



**ASIAN INFRASTRUCTURE
INVESTMENT BANK**

**AIIB Energy Sector Strategy: Sustainable
Energy for Asia
Discussion Draft for Consultation**

DRAFT

January 2017

ASIAN INFRASTRUCTURE INVESTMENT BANK

SECOND ROUND OF CONSULTATION ON ENERGY SECTOR STRATEGY DISCUSSION DRAFT

The Asian Infrastructure Investment Bank (AIIB) is a multilateral development bank (MDB) conceived for the 21st century. Through a participatory process, its founding members are developing its core philosophy, principles, policies, value system and operating platform. The Bank's foundation is built on the lessons of experience of existing MDBs and the private sector. Its modus operandi is lean, clean and green: lean, with a small efficient management team and highly skilled staff; clean, an ethical organization with zero tolerance for corruption; and green, an institution built on respect for the environment. The AIIB is putting in place strong policies on governance, accountability, financial, procurement and environmental and social frameworks.

In this context, AIIB is preparing an Energy Sector Strategy (the Strategy), focusing on contributing to Sustainable Energy for Asia. The Strategy is being developed through an iterative, consultative process. Two rounds of public consultations are being held on the document, with the objective to shape and inform the development of the Strategy.

AIIB had earlier developed an Issues Note that outlined some proposed objectives, goals, guiding principles and implementation matters, and sought comments on issues and policy options that may be reflected in the Strategy. The first round of consultation on the Issues Note was finalized on 12 November, 2016. AIIB wishes to thank all the parties who provided comments for their valuable contributions. A summary of the contributions received can be found on AIIB website.

The second round of consultation. AIIB has developed a Discussion Draft of the Energy Sector Strategy to initiate the second round of public consultation. The objective is to solicit further inputs and comments on the draft Energy Sector Strategy. After this, the Strategy will be completed and considered by the Board of Directors.

Written comments. Written inputs and comments are welcome to be sent to the following email address: es.consultation@aiib.org. These can be submitted until March 6, 2017. Written summary of the consultation inputs will be posted on the AIIB website for public access.



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ABBREVIATIONS

ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
CO ₂	Carbon dioxide
COP 21	21st session of the Conference of the Parties
CPS	Current Policy Scenario, defined in the World Energy Outlook
CSP	Concentrated solar power
EBRD	European Bank for Reconstruction and Development
EE	Energy efficiency
EIA	U.S. Energy Information Administration
ESF	Environmental and Social Framework
EvD	Evaluation Department of EBRD
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IEA	International Energy Agency
IEG	Independent Evaluation Group of the World Bank
IFC	International Finance Corporation
IsDB	Islamic Development Bank
MDB	Multilateral development bank
NDCs	Nationally-determined commitments
NPS	New Policies Scenario, defined in the World Energy Outlook
OECD	Organisation for Economic Cooperation and Development
PPP	Public-private partnerships
PV	Solar photovoltaic
RE	Renewable energy
SE4ALL	Sustainable Energy for All
SDGs	Sustainable Development Goals
SDG 7	Sustainable Development Goal 7
T&D	Transmission and distribution
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNSD	United Nation Statistics Division
WBG	World Bank Group
WEO	World Energy Outlook, published by the IEA
WHO	World Health Organization
450S	450 Scenario, defined in the World Energy Outlook

WEIGHTS AND MEASURES

Mtoe	Million tons of oil equivalent
TWh	Terawatt hours
GWe	Gigawatt electrical
GWh	Gigawatt hours
MWe	Megawatt electrical
US\$	US dollar

DISCUSSION DRAFT

Energy Sector Strategy

Sustainable Energy for Asia¹

Energy is central to nearly every major challenge and opportunity the world faces today. Be it for jobs, security, climate change, food production or increasing incomes, access to energy for all is essential. Sustainable energy is opportunity – it transforms lives, economies and the planet.

-- Sustainable Development Goal 7

Purpose of the Discussion Draft

1. The Asian Infrastructure Investment Bank (AIIB) is preparing an Energy Sector Strategy, focusing on contributing to Sustainable Energy for Asia. This Discussion Draft is, by intention, a high-level draft to facilitate consensus building as the Strategy develops. The options presented herein are for discussion purposes only. The proposals, findings, interpretations, and conclusions expressed in this draft do not necessarily reflect the views of, and may not be attributed to, the AIIB, its management, or its Board of Directors. AIIB does not guarantee the accuracy of the data included in this work.

Introduction

2. Energy services are essential to economic activity, social development and quality of life. They fuel the economy and facilitate the operation of large factories and small business. They are essential to deliver goods and services and to meet people's mobility needs. Finally, they contribute to wellbeing, quality of life and social development and are essential to lift vulnerable people out of poverty. As noted by the United Nations (UN) Secretary-General: "The decisions we take today on how we produce, consume and distribute energy will profoundly influence our ability to eradicate poverty and respond effectively to climate change"².

3. The objective of the Energy Sector Strategy is to provide the framework, principles, and operational modalities to guide the Bank's future energy sector engagement, including the development of its pipeline and future sub-sectoral lines of business.

4. The Strategy is consistent with the Bank's "Lean, Clean and Green" core values. The Strategy embraces, and is informed by, the principles underpinning the *Sustainable Energy*

¹ In this document, references to "Asia" and "Region" includes the geographical regions and composition classified as Asia and Oceania by the United Nations, (Annex 1). This definition does not include Russia. However, Russia is a regional member of AIIB and therefore is listed separately, and additionally, in various places in this document.

² "Energy for a Sustainable Future", Foreword, The Secretary-General's Advisory Group on Energy and Climate Change (AGECC), Summary Report and Recommendations – 28 April 2010, New York.

for All (SE4ALL), the 2030 Agenda for Sustainable Development, and the Paris Agreement (Box 1). It lays the framework for the Bank to support its client countries to: (i) develop and improve their energy infrastructure and facilitate their transition to a less carbon-intensive energy mix; and (ii) meet their goals and commitments under these global initiatives.

Box 1: Global Initiatives

The *Sustainable Energy for All (SE4ALL)* initiative, launched by the UN Secretary-General Ban Ki-moon in September 2011, has three objectives for 2030: ensure universal access to modern energy services; double the share of renewable energy in the global energy mix; and double the global rate of improvement in energy efficiency. The initiative was launched to coincide with the UN General Assembly Resolution 65/151 of 20 December 2010 that declared 2012 the International Year of Sustainable Energy for All.

The *2030 Agenda for Sustainable Development* is a set of 17 aspirational "Sustainable Development Goals" (SDGs) with 169 targets developed under UN auspices, involving 193 UN Member States and global civil society. The goals are contained in paragraph 54 of the UN General Assembly Resolution A/RES/70/1 of 25 September 2015. One of those goals, *SDG 7*, calls for ensuring access to affordable, reliable, sustainable and modern energy for all by 2030.

The *Paris Agreement*'s central aim is to strengthen the global response to the threat of climate change by "holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5 degrees Celsius". The Agreement also aims to make "finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development". According to the Agreement, countries shall publicly outline nationally determined contributions (NDCs) that they intend to achieve for reductions in greenhouse gas emissions. The Paris Agreement was agreed by 197 Parties during the 21st Conference of the Parties (COP 21) of the UN Framework Convention on Climate Change (UNFCCC) in Paris in December 2015, and entered into force in November 2016.

Source: Sustainable Energy for All, www.se4all.org; the 2030 Agenda for Sustainable Development, sustainabledevelopment.un.org/post2015/transformingourworld; the Paris Agreement, unfccc.int/paris_agreement/items/9485.php

The Global Energy Landscape

5. The Strategy is being developed in a global energy landscape that is characterized by a growing sense of energy insecurity and widespread environmental concerns at both local and global levels. Yet it is also a time of shared hope and promise as demonstrated both by ambitious goals and commitments under global initiatives, and by technological advances that will ease the transition towards more sustainable development. Bank support will assist its clients to meet their nationally determined commitments (NDCs) under the Paris Agreement and to reap the benefits of new technologies and innovation.

