI. In early 2020, the proposal was accepted and we received funding from GCRF to establish NBRI.



FIGURE 2. The establishment of NBRI through the cooperation between MRS-INA and QMUL (2019) with the support from the GCRF (2020-2021). The Faraday Institution became the benchmark of NBRI.

Vision and Mission

Our vision for the NBRI is to gather all Indonesian stakeholders in battery research and production, to help form strong national batteries research and increase the visibility of batteries research at government level. NBRI wants to help develop a batteries manufacturing industry using locally sourced resources, which will enable Indonesia to be independent in energy. The NBRI milestone is figure out in figure 3 [3].



FIGURE 3. The NBRI Milestone for short-medium term plan.

There are several institutes that exist in the world which inspire NBRI's vision. NBRI adopts some of their values and activities and implements them in Indonesia, for example the Faraday Institution in UK. The Faraday Institution is the UK's independent institute for electrochemical energy storage research, skills development, market analysis, and early-stage commercialization in the UK [4]. What is benchmarked from the Faraday Institution, that it delivers training to the next generation of battery scientists and engineers, who will go on to work in both academia and industry and be responsible for facilitating the transition of new technologies to market. Powering Indonesia Battery's Revolution is the quote for NBRI, adopted from FI. There are other center excellences worldwide that also inspired NBRI, such as UKBIC. It is a key part of the Faraday Battery Challenge (FBC) [5], Silicon Valley is the U.S. center for innovative technology companies [6]. There are also several center excellence institutions on battery, such as Volkswagen Center of Excellence for Battery Cells, In addition to Group research, the Center of Excellence (CoE) for Battery Sells plays a key role in Volkswagen's battery strategy. The CoE takes Group-wide responsibility for the development, procurement and quality assurance of all battery cells [7], Europe: a global center of excellence for batteries, whereas stated that Europe's clean energy future depends on plugging-in all battery technologies. [8] and Consortium for Battery Innovation [9]. The Fraunhofer Research Factory for Battery Cells FFB sees itself as part of an excellent German battery research landscape, in which it fulfils the role of a specialist for production technologies with advanced technological maturity (TRL > 6) [10].

NBRI ACTIVITIES

Since the institution/foundation was formed in early 2020, the NBRI have delivered 16 Focus Discussion Groups including four separate meetings ministers (Minister for Transport and Minister for Research and Technology) as well as many other stakeholders (including BATAN, PT LEN Industri, National Standardization Agency, Panasonic Indonesia, Indonesian Automotive Institute, Systra, British Embassy, B4T and PT Komatsu). Typically, between 100 and 150 people attend these events, where keynote speakers present their views on topical areas, which is followed by a discussion forum. In 2021, the NBRI has delivered three international events. The International Battery School (IBS2021) and The International Conference on Battery and Renewable Energy (ICB-REV2021) [11], were held in June 2021. The school was delivered by the international speakers, and attended by students and researchers from various institutions. The ICB-REV 2021 has been successfully conducted, by bringing in more than 40 speakers from more than 15 countries. The participants have taken part not only as presenters but also submitting the articles, which will be published in international proceeding indexed by Scopus (AIP Proceeding 2021). Some of them are to be published in International reputed journals. The Climate Challenge Workshop (CCW), was held in July 2021. [12] The Climate challenge workshop has been successfully delivered. The CCW was jointly organized with the QMUL, UK, and it was supported by the British Council, with the total Prize 30K GBP. Those prizes have been delivered to three winners of Climate Challenge Awards and The Travel Dissemination Awards. During the CCW, the training of Climate Challenge Workshop was delivered by experts from UK and Indonesia [12]. Furthermore, an industrial training has also been delivered to the engineers of PT. Komatsu Indonesia.

Besides the training and skill developments, NBRI have provided internship programs for undergraduate and fresh graduate students. There were more than 10 interns from various universities attended the program, coming from ITB, UNPAD, UI, UNDIP, STTN, UAI, Binus University, Pertamina University, UNAIR, UIN, etc. Their topics ranging from developing materials NMC for cathode, Graphene from rice husk, battery management system, smart solar street light, Power wall, electric bike, etc. [13,14] NBRI manages also one of the Indonesia National Research Priorities (NRP) Mandatory from the Ministry Research and Technology [15] The program is related to explore the potential of local mineral resources, such as nickel, manganese and cobalt to become the NMC cathode materials. In addition, the prefeasibility study of the local mineral resources for battery, as well as the study on 2 wheels electric vehicles in the market. The new system of cathode production has been designed and constructed. The technology process of mineral to cathode was submitted for patent as one of the Indonesian Intellectual Property Rights. Furthermore, most of the NRP members have contributed the articles to be presented at the ICB-REV 2021. Their articles are now being processed for publication in the international proceeding indexed by scopus and some have been published in international journals [16-18]. Those results have shown the successful and fruitful collaborations among these institutions BATAN, ITB, LIPI, INFIEN and NBRI. NBRI has managed the NRP professionally.

