Climate Science Considerations in Indonesia's President Joko Widodo's Policy on Energy and Climate Change

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Abstract

Indonesia has continuous energy and climate policies in place to solve climate change issue. This paper will review selected highlights from President Jokowi's energy and climate policies which includes the 35000 MW project, New and Renewable Energy (NRE) initiative, fuel subsidy reform, and Indonesia's submission for COP21 Paris Agreement. The policies will be analyzed broadly and in accordance to established climate science knowledges whenever possible. Both intended and unintended consequences of the policies will be discussed.

Some contradictions between energy policy, climate policy, and climate science was found. Further reliance towards coal, the inclusion of unconventional fossil fuel in NRE initiative and the lack of differentiation between land and fossil fuel carbon cycle in greenhouse gas reduction framework is inconsistent with climate change mitigation while fuel subsidy reform has to be appreciated. Consistency of the new administration is needed to keep the effective policies in place and to revise the contradictory policies for effective climate change mitigation efforts.

Keywords— Jokowi, Indonesia, energy, climate, policy

1 Introduction

Tackling climate change has become priorities in the past few years. As a response to the global challenge, Indonesia has continuous policies in place to contribute towards climate change mitigation since the ratification of Kyoto Protocol until now. This paper will assess the energy and climate policy highlights of the newly elected President Joko Widodo's administration since he assumed office in October 2014.

The country's National Action Plan for Greenhouse Gas Reduction (RAN-API) has compiled the scientific basis of climate change impact in Indonesia (BAPPENAS-National Development Planning Agency, 2013). Increase of the land surface temperature is estimated to be not greater than 1°C during 20th century (Figure 1). Rainfall has been changing during 1980-2010 compared to the baseline year, where rainfall is increasing in some place and decreasing in other (Figure 2). Sea level rise showing 1.6

mm/year rate since 1960 and drastically increase to 7 mm/year since 1993 (Figure 3). The chance of extreme rain is also increasing in some place from 1998-2008 (Figure 4). It is clear that climate change has affected Indonesia and proper policies have to be in place to enhance Indonesia's resilience towards its impacts.

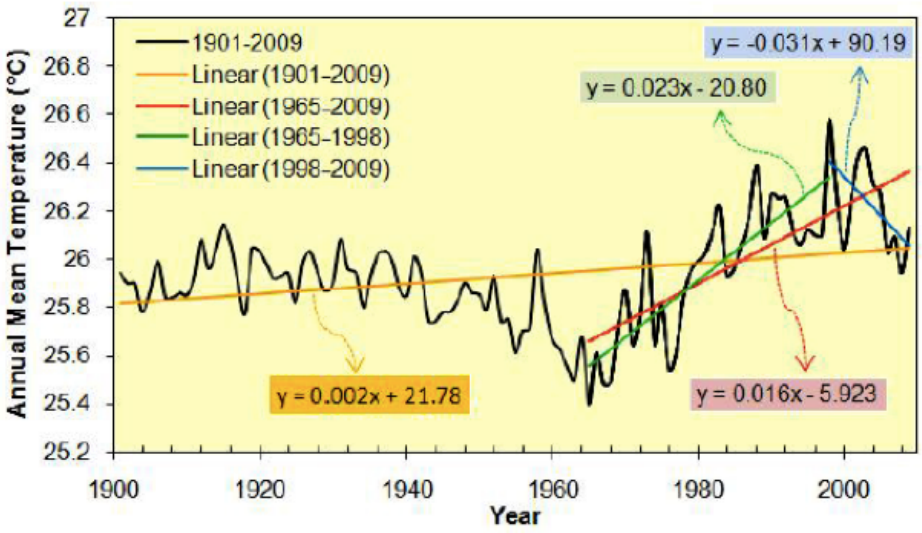

Figure 1: Average land temperature data from CRU TS3.1 data showing drastic increase since 1960s (BAPPENAS, 2013)