6. **Energy insecurity and environmental concerns.** Worries about energy security and pricing volatility have been a concern for over four decades. These concerns have been compounded by the free fall of oil prices after their peak in the late 2000s, and the geopolitical turmoil that threatens the security of vital energy infrastructure. Concerns about the environment and the impact of climate change also loom large. The effects of the Deepwater Horizon oil spill and the Fukushima Daiichi nuclear accident have added to public anxiety

and awareness about environmental and security risks. The first incident triggered increased scrutiny of environmental issues related to the development of unconventional oil and gas sources which may slow their development. The second incident has moderated the enthusiasm about the “nuclear renaissance”. A number of countries subsequently tempered their nuclear development ambitions significantly and some are considering phasing out this technology. The extremely high pollution in many of Asia’s large cities has heightened concerns about environmental risks and their impacts on the health and wellbeing of the population. Asian countries, especially the most populous ones, are already experiencing floods, devastating storms and drought and they will face higher risks if climate threats are not mitigated (Table 1).

Table 1: Countries Most at Risk of Five Climate Change Threats

Drought	Flood	Storm	Coastal Impact	Agriculture
Malawi	Bangladesh	Philippines	All low-lying Island states	Sudan
Ethiopia	China	Bangladesh	Vietnam	Senegal
Zimbabwe	India	Madagascar	Egypt	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Mali
Mozambique	Mozambique	Moldova	Indonesia	Zambia
Niger	Laos	Mongolia	Mauritania	Morocco
Mauritania	Pakistan	Haiti	China	Niger
Eritrea	Sri Lanka	Samoa	Mexico	India
Sudan	Thailand	Tonga	Myanmar	Malawi
Chad	Vietnam	China	Bangladesh	Algeria
Kenya	Benin	Honduras	Senegal	Ethiopia
Iran	Rwanda	Fiji	Libya	Pakistan

Note: Asian countries highlighted by the Study team.

Source: World Bank

7. **Primary energy consumption growth driven by non-OECD countries.** Since 2000, the world’s primary energy consumption grew on average at 2.2 percent to reach about 13.7 billion of tons of oil equivalent (toe) in 2014. However, during 2010-2014, it grew at 1.9 percent per year, a slower growth rate than prior to the financial crisis (2.7 percent per year), but likely due more to weaker global economic growth than to gains in energy efficiency. From 2000-2014, the primary energy consumption increase has been driven by non-OECD countries, which accounted for 98 percent of the growth during this period and reached 58 percent of the total world consumption in 2014.

Issues and Challenges

8. The specific issues countries in Asia confront in their energy sectors are similar to those facing most non-OECD countries - the need for affordable, sustainable and reliable energy systems to support regional and global economic growth.

9. Asia is endowed with abundant energy resources:

- More than half of global conventional **oil and gas** reserves are in Asia: 3,795 trillion cubic feet of gas (55 percent of the world reserves) and 888 billion barrels of oil (54 percent of the world reserves), most of which are concentrated in Western Asia:

Saudi Arabia, Iraq, Kuwait, Qatar and United Arab Emirates. In addition, Russia has 1,688 trillion cubic feet of gas (28 percent of the world reserves) and 80 billion barrels of oil (5 percent of world reserves).

- Asia's **coal reserves** are also abundant, amounting to more than 369,497 million short tons and representing 38 percent of global reserves, with a high concentration in five countries including: China (34 percent), Australia (23 percent), India (18 percent), Kazakhstan (10 percent) and Indonesia (8 percent). Russia's coal reserves amount to 173,074 million short tons, about 18 percent of the global reserves.
- Asia's **hydropower** technical potential amounts to about 5,980 TWh/year, accounting for 37 percent of the global potential, while the total generation in 2011 amounted to about 37 percent of the economically exploitable generation. Three countries accounted for more than 75 percent of total generation: China (61 percent), India (10 percent) and Turkey (5 percent). Generation in the rest of non-OECD Asia³ amounted in the same year to 182 TWh, about 22 percent of the economically exploitable potential. Russia's hydropower potential amounts to 1,670 TWh/year and accounts for about 10 percent of global hydropower potential.
- Asia's estimated **geothermal** potential amounts to about 63 GWe and amounts to 78 to 90 percent of global potential, estimated at 70-80 GWe⁴. Asia's potential is concentrated five countries⁵: (i) Indonesia with a potential estimated at about 27.8 GWe, and an installed capacity of 1,340 MWe and an annual power generation of 9,600 GWh; (ii) Japan with a potential estimated at 23.5 GWe⁶, and an installed capacity of 500 MWe; (iii) the Philippines with a potential of 6 GWe and an installed capacity of 1,870 MW, the second largest in the world and an annual power generation of 9,646 GWh; (iv) New Zealand with an estimated potential of 3.65 GWe, an installed capacity of 1,005 MWe and an annual generation of 7,000 GWh; and (v) Turkey with an estimated potential of 2 GWe⁷, an installed capacity of 397 MWe and an annual production of 3,127 GWh. Russia's geothermal potential is estimated at 2 GWe.
- Asia's **solar** resources are estimated at 119,536 TWh/year, about 30 percent of the global potential. China, Australia and India account for 55 percent of the potential. Asia is also endowed with modest onshore **wind** potential, about 11 percent of world potential, primarily limited to China, Australia, Mongolia, Afghanistan and Pakistan. Russia's solar resources amount to 30,586 TWh/year, accounting for 8

³ Non-OECD Asia is defined by IEA as: Bangladesh, Brunei Darussalam, Cambodia, China, Chinese Taipei, India, Indonesia, the Democratic People's Republic of Korea, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, Vietnam, and other Asian (UNSD definition) countries and territories. Furthermore, IEA notes that: "Individual data are not available and are estimated in aggregate for: Afghanistan, Bhutan, Cook Islands, Fiji, French Polynesia, Kiribati, Lao PDR, Macau (China), Maldives, New Caledonia, Palau, Papua Guinea, Samoa, Solomon, Timor-Leste and Tonga and Vanuatu.

⁴ Sanyal, et al (2016), "Comparative Analysis of Approaches to Geothermal Resource Risk Mitigation: a Global Survey", Energy Sector Management Assistance Program (ESMAP), Knowledge Series 024/16, Washington, D.C., World Bank Group.

⁵ Geothermal data for the five countries come from International Geothermal Association unless otherwise stated.

⁶ Geothermal potential is an estimated value from heat energy stored at a depth of geological basement or shallower. Source: "Japan – Renewed Opportunities", Kasumi Yasukawa, National Institute of Advanced Industrial Science and Technology (AIST), 2014.

⁷ Geothermal Country Update Report of Turkey (2010-2015), Proceedings of World Geothermal Congress 2015.

percent of the World's resources. Its wind resources amount to 9 percent of the world potential and 81 percent of Asia's potential.

10. Energy production in Asia is characterized by fast increasing production of fossil fuels. During 2000-14, Asia's fossil fuel production annual growth rate was: (i) 5.6 percent for gas, more than twice the global production growth rate; (ii) 6.7 percent for coal, 1.7 times the global rate; and (iii) 1.1 percent for oil, slightly higher than the global rate. Russia's fossil fuel production grew at 0.7 percent for gas, 2.8 percent for coal, and 1.1 percent for oil per year during the same period.

