Low-Carbon Energy Performance Evaluation of ICT Enabled Smart City Models in ASEAN

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Overview

Cities consume a large amount of energy demanding more than 75% of world energy prodicution and genarting 80% of Green House Gas (GHG) emissions. Between now and 2030, the number of city dwellers in Association of South East Asia (ASEAN) countries is projected to rise from roughly 500 million to 900 million. Urbanization at this rate will significantly increase energy demand, as more energy will be required to support greater economic activity, expanded urban infrastructure, and the rising need for municipal services. In order to ensure that such growth is sustainable, the ASEAN enhanced coordination with relevant sectors to create low-carbon sustainable cities and strengthen the capacity of local governments in conducting GHG inventory. It also recommended to strengthen the effort of government, private sector and community in reducing emissions and pollutions for the betterment of the standard of living of the people. Now a days, the large and small districts in ASEAN are proposing a new city model, which represents a community of advanced Information and Communication Technology (ICT) size, interconnected with artificial intelligence and big data. For developing "the smart cities: and agreements among 26 cities in 10 cities has been established. These cities have to elaborate and develop action plans for low-carbon energy before rigorously establish implementation plans. The low-carbon energy actions establish the development of smart cities would also contribute to national objective of Paris Climate Agreement or Nationally Determined Contributions (NDC). Coordinating programs for renewable energy uptake, waste to energy conversion and energy efficiency improvements are obvious step and enables cities to become low-carbon, and utilities to target the most appropriate residents, businesses, and communities for retrofit and rebate programs. Smart cities, on the other hand represent an enthusiasm drive for efficiency through interconnected technologies to share energy resources. The rapid speed of urbanization has led many city governments to think how to utilize resources more efficiently as their citizens demand more of everything. They turn into more sustainable approaches to city development, resulting in the eventual visioning of smart cities. A model to evaluate the low-carbon energy performance of smart city is presented here and discussed in the context ASEAN smart cities vision and startegeis.

Methods

The conceptualization of smart city, varies from city to city. So far, leading the smart city pack in ASEAN region are Singapore, Malaysia, and Thailand Under the Smart City initiative, they aims to harness the use of digital and smart technologies to become a more economically competitive and livable cities. The Smart Nation plan outlines several key enablers like an e-payment gateway, smart urban mobility and a national digital identification system which would help it fulfil its low carbon ambitions. A fuzzy methodology for modelling and representing low-carbon energy use planning is developed, considering environment economy and society aspects. A multicriteria decision making approach through Key performance indicators (KPIs) to assess smart city readiness. The KPIs aim to fulfill the three main objectives of (i) promoting energy efficiency and encouraging the rational use of energy resources in power, waste, water and transport subsectors (ii) increasing the use of new and renewable energy sources as week as encouraging energy diversification through application of ICT technologies (iii) stimulating energy efficiency through application of big data analytics. In order to compare the differetent indicators, the standardization of values is derived through z-transformation (Yager, 1978). This methodology embeds an element of urban design which uses highly advanced technologies, wherein energy services is becoming one big and highly complex cypher-physical system, in which computer based algorithms improve the quality of the residents of the city and build a sustainable and clean environment for the residents of the city. The smart city represents an design architecture similar to industry 4.0 representing a next industrial revolution currently taking place or represents the equivalent of Energy 4.0 (Anbumozhi and Kimura, 2018).

Results

A smart city is a city well performing in six characteristics namely, smart economy, smart mobility, smart environment, smart people, smart living and smar goverancne (ASEAN, 2018). In the ASEAN 26 smart city network, these smart charctersitics are builit upon combination of endownmnets as illustred in figure 1. The objective is correctly establish the value to assign to indicator system. The assigned value provides sysnthetic description of the low-carbon energy transformation practice.

