

Keynote Talk

APPLIED ENERGY WITH CLEANER ENVIRONMENT AND SMARTER SCHEMES TOWARDS INDUSTRY 4.0

Presented by:

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INTRODUCTION

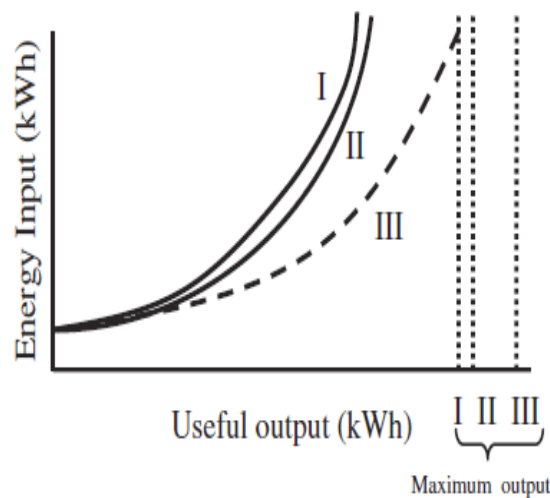
Applied energy refers to energy conversion when applied to energy systems for useful work production. Useful work output increases with higher energy efficiency and cleaner energy schemes.

In recent years, major focus has been given to smart, clean energy systems and their potential for improving the overall power generation. As a result, many countries around the globe are now adopting various smarter, greener technologies coupled with optimum power and best practice environmental management.

All these strategies when integrated with industrial digital transformation such as data visualization via real-time monitoring, internet of things, total automation, and so forth, lead to the Industry 4.0 notion.

What is hybrid green energy?

- Clean & green;
- Sustainable; and
- Smart



The energy performance curves. The PV scheme (I), The hybrid PV/hydro scheme (II), and the combined PV/hydro/fuel cell scheme (III).

Introducing an inactive (idle) energy input, E_1^0 into Eq. (1), and expressing in terms of E_{Loss}^0 and E_{Excess}^0 as follows:

$$E_1^0 = E_{\text{Loss}}^0 + E_{\text{Excess}}^0 \quad (\text{At } E_0 = 0) \quad (3)$$

The net energy input efficiency, ϵ , therefore is,

$$\epsilon = \frac{\text{useful output}}{\text{total net input}} = \frac{E_0}{E_1 - E_1^0} \equiv \epsilon^o \left(1 - \frac{E_0}{E_{0, \text{max}}} \right) \quad (4)$$

Now, the energy performance equation can be established as in Eq. (5),

$$E_1 = E_1^o + \frac{E_0}{\epsilon^o \left(1 - \frac{E_0}{E_{0, \text{max}}} \right)} \quad (5)$$

Subsequently, energy performance curves, in terms of energy input vs. useful energy output, were drawn as in Fig. 5 based on equations above.

OBJECTIVES

To discuss the concept of smarter schemes and recent advancements in hybrid renewable energy technologies for energy conversion and how the hybrid energy systems may incorporate smarter and greener schemes towards Industry 4.0.

To address Sarawak's great potential and opportunity to make use of its ICT towards Industry 4.0 capabilities, provide further improvements to embrace such technologies.

To discuss on a conceptual design of a cleaner, smarter, megawatts level hybrid energy system at a typical selected seaside for both efficient rural-urban link electrical power generation and hydrogen production