11. There are significant challenges to achieve energy sustainability:

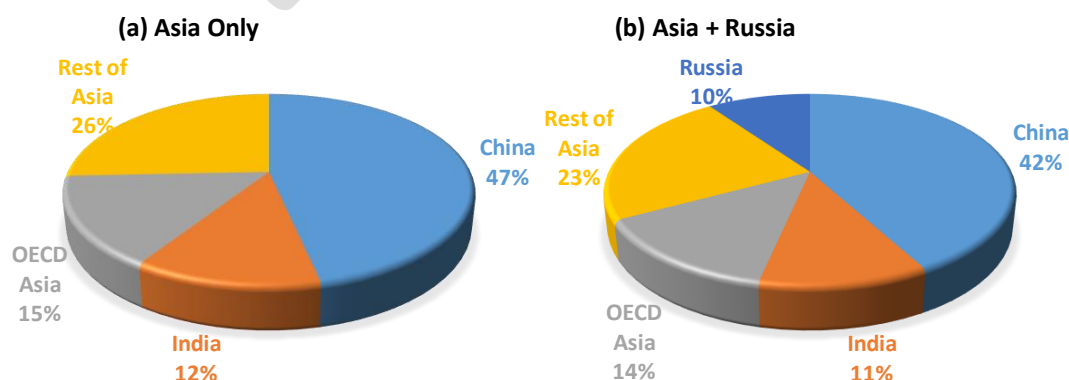
- **Rapidly growing primary energy consumption.** Asia's primary energy consumption grew at 4.6 percent per year from 2000-14, more than twice the global growth rate. It increased from 3,528 million tons of oil equivalent (Mtoe) in 2000 to 6,579 Mtoe in 2014, accounting for 84 percent of the global increase in consumption during this period (Table 2). Of note, 98 percent of Asia's consumption increase was driven by demand in non-OECD Asia. Figure 1 below shows that China accounted for 47 percent of Asia's consumption followed by OECD Asia (15 percent), India (12 percent) and the rest of Asia (26 percent). In addition, Russia's primary energy consumption grew at 1.0 percent per year during 2000-14, much slower than the global 2.2 percent per year and Asia's 4.6 percent per year.

Table 2: Total Primary Energy Consumption (Mtoe)

By Region	2000	2014	CAAGR* (2000-14)
Asia	3,528	6,579	4.6%
China	1,175	3,066	7.1%
India	441	824	4.6%
OECD Asia	926	1,000	0.5%
Rest of Asia	986	1,688	4.6%
Russia	620	712	1.0%
World	10,053	13,690	2.2%

*Compounded Annual Average Growth Rate;
 Note: number may not exactly add up due to rounding
 Source: International Energy Agency (IEA) Database

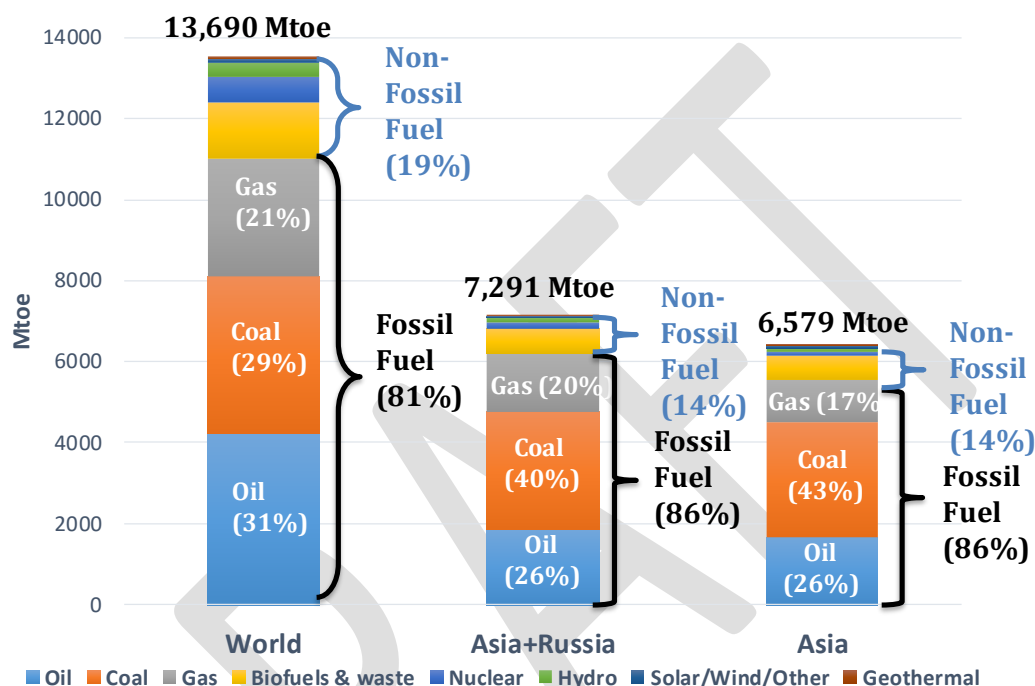
Figure 1: Breakdown of Total Primary Energy Consumption in (a) Asia and (b) Asia + Russia (2014)



Source: IEA Database

- **Dominance of fossil fuels.** Fossil fuels accounted for 93 percent of Asia’s consumption increase during 2000-14, and 84 percent of Russia’s consumption increase during the same period. Non-fossil fuels made up the remaining 7 percent in Asia and the remaining 16 percent in Russia. Figure 2 shows that in 2014, Asia’s reliance on fossil fuels was 5 percentage points higher than the world average, 86 percent compared to 81 percent. The higher percentage remains unchanged if Russia is added to Asia.

Figure 2: Dominance of Fossil Fuels in Asia, Asia + Russia, and the World (2014)

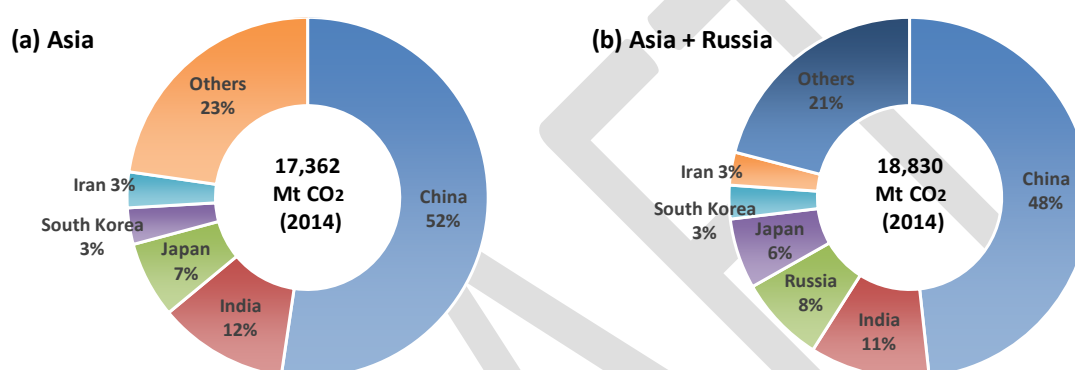


Source: IEA and EIA Databases

- **Declining energy intensity, but slower than the world average.** Energy intensities of Asian countries declined steadily during 2000-14 indicating increased energy efficiency. However, the decline of the average energy intensity in Asia was less than the decline in the global average. The average rate of reduction of Asia’s energy intensity was greater during 2010-14 than during 2000-10. Regionally, OECD Asia (excluding Turkey), Central Asia, Eastern Asia (excluding China) and Southeastern Asia achieved the improvement rate in energy intensity needed to achieve the Energy Efficiency objective of Sustainable Energy for All (SE4ALL sets a 2.3 percent per year target). Russia’s energy intensity also declined by 35 percent during 2000-14. Its energy intensity decreased by 3.1 percent per year during 2000-10 but slowed down to 1.5 percent per year during 2010-14, which fell short of the SE4ALL target.
- **Low access to modern energy.** Asia’s population without access to electricity was estimated in 2012 at 464 million, about 43 percent of the world population without such access. However, power system reliability in many countries does not meet the reliability standards required by sophisticated equipment and the connectivity needs of households and businesses. According to the World Bank Enterprise

Survey⁸, unreliable electricity services have been identified by enterprises as a major constraint in 10 Asian countries, including Yemen, Syria, Lebanon, Iraq, Georgia, Pakistan, Afghanistan, Bangladesh, the Kyrgyz Republic, and Papua New Guinea. Moreover, according to the International Energy Agency (IEA), in 2013 about 2.7 billion people (about 38 percent of the World population) relied on traditional biomass combustion, with over 2 billion (about three quarters of the total) located in Asia and 1.43 million in Russia. These populations are exposed to indoor pollution and suffer devastating health impacts. It is estimated by World Health Organization (WHO) that about 4 million deaths per year are attributable to the lack of access to non-solid fuels for use in lighting, cooking and heating.

