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## **Introduction**

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## 1 Introduction

Energy is a prerequisite to economic development. Access to conventional energy sources, such as petroleum and electricity, is directly correlated with economic growth potential and community prosperity. For example, energy is necessary to operate the machine contained in factory's, to grow and harvest food crops capable of feeding entire

communities, and of course to facilitate the flow and delivery goods and services to consumers. Historical data has provided strong evidence that energy consumption (per capita) and GDP (per capita) are significant and consistently connected to each other, and this has remained true over time (Sheng et al., 2013). The access to and consumption of modern energy services – especially electricity – are key contributors to human development, as reflected in the UN sustainable development goals. Energy services help fulfil basic human needs, by enabling cooking, providing lighting and heating for warmth, and facilitating advanced needs such as improved health, access to transport and education. The World Bank (2017) regards individual’s access to electricity as one of the clearest and least-distorted indicators of a country’s energy poverty status. For many countries, accessible, reliable and affordable energy supply, lie among the key concerns for energy security and national prosperity (Li et al., 2016), and public policy connected to energy is of genuine strategic importance to a nation.

The realm of policy connected to energy has evolved tremendously in recent years. Increasing awareness of climate change has elevated energy policy to be global importance, as for example can be demonstrated by the Paris Accord. The rationale is simple: energy consumption typically creates pollutant emissions such as carbon dioxide into the air, and these pollutants remain in the atmosphere creating warming effects, and disperse around the atmosphere. The importance of the dispersion is that pollutant emission generated in one country become the burden of other countries too, hence policy design and action being elevated to be of global relevance. The traditional use of energy that generates significant emission is no longer favourable in the developed countries, and also increasingly less favourable in developing countries. Yet, despite concerns over the growing concentrations of carbon emission in our atmosphere, there remains a compelling need for more electricity and energy services throughout the world, particularly in less developed part.

According to the estimates by the IEA (2016), 6% of the global population lacks adequate access to electricity, while 38% of the world relies on the traditional use of solid biomass (i.e., wood/charcoal) for cooking. Asia has a significant share of these individuals. Designing policies to remedy these issues is complicated by the fact that about 80% of people who do not have access modern energy services are living in rural areas. These access challenges indicate that energy development and economic and social development needs to address disadvantaged groups between countries and within countries. To further complicate things, while emissions reduction is of paramount importance, developing countries also have a ‘duty’ to provide modern lifestyles for their people, which inevitably requires increased energy consumption. The goals of emissions reduction in demand for economic growth and development are at odds with each other. Enhancing access to clean electricity for productive uses is a significant challenge faced by policymakers in addition to meeting the basic needs of countries (Shi et al., 2016).

Implementing energy efficiency improvements and modifying the energy-mix to be more concentrated towards low emission energy sources, are two favourable approaches to producing a sustainable energy sector without constraining the demand of energy. These approaches have both seen broad international implementation, with little negative feedback. Energy efficiency is a cost-effective approach to resolving the conflict between sustainable development and economic development, since it focuses on optimising the use of already-available infrastructure. This is desirable, since a lack of access to financial resources is a common challenge facing developing economies.

Whilst much has been learned about how to optimise coal and natural gas based power generation, modern-day implementation of energy efficiency is somewhat at odds, at least historically speaking, with the implantation of renewable energy systems such as solar and wind. The reason is that these energy sources demonstrate high-variability of supply even within a day (also referred to as the problem of variable renewable energy or VRE), which raises questions for example over how to provide energy at night (which limits the usefulness of solar), or when winds are low (which impacts wind generation). However, in recent years – and going forward into the near future – there is important progress in both the demand and supply side of the energy system. One exciting new feature is that of electric vehicles, which have the potential to act as a ‘battery’ for a household, providing energy at times where renewable supply may be constrained and charging when there is a surplus. Even using current day (arguably inefficient) electric vehicle technology this appears to be economically viable, and is an exciting prospect for the energy industry.

These new developments in the energy sector, though exciting, also create new challenges for energy policy makers to contend with. In developing countries in particular, there is already a lack of expertise and necessary resources, and this will not change in a hurry. Coordinating development between the energy industry and broader regional economic development, in order to sustain economic development without further damaging the environment, will remain a pressing challenge for developing countries.

There are many further public policy issues/questions to take into consideration: How can sustainable VRE policies be successfully implemented given the rapid pace of technological advancements in this sector? How can mutually beneficial cross-border energy trade be identified and promoted? How to incentivise investment into renewable energy and cross border power trade? Is it possible to coordinate adoption of low carbon energy, and electric cars as a solution for rural development? What are the possibilities to prioritise access to energy for disadvantaged groups, including rural communities, and ethnic minorities?

The aim of this special issue is to discuss various aspects of government policy which address (either directly or indirectly) the challenges associated with implementing a wide-scale modern energy system capable of supporting economic development. The analyses are a timely reminder not only of the importance of building bridges among policy makers, academic community, industrial practitioners, and the public, but also that in today’s society this is not only within government but across governments of neighbouring countries.