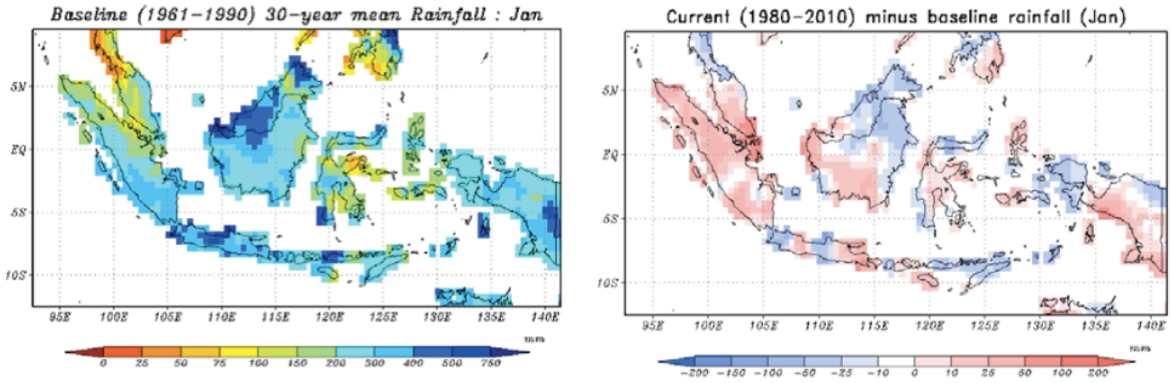

Figure 2: Rainfall data showing increase in Sumatera and both increasing and decreasing trends in other islands in 1980-2010 from baseline year (BAPPENAS, 2013)

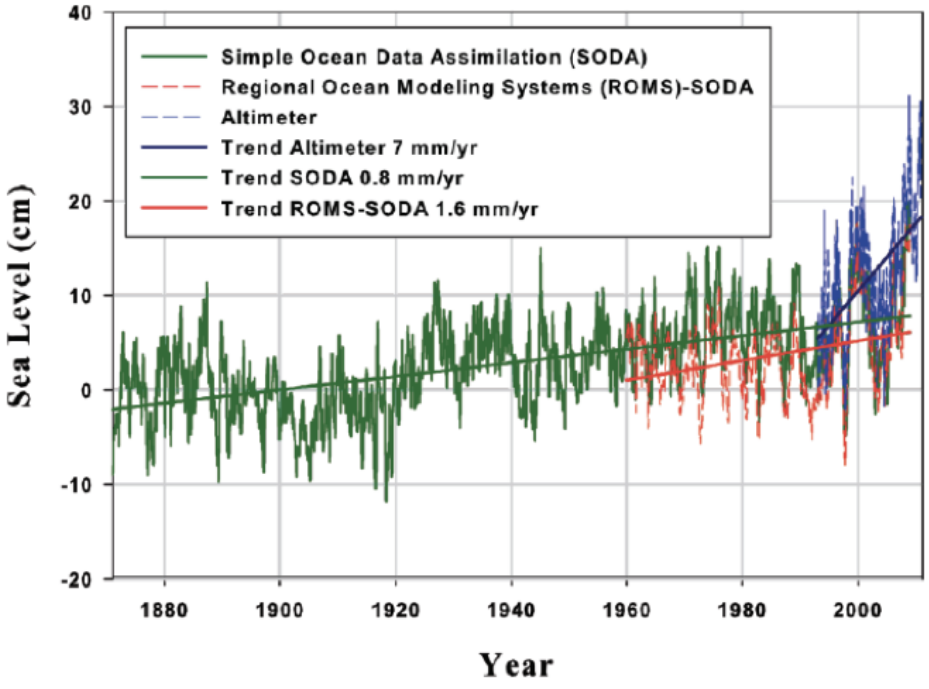

Figure 3: Various sea level measurements showing increasing trend since 1860-2010 and a drastic rise since 1993 (BAPPENAS, 2013)