Figure 3: Fuel Combustion-related CO₂ Emissions in Asia and Russia (2014)



Source: IEA Database

- **Rapidly increasing combustion related CO₂ emissions.** Asia's fuel combustion-related CO₂ emission amounted to 17,362 Mt in 2014, up by 42 percent from its 2006 level. The growth rate at 4.5 percent was more than twice the world average during the same period. Although Asia's per capita energy consumption is below the world average, it is growing at a rate 2.5 times faster than the world average. Asia's carbon intensity was on a steady downward trend during 2006-14, but at a slower pace than the world average. Figure 3 below shows that in 2014, five countries (China, India, Japan, South Korea, and Iran) accounted for more than three-quarters of Asia's total emissions. Russia's fuel-combustion related CO₂ emissions reached 1,468 Mt in 2014, amounting to 8 percent of Asia's emissions and 5 percent of the global emissions. Notably, Asia's emissions grew at 3.6 percent per year during 2006-14, much faster than the 0.6 percent global average, while Asia's average per capita fuel combustion-related CO₂ emissions were 10 percent lower than the average of the World (4.47 tCO₂/capita) in 2014. Russia's per capita emissions were practically stable during 2000-14 at 10.3 tCO₂ per capita, more than twice the global average.
- **Extensive local pollution.** 19 of the 20 most polluted (PM_{2.5}) cities in the world are located in Asia: 10 in India, 4 in China, 3 in Saudi Arabia, 1 in Iran and 1 in Pakistan. These cities experience annual mean PM_{2.5} concentrations, 11 to 22 times the WHO guideline value.

⁸ Based on surveys of more than 125,000 firms globally.

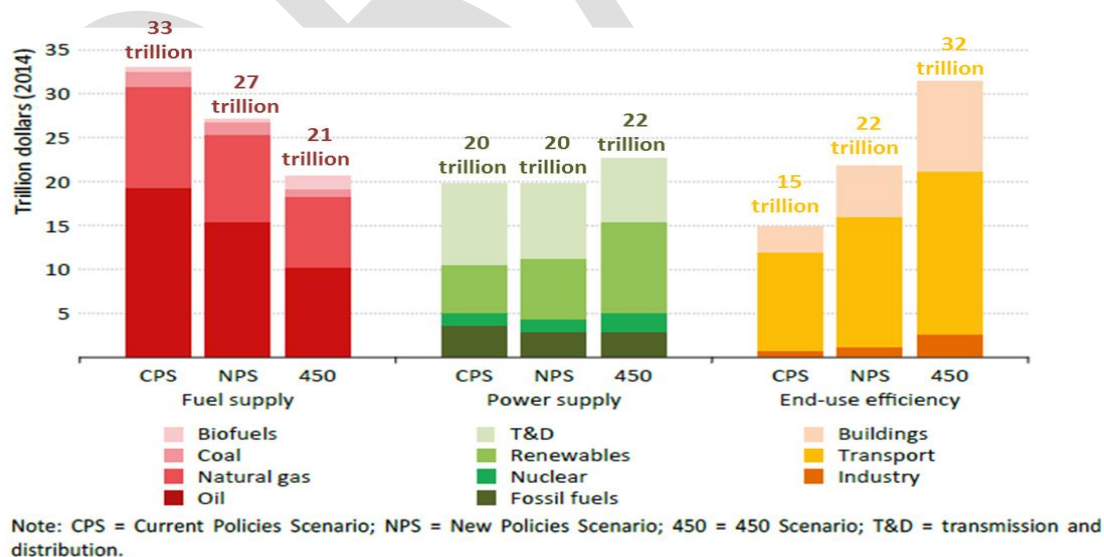
12. Against the backdrop, non-OECD Asian countries and Russia face daunting challenges to meet their energy needs to sustain economic growth while transitioning to a less carbon-intensive energy mix.

13. According to the 2015 World Energy Outlook scenarios (Figure 4), global energy investment during 2015-40 would amount to US\$68 trillion under the Current Policies Scenario (CPS), US\$69 trillion under the New Policies Scenario (NPS) and US\$75 trillion under the 450 Scenario (450S) (in 2015 US\$)⁹. The IEA further pointed out that the current energy investment trends “continued to shift in the direction of low-carbon sources and technologies, but not fast enough to meet energy security and climate goals”.¹⁰ To meet the Paris Agreement goals would require not only a significant investment increase, but also more focus on energy efficiency (EE) and renewable energy (RE). Energy investment in Asia and Russia has been estimated based on the 2014 World Energy Investment Outlook (WEIO)¹¹, which focuses on energy investment requirements (in 2012 constant US\$) for NPS and 450S during 2016-2035:

- Global investment would amount to about US\$44 trillion under both NPS and 450S;
- Asia’s investment would amount to about US\$18 trillion under NPS and US\$18.7 trillion under 450S; and
- Russia’s investment would amount to about US\$2.3 trillion under NPS and US\$2.5 trillion under 450S.

Figure 4: IEA 2015 World Energy Outlook Scenarios

Cumulative world energy sector investment, by sector and scenario (2015-2040)



Source: IEA World Energy Outlook 2015

⁹ According to the IEA, the Current Policies Scenario (CPS) takes into account only formally enacted policies and measures affecting energy markets as of mid-2015 and makes the assumption that these policies persist unchanged; the New Policies Scenario (NPS) is the central scenario of the Outlook and it takes into account the already adopted policies and measures as of mid-2015, as well as other relevant commitments that have been announced, even when the precise implementation measures have yet to be fully defined; the 450 Scenario (450S) takes a different approach, adopting a specified outcome – the international goal to limit the rise in the long-term average global temperature to two degrees Celsius (2 °C) – and illustrating how that might be achieved.

¹⁰ IEA (2016) World Energy Investment, page 159.

¹¹ Team estimate based on the results of IEA’s World Energy Investment Outlook – Special Report, 2014.

Lessons Learned from MDB Energy Sector Investment in Asia

14. The Strategy has been informed by the lessons from the evaluations of the Asia portfolios of the Asian Development Bank (ADB), the European Bank for Reconstruction and Development (EBRD), the Islamic Development Bank (IsDB) and the World Bank Group (WBG).