In the next section, we summarise the purpose and motivations behind the special issue. Section 3 explains the papers and their findings. Section 4 presents policy implications that have been extracted from this study. The last section conclude the introduction by highlights some key policy issues.

## **2 The special issue**

The special issue was launched in January 2015 and received 11 submissions in total. After strict peer reviews, five papers have been accepted for publication. This special issue provides a snapshot of public policy context in South Asia, South East Asia, North East Asia and Europe. The focus on the Far East is not incidental. Many of the most

pressing energy development issues facing the world today are centred on the countries in this region. It is estimated that around 1.2 billion people across the world lack access to electricity (IEA, 2016), of which around half a billion are from the South Asian region (World Bank, 2017).

The policy topics covered in the issue include: renewable energy policy development; energy access; low carbon transportation systems; regional connectivity; and energy security. These studies cover both primary development issues such as fundamental concepts of energy access and advanced development issues, such as enabling the transition of an economy to a low carbon development paradigm. While phrased in the context of developing economies, many of these issues remain topical for developed economies also.

The authors of the papers come from many different countries and institutions from within the region, including China, India, Russia, Nepal, Thailand, as well developed countries such as the USA, Japan and Singapore. This mixture of authors from both developed and developing countries within the region, allows the papers to address the development issues in a balanced way, and helps ensure that many complex and important dimensions of public policy for energy spanning the region are explored.

### **3 Summary of papers and findings**

Shi et al. address the challenges of developing VRE policy, with Sri Lanka as an example. Policy design and implementation in developing countries, where resource endowment is abundant, is challenging due to a lack of capacity in technical and fiscal resources. They explore the development of VRE in Sri Lanka during the 2000s and analyse the impacts of the cost reflective feed-in-tariffs (FITs). They find that VRE public policy in Sri Lanka has met with various policy development challenges: VRE policy could lead to overheated responses from the market due to windfall profits and a lack of cost containment mechanisms forcing changes of public policy. A lack of coordination among different government agencies also resulted in difficulties for VRE policy implementation. They found that disadvantaged groups were not able to benefit from 'solar house' programs due to a lack of capital liquidity, despite the high tariff and subsidies making such programs profitable.

Yamaguchi et al. examine the challenges related to cross border power trade between Myanmar and Thailand. They try to reveal the reasons behind a slower than expected development of power trade between Myanmar and Thailand, when compared against the rapid development in trade between Myanmar and China. Taking three projects as case studies, and through stakeholder meetings, focus group interviews, as well using the frameworks derived from a UN literature survey, they identified the characteristics of distinctive barriers related to fuel types. That is, coal-fired power projects are often challenged by economic barriers, while hydropower projects are often challenged by social barriers that are also closely linked to environmental issues. Both kinds of barriers are related to a lack of necessary legal arrangement.

Although Russia's energy intensity has been declined significantly since the breakdown of the Soviet Union, it still has a high primary energy intensity of GDP. Rudenko and Raschetova investigate how different determinants have contributed to the decline in Russia's energy intensity. By applying co-integration test, they establish the

long-run relationships among the variables influencing energy intensity. They found that energy prices and the share of non-carbohydrate energy have significantly contributed to the reduction of energy intensity. A 1% increase in real crude oil price is expected to reduce energy intensity by 0.26% approximately, while a 1% increase of the share of alternative energy sources is expected to reduce energy intensity by 0.86%.

Bhattacharya et al. examine the role of energy for transport within the Bhutan economy. Bhutan is dedicated to making its economy carbon neutral, and to follow the exemplary path of low carbon development. In the process of doing so, Bhutan has identified that its transport sector is one of the most important sectors to address. Bhattacharya et al. identified four different low-carbon interventions for Bhutan and analysed their impacts on national economy, social welfare, income status and environment as a whole using a CGE framework. The four interventions are electric cars, bikes, public buses and modal shift (from private to public transportation). The study demonstrates that low carbon transport intervention especially electric cars have highest positive macroeconomic impacts in Bhutan but at the cost of increasing urban rural income disparity. Due to replacement of imported petrol with indigenous hydroelectricity, the introduction of electric cars generates positive economic benefits to Bhutan. However, due to the distribution of income generation in the transport sector, introducing electric cars leads to an increasing income inequality between urban and rural households. This result emphasises the trade-offs faced in public policy design and implementation.

Dhakal et al. notice the significant rural-urban energy access divide in Nepal: while more than 95% of urban residents have access to electricity, less than two-thirds of rural residents can access electricity. Due to the mountainous topography that discourages grid extension, a decentralised, affordable and efficient off-grid renewable energy such as solar has been considered a country-appropriate way in electrifying rural areas in Nepal. They assess 'to what extent is the current policy environment in Nepal conducive to the uptake of solar energy at the household level?' by using an exploratory research approach to analyse data. They find that Nepal's renewable energy market is still in its infancy and that exclusivity of subsidy mechanisms coupled with the lack of cross-sectorial policy harmony are the major barriers for solar energy development, despite donor-driven subsidies being successful in promoting solar energy development. Centralised and uncoordinated approaches between various government agencies are also found to be barrier for the RE sector. Interestingly, they observe that that socio-economically disadvantaged districts are the highest adopters of solar energy due to foreign aid projects and availability and willingness of investment due to remittance flows from migrant workers.