CONCLUSION

The NBRI is fast growing institute, within short periods has been delivered several important issues towards the battery development and renewable energy. Its exposure has been widely spread out globally. Various topics towards the sustainable development goals have been discussed in various forms to broad audiences. The topics are ranging from materials, electric mobility, renewable energy, until the important of nickel as source of battery components. The battery as key technology for sustainable development goals will be in line with the NBRI activities.

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REFERENCES

1. E Kartini, W.Honggowiranto, Sudaryanto, A.Purwanto, "Indonesian consortium of lithium ion battery for solar street lamp", 2018 *IOP Conf. Ser.: Mater. Sci. Eng.* **432** 012063.
2. E.Kartini, "Emerging battery research in Indonesia: The role of nuclear applications", *AIP Conference Proceedings* **1697**, 100001 (2015); doi: 10.1063/1.4937703.
3. E.Kartini, J.A.Drew, M.Firmansyah, A.T.Wiguna, GCRF Report on the Establishment NBRI (2020), unpublished.
4. The Faraday Institution, Powering Britain's Battery Revolution, <https://www.faraday.ac.uk/>
5. UK Battery Industrialization Centre, <https://www.ukbic.co.uk/> Retrieved Dec., 2020.
6. Malone, Michael S. (2002) *The Valley of Heart's Delight: A Silicon Valley Notebook 1963 - 2001*. New York: John S. Wiley & Sons. p. xix. ISBN 9780471201915. Retrieved July 28, 2020.
7. Volkswagen Center of Excellence for Battery Cells, <https://www.volkswagenag.com/en/news/stories/2019/09/battery-cell-assembly--pilot-line-started.html#> Retrieved Sept. 28, 2020.
8. CTF -Europe: a global centre of excellence for batteries <https://chargethefuture.org/blog/europe-a-global-centre-of-excellence-for-batteries/> Retrieved July 28, 2021.
9. Consortium for Battery Innovation, <https://batteryinnovation.org/cbi-research-team-visit-japanese-energy-storage-and-advanced-lead-battery-manufacturing-hub/> retrieved 29 June 2020.
10. The Fraunhofer Research Factory for Battery Cells, <https://www.fraunhofer.de/en/institutes/cooperation/research-factory-for-battery-cells.html> Retrieved Oct.11, 2021
11. International Conference on Battery, Renewable Energy and Electric Vehicle (ICB-REV) 2021 <https://n-bri.org/event/icb-rev-2021> Retrieved June 24, 2021.
12. Climate Challenge Workshop (CCW) 20201, <https://n-bri.org/event/climate-challenge-workshop> Retrieved July 28, 2021.
13. Early Career Researcher, <https://n-bri.org/education-and-skill/early-career-researchers> Retrieved Sept.1, 2021
14. Undergraduate Internship, <https://n-bri.org/opportunities/undergraduate-internships> Retrieved Oct.15, 2021
15. <https://n-bri.org/research/indonesia-national-research-priority> Retrieved July 1, 2021
16. E.Kartini, Valentina Yapriadi, Heri Jodi, Maykel Manawan, Cipta Panghegar, Wahyudianingsih, "Solid electrolyte composite Li₄P₂O₇-Li₃PO₄ for lithium ion battery", *Progress in Natural Science: Materials International* **30** (2020) 168–173.
17. Maykel Manawan, Evvy Kartini and Maxim Avdeev, "Visualizing lithium ions in the crystal structure of Li₃PO₄ by insitu neutron diffraction", *J. Appl. Cryst.* (2021). **54**, 1409–1415
18. Andam Deatama Refino, NursidikYulianto, Iqbal Syamsu, Andika Pandu Nugroho, Naufal Hanif Hawari, Alina Syring, Evvy Kartini, Ferry Iskandar, Tobias Voss, Afriyanti Sumboja, Erwin Peiner&Hutomo Suryo Wasisto, "Versatily tuned vertical silicon nanowire arrays by cryogenic reactive ion etching as a lithium ion battery anode" *Scientific Reports* (2021) 11:19779, <https://doi.org/10.1038/s41598-021-99173-4>