15. The review of the active Asia portfolios of these MDBs indicates that:

- **Transmission and distribution (T&D)** financing accounted for the largest share of the MDBs' sovereign portfolios, ranging from 31 percent to 48 percent of total support to the public sector. For non-sovereign or private windows, T&D financing accounted for only 3 percent to 14 percent of total support to the private sector, reflecting the public sector dominance in this segment of the power industry in Asia.
- **Zero carbon investments (EE and RE)** accounted for between 20 percent and 41 percent of the total public loans and grants provided by each organization. They also accounted for a large share, from 39 to 67 percent, of the non-sovereign financial support. Intermittent (wind and solar photovoltaic) and still high cost RE (geothermal and concentrated solar power) benefitted from grants and concessional lending. Examples of grants providers include Global Environment Facility (GEF), Clean Technology Fund (CTF), Scaling up Renewable Energy Program (SREP), International Development Association (IDA).
- **Support to public thermal generation projects** accounted for 7 to 23 percent of respective total sovereign loans. Support to private sector thermal generation accounted from 3 to 30 percent of total respective support to private sector energy investments.
- **Financing of upstream activities (oil, gas and coal)** accounted from 2 to 10 percent of total support to public energy projects. They accounted from 6 to 17 percent of total support to private sector. The number of projects and loan amounts were limited for sovereign and moderate for non-sovereign operations.
- Evaluations of completed energy projects by MDBs' independent audit departments show that the performance of energy projects has usually been higher than the average performance of overall portfolio. For the less performing projects, many of the implementation problems centered around failure to address weak or inadequate legal, regulatory frameworks and effectively implement institutional reforms related to corporatization, restructuring and privatization of energy subsectors.

16. Lessons Relevant to the Bank's Strategy:

- The T&D operations are straightforward in preparation and generally do not raise controversial or complicated implementation or policy issues. They should however integrate technological advances to improve management and efficiency of networks and empower consumers.

- Investments in RE and EE (especially at the demand side level) are fragmented and required in most cases access to grants and/or concessional financing. They require specialized skills and financial intermediation, especially for EE operations.
- Addressing institutional issues requires extensive policy analysis and dialogue, and the ability to provide technical assistance, often on concessional terms.
- There are ample opportunities for investments in oil and gas extraction as clients seek to improve the security of their energy supplies. However, such projects tend to involve higher risk and must be subject to thorough assessment.

Objective of the Energy Sector Strategy

17. The objective of the Energy Sector Strategy is to provide the framework, principles, and operational modalities to guide the Bank’s future energy sector engagement, including the development of its project pipeline and future sub-sectoral lines of business.

18. The Strategy embraces, and is informed by, the principles underpinning *the Sustainable Energy for All (SE4ALL)*, *the 2030 Agenda for Sustainable Development*, and *the Paris Agreement* (see Box 1 above). It lays the framework for the Bank to support its client countries to: (i) develop and improve their energy infrastructure and facilitate their transition to a less carbon-intensive energy mix; and (ii) meet their goals and commitments under these global initiatives.

19. The Strategy is consistent with the Bank’s “Lean, Clean, and Green” core values and its institutional goals. The Strategy embodies the Bank’s three thematic priorities: *sustainable infrastructure*, *cross-country connectivity* and *private capital mobilization*. Regular monitoring and reporting of portfolio composition will be an important discipline and help build a portfolio that reflects the Strategy and is aligned with the Bank’s core values.

Guiding Principles

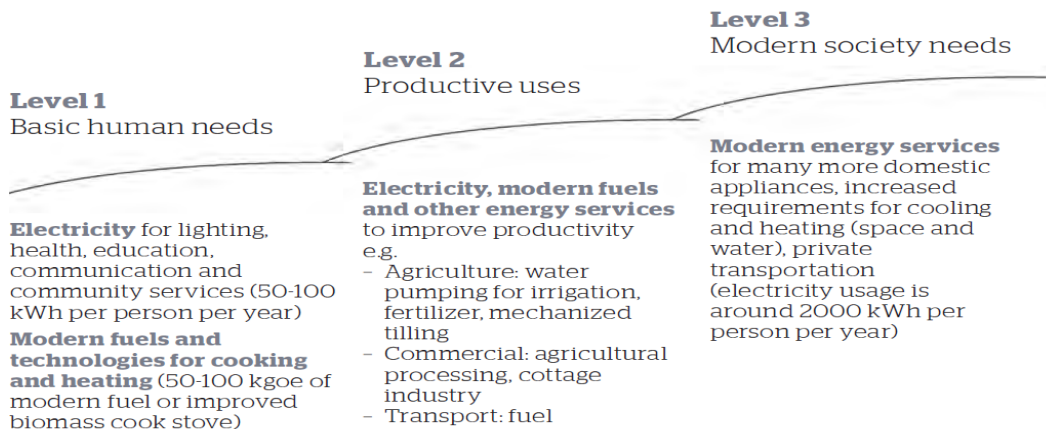
20. The Energy Sector Strategy is developed around six principles, which will guide the build-up of the Bank’s energy portfolio during the early years of operation.

21. ***Principle 1: Promote energy access and security.*** Lack of access or unreliable access to energy services deprives the most vulnerable people from availing of economic and other opportunities to improve their lives. Bank financing for improved energy access and security will support clients in achieving Sustainable Development Goal 7 (SDG 7). The Bank proposes to place emphasis on: (i) promoting, directly or indirectly, access to modern energy by those who currently have little or no access; (ii) improving the reliability of electricity supply; and (iii) reducing the negative health impacts caused by indoor combustion of solid fuels. According to the IEA¹², achieving universal electricity access for basic human needs by 2030 (Figure 5) would increase global greenhouse gas emissions by just 1.3 percent.

¹² IEA (2009) World Energy Outlook, page 132.

Figure 5: Access to Modern Energy Services

Incremental levels of access to energy services

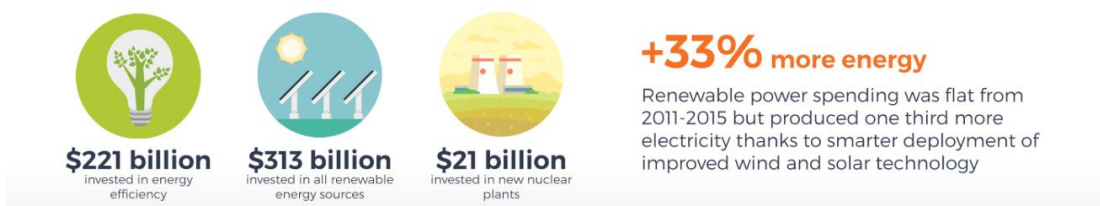


Source: Energy for a Sustainable Future – United Nations AGECC. 28 April 2010- New York, page 14.

22. **Principle 2: Realize Energy Efficiency potential.** International experience and primary energy forecasts by international institutions indicate that energy efficiency is one of the major means to achieve global environmental objectives. Prosperity and wellbeing can no longer be gauged by the consumption of energy but by the services derived from it. Given the high energy intensity in most non-OECD countries in Asia, the Bank proposes to cooperate with other MDBs operating in Asia to tap the existing large, but dispersed, potential for energy efficiency in industry, buildings and transport. Initially, the Bank proposes to focus on projects that make the most of existing energy infrastructure stocks through: (i) rehabilitation and upgrade of existing generation plants, and (ii) aggressive loss reduction and utility-driven energy efficiency programs in power and gas transmission and distribution networks. Over time, it will also develop financial instruments and engage with potential financial intermediaries in these areas.

Figure 6: Increased Low Carbon Energy Production

A major shift in investment towards low carbon sources of energy



Source: IEA 2016 World Energy Investment

23. **Principle 3: Reduce the carbon intensity of energy supply.** Energy is the dominant contributor to climate change, accounting for around 60 per cent of total global greenhouse gas emissions. The Bank proposes to support clients to reduce the carbon intensity of energy to help them achieve their long-term climate goals provided in the Paris Agreement. According to the IEA 2015 World Energy Outlook (see Figure 4 above), energy infrastructure investments need to be reshaped to meet the Paris Agreement goals:

- Investments in fuel supply during 2015-40 need to decrease from US\$33 trillion in the Current Policies Scenario (CPS) to US\$21 trillion in the 450 Scenario, mainly through a considerable reduction in oil investments, a sizable reduction in coal investments, and slightly lower investments in natural gas (although gas investments will remain significant in all three scenarios);
- Investments in power supply during 2015-40 need to increase from \$20 trillion in the Current Policies Scenario and the New Policies Scenario to US\$22 trillion in the 450 Scenario. The power sector overall would need to focus more on renewable energy (which will need to more than double to meet the goals of the Paris Agreement), and sustained investment in power transmission and distribution (T&D).