#### **4 Summary of policy implications**

In the study of VRE policy development in Sri Lanka, Shi et al. try to draw some implications for the development of VRE policy in developing countries. They suggest that the future VRE policy development in Sri Lanka should improve coordination among various government agencies; install cost reflective and technology specific policy; set up

capacity and cost containment mechanisms; and create an appropriate cost sharing scheme. They point out that subsidy policy should not create market distortions. Regarding to narrowing development gaps, they suggest that considering the impact on low income households should be an explicit concern in any energy policy adjustments.

In the case of Myanmar-Thailand power trade, Yamaguchi et al. suggest that in order to facilitate trade, the government of Myanmar needs to set legal precedents for issues such as intellectual property rights, concession rights, and environmental impact assessments. A clear power development plan in Myanmar is also necessary to ensure confidence for foreign investors. Easing the social tension connected to local opposition against power development projects is another tough task that must be addressed. They suggest an important role for the international community to provide legal technical assistances to address the insufficient legal arrangements.

Given an unstable history behind Sino-Russian energy cooperation, Ke et al. conclude that China should try to limit its dependence on Russian imported energy. China can achieve this by continuing to diversify its import sources and channels. China should also send clear signals to Russia that their interests and goals are not contradictorily. China should fully implement the existing agreements and continue expanding trade scale. More broadly, the paper suggests that energy security strategy should be coordinated the economic development strategy and perhaps most importantly not be considered independent of long-run diplomatic strategies.

Based on their assessment of determining factors of energy intensity, Rudenko and Raschetova make several policy suggestions to develop clean energy. These include creating a 'favourable' investment environment for clean energy development through measures such as public-private-partnerships, promoting the spread of knowledge and through the implementation of global best practices. In addition they also promote value in simplifying the existing certification procedure and remove energy subsidies.

Analysing the impacts of adopting electric vehicles in Bhutan, Bhattacharya et al. draw policy makers, attention to the importance of preventive measures, specifically to alleviate any risks of creating long-term income disparity as a result of the transition to an electrified personal transport system. Given Bhutan's rapidly increasing emissions from transport and its increasing level of population growth, it is envisaged that Bhutan needs a long term sustainable transport policy that implements transition within the next couple of decades. Among the key results it is shown that since rural residents benefit less than urban residents, the promotion of electric cars must be accompanied by a well-conceived rural development plan which might encourage the provision of technical knowledge for repairing and maintaining electric vehicles, and supporting to construction of battery charging stations and its related services.

In studying the development of solar projects in Nepal, Dhakal et al. suggest that policy priorities that take into consideration the changing rural socioeconomic realities and support market-centric approaches – as much as donor-centric subsidy initiatives – are needed. They also highlight that policy harmonisation and coordination between the Ministry of Industry and Ministry of Environment, Science and Technology is necessary to develop RE at the local level. The finding that disadvantaged districts are more likely to update solar energy is in contrast to the traditional donor mentality and there is a need to adjust future RE policy accordingly.

## 5 Conclusions

Energy consumption is a crucial component of economic development and modern human life, however, a lack of individual level access to energy is a prevailing phenomenon in many developing countries. It is therefore a key priority of energy related public policy to increase access to modern energy, including electricity. On the other hand, not all energy is good energy from the climate change perspective and there is a danger to end into lock-in into high carbon energy if there no long term policy planning and strategy. Energy efficiency and low carbon energy are the solution to the conflict between increasing demand for energy services and need to reduce emission. However, maintain such balance needs good public policy intervention.

Furthermore, publication policy also needs to balance the interests of various stakeholders, particularly disadvantaged regions or groups. The disadvantaged should be carefully considered and monitored during the development of energy policy and through its implementation. On one hand, they should not be disadvantaged or lagged behind by energy development. On the other hand, the benefits from the energy development should be properly distributed to them either through existing social and economic channels, or through new policy intervention.

Local communities should be a point of central focus. This is particular important in the case of cross border energy trade, which often rely on local communities to secure the project. While economic development is a common interested among various stakeholders, ethnic and other non-economic reasons could divert the development from economic rational track. Environmental impact assessment is a key instrument to build consensus from local community to support energy project development.

When making policy for VRE, the rapidly changing dynamics needs the policy makers to be experience and capable to avoid making unsustainable policy. The tough bargaining process during cross boundary trade needs governments from both parties to provide appropriate legal arrangements that can enable private investment.

Government coordination is a must in terms of implementing policy. Such coordination includes two levels. At the regional level, national governments include in energy project need to coordinate their plan, regulations and technical terms to facilitate cross boundary collaboration. At the national level, coordination among various agencies within the government is cortical to make energy policy workable.

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