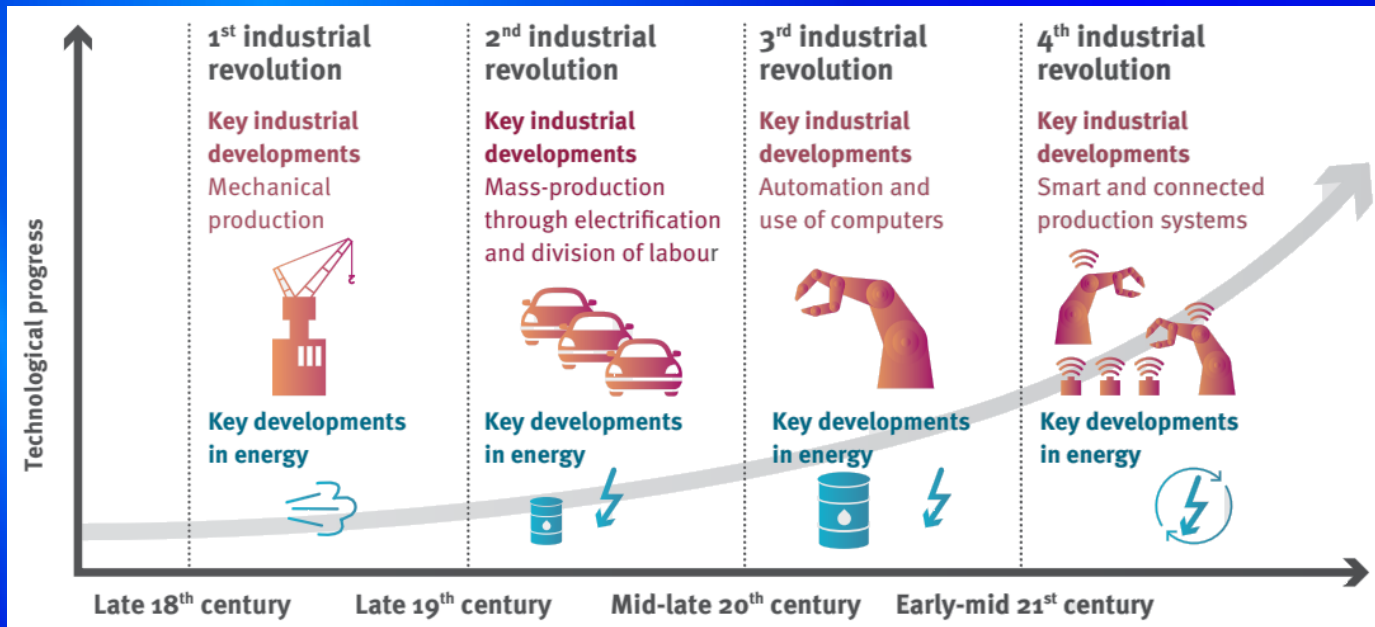
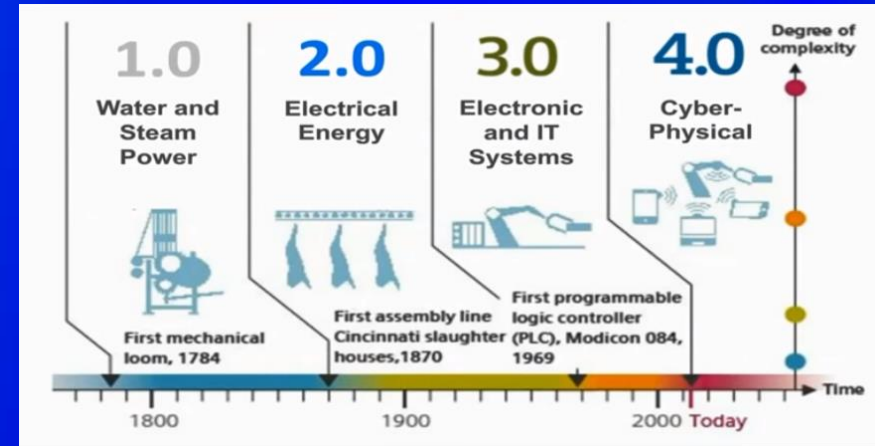
Clean Energy Management using IoT With the Industry 4.0 Standard

To overcome the challenges in clean energy management Industry 4.0 can give the digital economic acceleration in Sarawak, Borneo Island. To do so, clean energy (source: hydro/windmill/fuel) production can be merged with digital world by the use of **information technology**. So that the generation to distribution of the entire system will be **digitized and interconnected through cyber-physical systems framework**. These new state-of-the-art technologies offer increased deployment of renewable energy in manufacturing, reduced carbon emissions, optimized energy-use, heightened productivity and cost savings at an unprecedented scale. This transformation towards Industry 4.0 will involve **retrofitting** existing clean energy systems with Industry 4.0 technologies that could provide more sustainable solutions in Borneo Island.