The IEA 2016 World Energy Outlook confirmed the message above, and showed that more ambitious investments would be required for renewable energy and energy efficiency in the New Policies Scenario and the 450 Scenario.

The Bank proposes to support energy investments that minimize adverse environmental impacts, and also reflect clients' individual energy situations (e.g., energy resource endowment, affordability of capital-intensive investments, security of supply, etc.). During the transition to a lower carbon intensity energy sector, fossil fuels will continue to play a significant role in the energy mix of most member countries. The Bank proposes to support and accelerate its members' respective transitions toward a low-carbon energy mix through investments in renewable energy and reduction of carbon emissions from fossil fuels.

24. ***Principle 4: Local and regional pollution management.*** The Bank proposes to support its clients in reducing, limiting and mitigating the deleterious impact of pollution. Fossil fuel production, transport and consumption have severe negative impacts on the local environment, especially in Asia's densely populated cities. Historically, issues related to local and regional pollution have been addressed mainly by limiting emissions of fossil fuel-based power generation, especially coal-fired plants. New projects are now being developed by MDBs to address local pollution specifically and comprehensively, to counter the negative impacts on health and wellbeing. The Bank proposes to cooperate with other MDBs on these initiatives.

25. ***Principle 5: Catalyze private capital.*** The Bank is committed to promote private sector investments to help to close the momentous infrastructure investment gaps in developing Asia. For varying reasons, to date, private capital investments in energy and infrastructure have been marginal in non-OECD countries, although partial credits, investment and country guarantees by MDBs have been instrumental in promoting successful projects in several countries. Innovative approaches have also been initiated using grants and concessional financing by some countries to reduce the cost of electricity generated under public-private partnerships (PPP) and/or to improve risk sharing in PPP ventures. The largest concentrated solar power (CSP) generation project in Morocco supported by the World Bank and African Development Bank and the geothermal project supported by the World Bank in Indonesia are representative of the former approach, whereas the envisaged support of a geothermal PPP project in Nicaragua by the World Bank is illustrative of the latter. The Bank proposes to: (i) explore innovative models to catalyze private investments, and significantly increase their contribution to meet the infrastructure needs of countries in Asia, especially those that are budget-constrained; (ii) build upon successful experiences and lessons learned

of MDBs operating in Asia, especially in PPPs, ensuring that the costs and risks are appropriately shared and distributed; and (iii) explore with clients and private partners new cooperation modalities to meet country needs. In addition, the Bank proposes to avoid crowding out the private sector. When pursuing such opportunities, the Bank will evaluate risk carefully and ensure that appropriate measures are put in place to mitigate and manage such risks.

26. **Principle 6: Promote regional cooperation and connectivity.** Regional integration and cooperation are essential to take advantage of synergies, increase market size to improve competitiveness, and create a critical mass for cooperative R&D and manufacturing capabilities. Efforts deployed by MDBs and bilateral organizations in Asian countries and other regions have had moderate success. The Bank proposes to engage client countries and pursue regional connectivity of energy systems in Asia, especially power and gas, with a view to strengthening systems; improving the security and efficiency of energy supply; optimizing the use of resources; allowing for greater flexibility in their operation; reducing local, regional and global adverse environmental impacts; and fostering greater use of renewable energy resources.

Implementation

27. The principles outlined above will guide the Bank's investment approach in the energy sector in its early years. As the Bank matures, accumulates experience, and its portfolio develops, these principles will be reviewed. The review would take into account the lessons of experience and also integrate the advances in scientific knowledge, technological progress, and changed economic circumstances.

28. Application of the guiding principles will take into account, to the extent possible, client countries' constraints and uniqueness. Bank support to countries will be aligned with their national energy investment plans/strategies.

Sectoral Approach

29. The Bank's process for selecting projects will focus on projects that, among others: improve country and regional connectivity; promote efficiency along the supply chain; and use proven, transformational, low carbon-intensity technologies that are economically and financially viable.

30. **Power transmission and distribution.** Power grid infrastructure development will be an essential component of the Bank's connectivity strategy and to promote regional cooperation. Support for the development of transmission and distribution infrastructure remains indispensable to ensure transfer of generated electricity to demand centers without the bottlenecks and high losses that are hampering economic growth in many Asian countries. MDBs operating in the region have deployed great efforts but substantial investments are still needed to achieve SDG 7 and SE4ALL of access to modern energy and allow smooth RE integration in power systems.

31. In 2015, global investments in transmission and distribution amounted to US\$262 billion, or about 15 percent of total infrastructure investments. They are expected to increase, as greener infrastructure will require increased support to renewable energy sources, which are generally far from load centers. International experience also indicates that strong

transmission networks allow higher penetration of intermittent renewable energy. In common with most MDBs, lower risk T&D projects are good vehicles for the Bank to build its project pipeline in the early years of operation. Support for power T&D is expected to be one of the core areas for Bank interventions, alone or in association with other multilateral or bilateral institutions. The Bank proposes to support: (i) new T&D projects to increase power systems' resiliency to natural disasters, and assist member countries in "leapfrogging" to smart metering and other digital solutions to empower consumers, and manage the system efficiently; and (ii) rehabilitation and reinforcement of existing networks to increase their resiliency to natural disasters, reduce technical losses, allow smooth integration of intermittent RE and improve reliability of supply.

32. **Energy Efficiency (EE) investments.** Figure 4 above shows that limiting the world's rise in average temperature to "well below 2 degrees Celsius above pre-industrial levels" (450 Scenario) would require more than doubling global energy efficiency investments. Demand-side EE investments are in most cases economically justified but financially challenging because of pervasive subsidization of fossil fuels and electricity. They are also usually small and fragmented. The implementation requires financial intermediation and capacity building, as indicated by the most successful public or private sector projects implemented by MDBs to date. Investments in energy efficiency (especially housing and small and medium enterprises) are generally small-scale and might require retailing channels and specific financial instruments (such as financial intermediary loans) and technical assistance to build client capacity. Most EE activities undertaken by MDBs have been supported by grants to build the capacity of financial intermediaries to evaluate potential EE projects and monitor achievements during their implementation. At present, the Bank does not provide technical assistance either on its own or associated with lending. It will look to cooperate with multilateral, bilateral and other partners to address this constraint.

33. The Bank proposes to proactively support generators and utilities to: (i) improve the use of existing electricity generation stocks through rehabilitation to reduce fuel consumption, introduce predictive maintenance methods, and upgrade of the regulation systems; (ii) develop and implement loss reduction programs at all levels of the electricity supply chain and demand side management programs; (iii) design and implement utility-driven final use efficiency initiatives, such as green lighting, improvement in insulation of buildings; and (iv) enhance the efficiency of district heating networks and extend them to meet the need of rapidly urbanizing cities. While developing the skills and approaches to develop own portfolio, the Bank proposes to partner with MDBs and bilateral agencies operating in the region to scale-up efficiency programs.