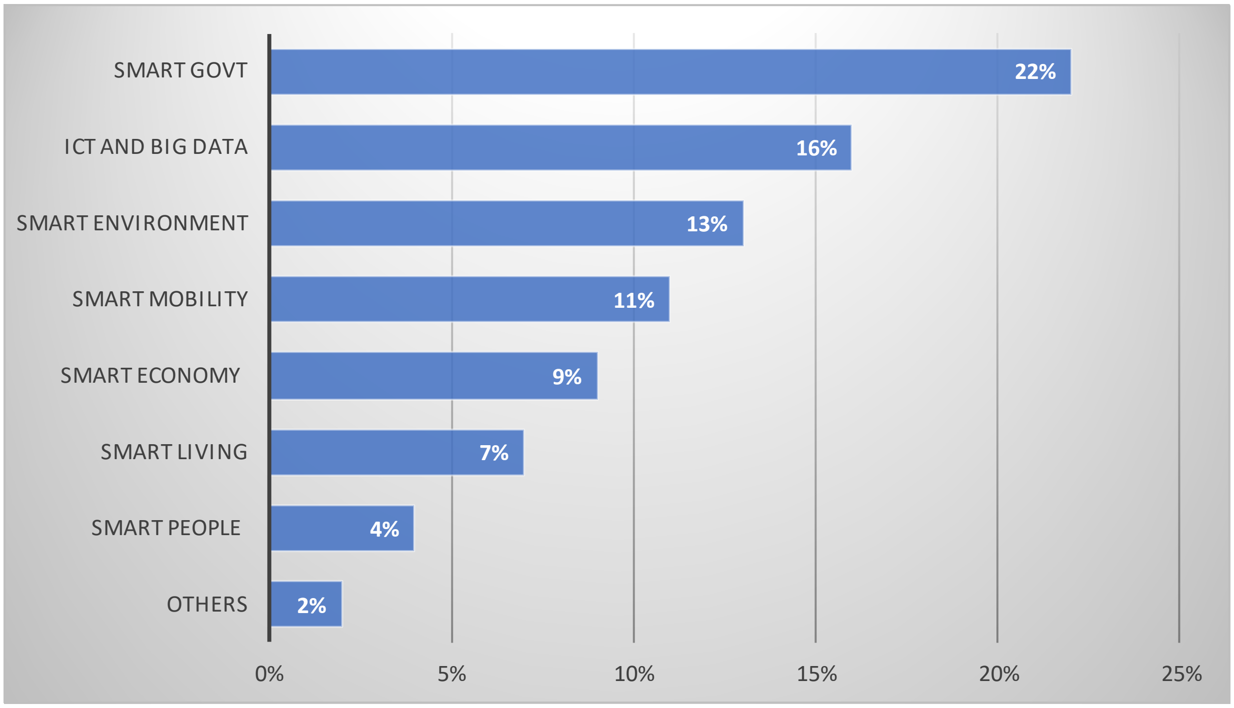

Fig 1. Constitutents of ASEAN smart City model

A low-carbon prespective that can be misleading in the selection of smart city ondicators is to consider the smart citu as measurable in a single ay. The relationship between smart city and low-carnon energy transition through ICT is interconnected. A set if 18 smart city indicators are found to be effective in the interconenctions. Since the codification in categoroes of smart city indicators eelcose in itself some elements low-carbon attributes, the technical defitition of an indicators in power, transport, waste, water sector justifies its use and purpose of ICT technology application on its charteristics. Some essential term for the predisposition of low-carbon energy transition within smart city indicators are (i) identification of the space and time context that is taken as reference (ii) decision on the type of low-carbon in infrastructure and the method to synthesise the carbon emissions and (iii) investigation of dome common areas that would characterise the definition of smart low-carbon cities. Therefore, it is possible to equip the policy maker with for readiness of smart city, to provide him the that put him in situation to attend and to estimate the effects of particilaur ICT intervention. An application for the smart cities of ASEAN through the weights calculated with fuzzy logic is conducted. The anlusi allows estimating the smart city in accordance with established goals of low-carbon, economy and inclusive society. For eacg ibdicaror a low carbon city goal, equal to 100 us determined without attributing to weights. Therefore each indicator can assume a value between 0 (min) and 100 (max). For the 26 cities in the ASEAN smart city network the proposed calacuation is applied. The results varied from 0.43 (Luong Prabong, Lao PDR) to 0.68 (Singapore). For the investigated cities, it is high lighted how some parameters widely respect low carbon city condition, and how other paratmers need further work for limting. It can also also been seen that only some parmeters do not respect the smart city concept, while other resepcts totally the established low-carbon transition goals.

Conclusions

The smart city represents the challenges and the opportunity with low-carbon energy transition. The applied methodology for calaculating smart and low carbon energy transition indicators highlights the importance of decision makers subjectivity in making ICT infrastructure decisions. The proposed assessment system allows examaination of different combination of means to achieve low-carbon transition.

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