Concepts of Industry 4.0

- Industry 4.0 evolutions:



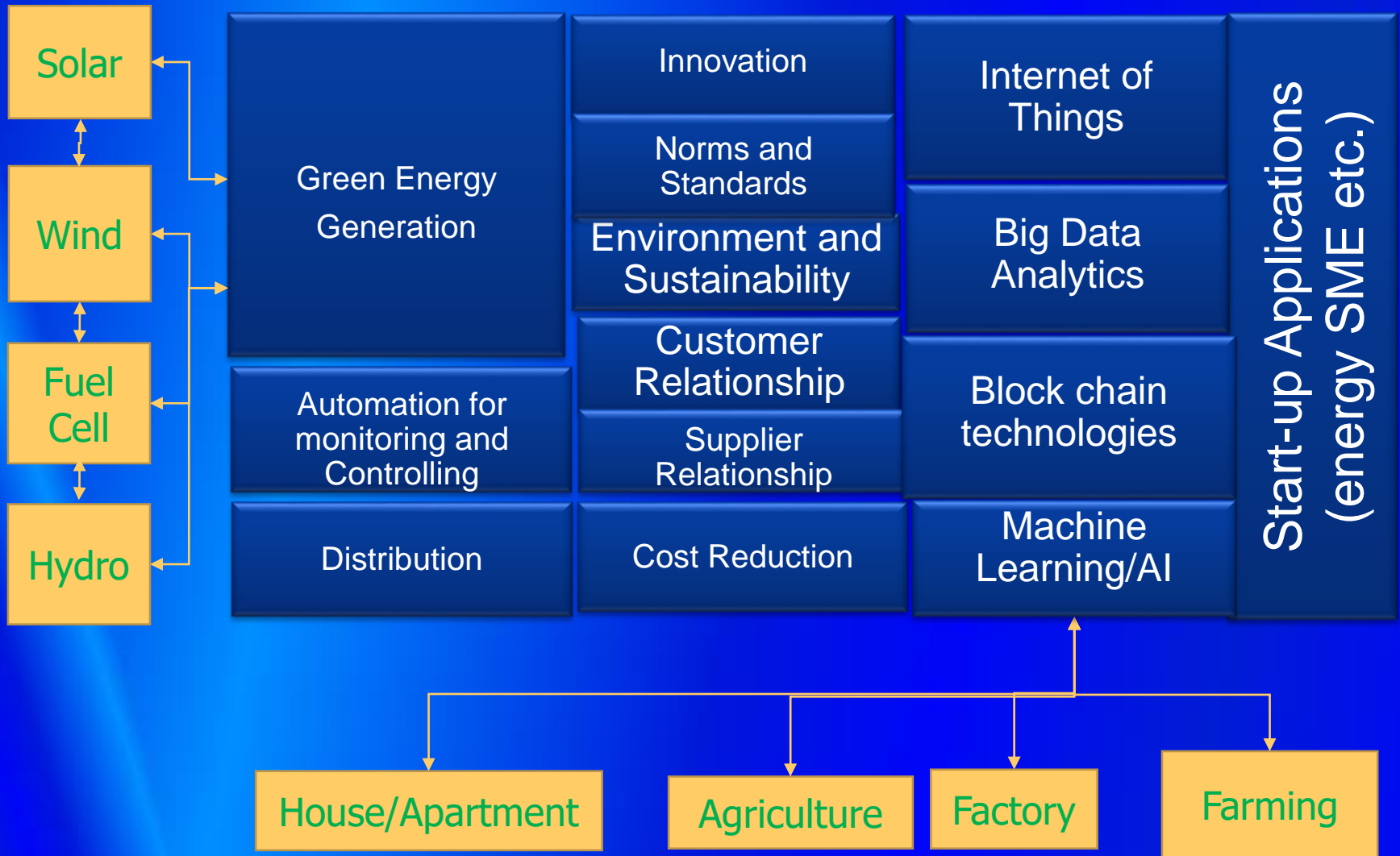


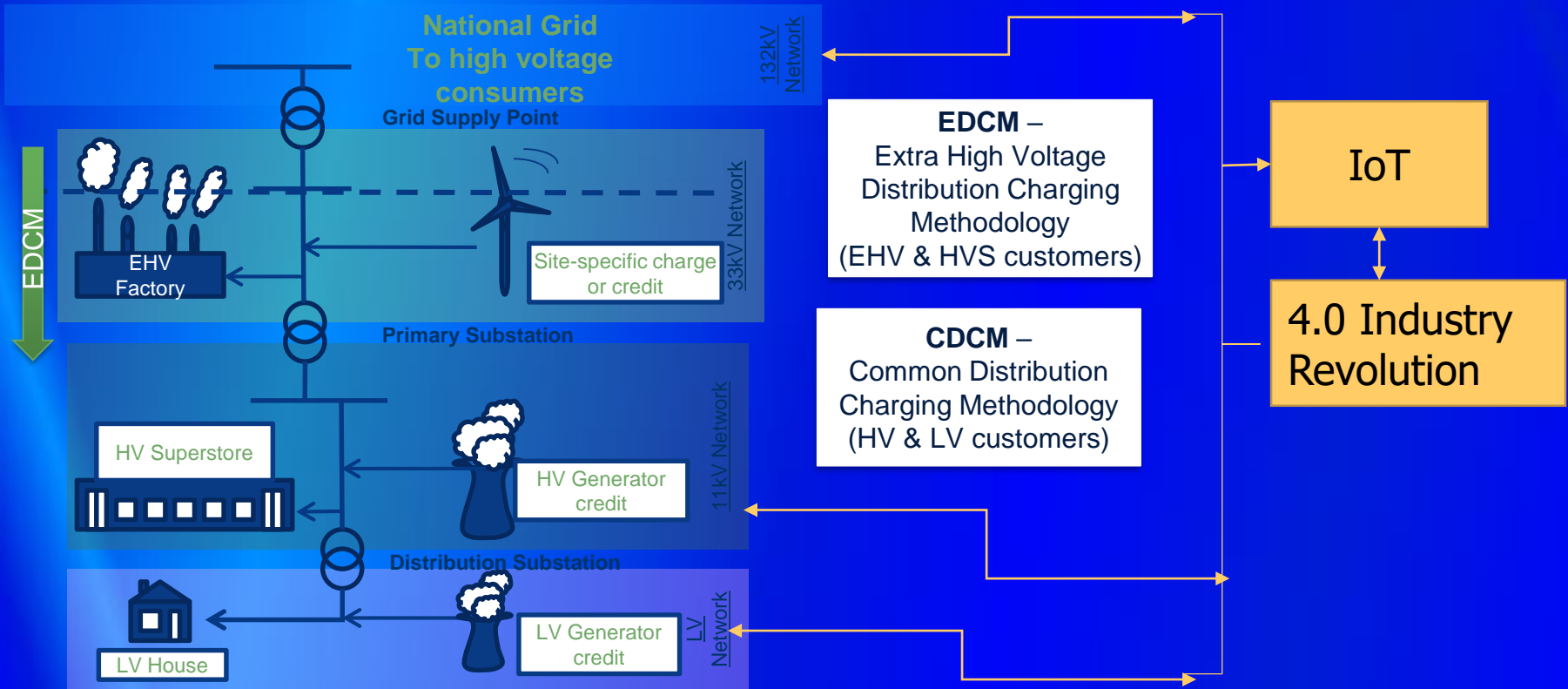
Impact of Industry 4.0 Standard in Clean Energy Management

- The IoT based Industry 4.0 Standardization, partnerships, and responsible policy design can lead up to maximizing the economic, social and environmental potentials.
- The framework of Industry 4.0 technologies can facilitates
 - Improvement of industrial energy efficiency in heavy industries
 - capitalize on the sustainable energy aspects, **smart rural electrification** in the present case.
 - Social impact in colleges, universities education in fostering entrepreneurship with the adoption of Industry 4.0 technologies.



Clean Energy Management Industry 4.0 Framework for Sarawak Smart Digital Economy







DIGITAL INFRASTRUCTURE

- To increase the broadband coverage and upgrade its speed and reliability;
- To optimise the utilisation of existing and new telecommunication and network infrastructure; and
- To achieve higher investment inflow in digital businesses

Across the board, Sarawak is committed to build a world-class ICT infrastructure, and is already addressing its **ICT infrastructure** covering broadband reach and speed, to achieve new dimension of economic development and growth.

The E-Commerce Transformation Plan will prepare all industry players to have the necessary resources and capabilities to drive the progress of industry sector in Sarawak.

Conclusion

The local state government already took initiatives to establish Industrial 4.0 in the Sarawak considering this smart rural electrification & smart cities.

The present Industry 4.0 frame work is huge potential to the Sarawak State, in terms of the digital economy and green energy sustainability.

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THANK YOU