34. **Renewable energy (RE) investments.** RE investments are essential to limit CO₂ emissions. The Bank will support clients to develop intermittent RE—wind, solar photovoltaic (PV), hydropower—to reduce fossil fuel consumption and increase access to modern energy through decentralized generation, and mini- and micro-grids. Moreover, data collected to date indicate that: (i) out of the 20 countries with the largest wind potential, only 4 are in Asia; (ii) out of the 20 countries with the largest solar potential, 8 are in Asia; and (iii) about two-thirds of the hydropower potential in Asia is untapped. Currently, the Bank does not manage trust funds. Therefore, to further RE development in client countries, the Bank proposes to proactively:

- support hydropower that is technically, economically, financially, environmentally and socially viable, in a manner consistent with the provisions of the Bank's Environmental and Social Framework (ESF) and lessons learned from other MDBs operating in Asia and elsewhere. Development of hydropower, of all scales, in an environmentally and socially sound manner could make an important contribution to sustainable energy supply. This includes multi-purpose and run-of-the-river hydropower investments. The Bank has already engaged in co-financing the upgrading of generation capacity and rehabilitation of existing hydropower infrastructure to improve efficiency and dam safety. It will continue to pursue such capacity upgrading, rehabilitation and dam safety opportunities at existing facilities as they arise. When appropriate, the Bank proposes to consider supporting hydropower development through two-stage loans: a first phase loan to support thorough project preparation and a second phase loan to support the actual investments.
- support intermittent centralized and decentralized RE generation. For wind and PV, the Bank proposes to build partnerships with other MDBs/bilateral agencies operating in Asia, and seek access to grants from global funds and partners, to improve the financial viability of investments in intermittent renewable technologies, and share associated risks. The Bank proposes to also promote distributed generation (e.g. mini- and micro-grids) to reduce burdens on centralized systems, increase RE penetration, and improve reliability of power supply.
- support selected countries (including possibly high-income countries with sizable intermittent RE resources and the financial capacity to support them) to develop innovative and transformative projects, particularly solar with adequate storage. The Bank proposes to explore the development of transformative, but still high-cost, technologies such as concentrated solar power (CSP) to contain consumption of fossil fuels and help create a market of scale for such technology. The latter could be done through increased cooperation among Asian countries to tap the synergy of the regional technological and manufacturing capabilities to make the announced development programs more affordable and replicable at lower cost in other regions.
- support the development of the significant geothermal resources identified in many Asian countries, alone or in partnership with other MDBs, through the development of new approaches to reduce resource risks. Sovereign loans to governments or state owned entities could be considered to confirm resources prior to requesting private sector proposals for power generation or novel PPP approaches based on appropriate resource risk sharing.

35. ***Local and regional pollution management.*** Stand-alone local and regional pollution management projects represent an emerging new business line for MDBs operating in Asia. These projects address the debilitating impacts of local and regional pollution on Asian economies and populations. Economic valuations of local environment externality costs are country- and even region-specific. They require detailed studies of the negative impacts of pollution on the economy and health of the population, as well as a broad range of economic assumptions, including sensitive assumptions such as the valuation of lost lives. The results of high quality studies carried out in developed and some developing countries can, under carefully determined assumptions, be transferred to Asian countries where fewer studies have

been carried out. The Bank proposes to assist client countries in reducing local and regional pollution, in partnership with MDBs and bilateral agencies. Over time, it will consider developing multi-sectoral approaches and instruments that contribute to the cleanup of Asia’s highly polluted cities and/or regions. These could include initiatives addressing the problems of acid rain (SO₂), PM_{2.5}, and smog, etc.

36. **Fossil fuel power generation investments.** Carbon intensity of power generation investments in 2015 was more than 4 times the level required to reach climate change stabilization in the next two decades (See Figure 7). While fossil fuels will continue to play a significant role in the energy mix of most of its member countries, the Bank focuses on supporting and accelerating its members’ respective transitions toward a low-carbon energy mix including lower-carbon emissions from fossil fuels. The Bank would finance investments that are demonstrably compatible with a country’s transition toward sustainable, low-carbon energy and internationally agreed targets. Supported fossil fuel based generation facilities would be expected to use commercially available least-carbon technology. In many countries, gas-fired power generation would form part of such transition. Carbon efficient oil and coal-fired power plants would be considered if they replace existing less efficient capacity or are essential to the reliability and integrity of the system, or if no viable or affordable alternative exists in specific cases, particularly in low income countries.

Figure 7: Investments in the Electricity Sector (2015)



Source: IEA World Energy Investments 2016

37. **Oil and natural gas processing, transportation and distribution.** Private sector involvement is more likely here than in other subsectors, as international oil and gas companies have the technology and financial strength to support such projects in many cases. In some countries in Asia, national oil and gas companies also are active in these subsectors and governments may express interest in Bank financing. The Bank proposes to support such investments provided that they improve energy security or promote regional integration and trade. The Bank proposes to also consider development, rehabilitation and upgrading of natural gas transportation (including storage) and distribution networks, and controlling gas leakage, to foster greater penetration of gas during the transition to a “less CO₂ intensive” energy mix/power sector, especially in Asia where such penetration is low compared to other regions.

38. **Nuclear power generation.** Financing of nuclear plants will not be considered by the Bank. Should demand arise for very special cases of support in safety enhancement/upgrading, the Bank could possibly consider engagement.

39. **Adaptation projects.** Climate change adaptation is emerging as an MDB business line in association with grant facilities, such as the Green Climate Fund (GCF), Global Environment Facility (GEF) and climate change trust funds. A recent study¹³ on infrastructure finance noted “it was estimated that between 10 and 15 percent of the (future) required infrastructure investment could be attributed to making such investment (including adaptation) sustainable, by ensuring lower emissions, higher efficiency and resilience to climate change.” The Bank proposes to partner with MDBs and bilateral partners to support such efforts in the Asian countries most threatened by climate change.

Cross-Cutting Issues

40. Global environmental and sustainable energy for all goals and principles are widely accepted and embraced by other MDBs and clients, however, their application is not always straightforward. Green energy investments require: (i) new approaches to evaluate their economic viability because they may not be economically justified according to the assumptions traditionally used by most MDBs; (ii) highly skilled and diversified teams and a solid knowledge base; and (iii) effective coordination among sectoral teams within the financing institutions to meet client needs efficiently. These issues are discussed below.

41. **Developing a solid base for economic evaluation.** The economic evaluation of energy projects raises issues relating to the assumptions used for discount rates, carbon price and externality costs of local pollution used in economic evaluations of projects, such as: (i) high discount rates indicate a strong preference for the present; (ii) low carbon prices underestimate the economic impacts of climate change; and (iii) low local and regional pollution externality costs lead to pollution levels beyond the absorption capacity of the environment, as experienced in most Asian cities. The Bank proposes to use an appropriate discount rate and shadow price for carbon emissions and other externalities in its economic evaluation of projects to determine their economic viability. Considering the lack of consensus about a discount rate and carbon price, the Bank proposes to test the robustness of its economic analyses using a range of different discount rates and carbon prices.

42. **Building highly skilled multi-disciplinary team.** Highly skilled teams are a prerequisite to developing a strong and diversified energy portfolio. In line with its lean approach to staffing, the Bank proposes to progressively build a highly skilled and diversified team of staff and consultants with recognized expertise in technical, economic, financial, environmental and social aspects of project conception, preparation, evaluation and supervision. For example, strong hydropower technical expertise and highly qualified environmental and social specialists are needed to engage with clients in developing large hydropower schemes. High quality staff/consultants directly contributes to successful project outcomes and a high quality portfolio. During the implementation of the Strategy, the Bank proposes to focus on developing and deepening its sectoral expertise and knowledge. In the early stages of its energy portfolio development, the Bank proposes to build partnerships with other MDBs, private financial institutions, think tanks and academia to ensure that its energy team has timely access to existing knowledge bases and sectoral developments. The Bank also recognizes the importance of a supportive policy environment to project success. In the

¹³ A. Bhattacharya, M. Romani and R. Stern: Infrastructure for Development: Meeting the Challenge (London School of Economics - 2012)

early years of operations, the Bank would not support policy-based financing instruments and programmatic or sector loans. Over time, it may develop performance-based lending instruments that are tailored to client needs and circumstances.

43. ***Promoting collaborative approaches among infrastructure subsectors.*** In developing its portfolio, the Bank proposes to promote holistic approaches to energy sector development. The Bank aims to: (i) ensure that its other sector strategies recognize the importance of energy and incorporate energy efficiency in the Bank's core business; and (ii) promote intra-sectoral collaboration to meet client needs in the most efficient way and maximize synergies among the different sub-sectors. Examples may include: EE and sustainable urban infrastructure, including energy efficient buildings; transport sector initiatives that improve carbon and energy efficiency outcomes; multi-purpose dams with the agriculture, industrial and urban sectors; and access to modern energy within the rural development and agriculture sectors.

Results Monitoring Framework

44. The Bank proposes to monitor outcome and output indicators to assess the alignment of its evolving energy portfolio with the Strategy principles. A proposed Results Monitoring Framework is attached in Annex 2.

Annex 1: Definitions for Asia and Region and Income Classification

In this document, references to “Asia” and “Region” includes the geographical regions and composition classified as Asia and Oceania by the United Nations. This definition does not include Russia. However, Russia is a regional member of AIIB and therefore is listed separately, and additionally, in various places in this document. In this analysis, the Asian countries are broadly divided into 3 groups:

Five Members of the Organization for Economic Co-operation and Development (OECD). They are Japan and South Korea from Eastern Asia, Australia and New Zealand from Oceania, and Israel from Western Asia.

Three individual countries - China, India (Non-OECD) and Turkey (OECD), are examined separately from their regions because of their size or their different energy characteristics.

The Rest of Asia, which is defined as Asia excluding 6 OECD countries, China and India. The Rest of Asia is then classified into six sub-regions: Eastern Asia, Southern Asia, Southeastern Asia, Central Asia, Western Asia and Oceania, according to the geographical classification adopted by United Nation Statistics Division (UNSD) (see Figure A.1). Regionally, 23 countries/territories are in Oceania, 16 in Western Asia, 11 in Southeastern Asia, 8 in Southern Asia, 4 in Eastern Asia, and 5 in Central Asia.

Figure A.1: UN Geo-scheme of Regional and Sub-Regional Groups



Note: Statistical regions as defined by UNSD. Antarctica is omitted.

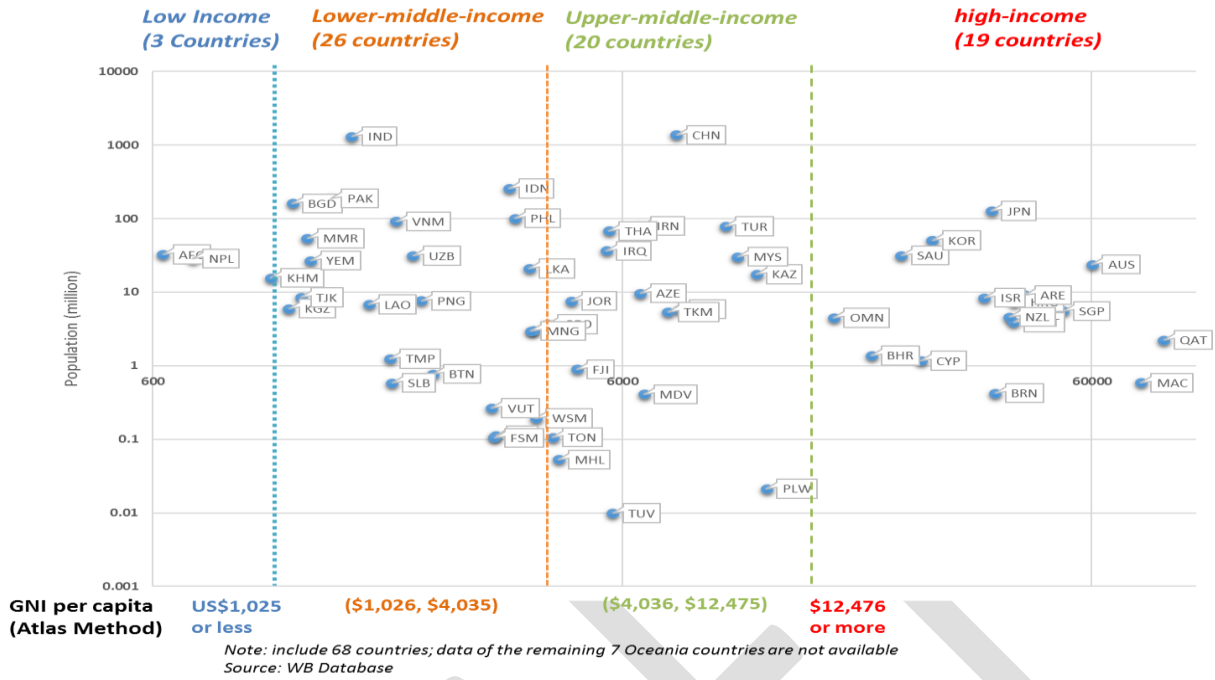
Source: CC BY-SA 3.0 based on geographical subregions and breakdown by country information obtained from unstats.un.org/unsd/methods/m49/m49regin.htm

The Asian countries can also be grouped into four income classes according to World Bank Income Classification Criteria¹⁴. As illustrated in Figure A.2, there are 3 countries / territories classified as low-income; 26 as lower-middle-income; 20 as upper-middle-income; and 19 as high-income¹⁵.

¹⁴ *Low-income economies* are defined as those with gross National Income (GNI) per capita, calculated with the World Bank Atlas method, of US\$1,025 or less in 2015; *Lower-middle-income economies* are those with a GNI per capita between \$1,026 and \$4,035; *Upper-middle-income economies* are those with GNI per capita between \$4,036 and \$12,475; and *high-income economies* are those with GNI per capita of \$12,476 or more. *Source: datahelpdesk.worldbank.org/knowledgebase/articles/906519*

¹⁵ 68 countries/territories in total as data of the remaining 7 Oceania countries are not available from World Bank database.

Figure A.2: Income Classification of Countries in Asia



Annex 2: Proposed Results Monitoring Framework

Outcome	Outcome Monitoring Indicators	Output	Output Monitoring Indicators	Assumptions
1. Reduction of energy inequality	<p>1. Increase of population with access to modern energy services</p> <p>2. Increase in primary energy consumption per capita in low and lower-middle income countries.</p>	<p>1. Increase in total energy infrastructure investments in Asia (US\$ million)</p> <p>2. Increase of energy infrastructure investments share in GDP (%)</p>	<p>1.1. The Bank's energy infrastructure lending (US\$ million)</p> <p>1.2. Private sector investments leveraged</p> <p>1.3. MW of total generation installed</p> <p>1.4. km of transmission and distribution lines financed</p> <p>1.5. Number of connected households</p>	<p>Strong partnerships with MDBs and bilateral agencies operating in Asia.</p> <p>Continued focus of client countries on improved infrastructure and connectivity</p>
2. Improved energy efficiency	2.1. Energy intensity reduced in client countries	2. The Bank EE investments (US\$ million)	2.1. Primary energy consumption avoided	<p>Strong commitment of client countries to NDCs</p> <p>Access to GCF funds</p>
3. Reduction of carbon intensity of energy supply	<p>3.1. Share of RE in primary energy consumption</p> <p>3.2. Lower CO₂ emissions per MWh generated</p>	3. Investments in RE increased	<p>3.1. The Bank RE investments (US\$ million) of which support to transformational technologies</p> <p>3.2. Avoided CO₂ emissions (million tons)</p> <p>3.2. Support to manufactures in client countries</p>	<p>Strong commitment of client countries to NDCs</p> <p>Access to GCF funds</p>