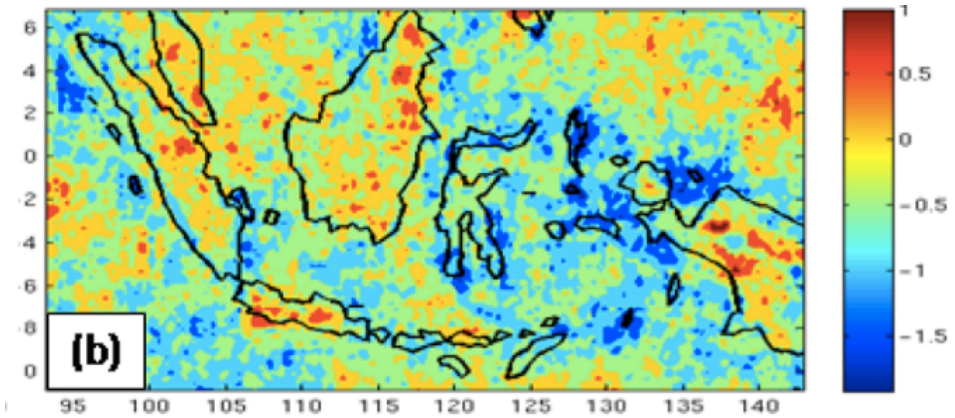

Figure 4: TRMM satellite data shows increasing extreme rainfall probability for 2003-2008 from baseline year in almost all of Indonesian islands (BAPPENAS, 2013)

2 Energy and Climate Policy Highlights Since 2014

A number of energy and climate policies has been enacted in the form of legally-binding Act (*Undang-Undang/UU*), Government Regulation (*Peraturan Pemerintah/PP*) or Presidential Decree (*Peraturan Presiden/Perpres*) by President Joko Widodo's government since October 2014. This section will review four of the new administration's energy and climate policy.

2.1 35000 MW Program

Indonesia's GDP has grown by 4.6-6.2% per year during 2006-2015 BPS-Statistics Indonesia (2016), and is expected to grow by an average of 6% per year until 2050 (BPPT-Agency for Assessment and Application of Technology, 2016). As of 2015, the installed power generation capacity in Indonesia was 51348 MW (PLN-State Electricity Company, 2016). To sustain the high economic growth, additional power plants are needed in order to meet the increasing electricity demand. President Jokowi has launched the 35000 MW new power plant campaign to be built during his 5-year tenure, based on the assumption of 7000 MW electricity demand growth per year (PLN-State Electricity Company, 2015). The commitment was further demonstrated by making it as a Perpres (Government of Republic of Indonesia, 2016a).

The megaproject requires an investment of around USD 92.9 billion, and private sector investment is needed to finance the project (Deloitte, 2016). The State Electricity Company PLN will build 10000 MW and the remaining 25000 will be built by independent power producers. Around 21000 MW, or 60% of the planned capacity will be coal-fired. Figure 5 shows the funding of the project and the planned energy mix.

2.2 New and Renewable Energy (NRE) Commitment

If firewood for household sector is not included, 92% of Indonesia's 2015 primary energy mix was supplied by fossil fuel (BPPT, 2016). Such high level of dependency might have adverse effect on the economy in the future (Hasan et al., 2012). To improve energy security, President Jokowi's administration has mandated to increase the NRE mix for 2025 and 2050 in PP on National Energy Policy (*Kebijakan Energi Nasional/KEN*) (Government of Republic of Indonesia, 2014a).

KEN stated the definition of "new energy" as energies that comes from future technical improvements which includes nuclear, hydrogen, coal bed methane, liquefied coal, and gasified coal. Hence, the NRE commitment will include not only renewable energy but also unconventional fossil fuel resources in the energy mix as well. The future energy mix aspiration of KEN is shown in Figure 6.

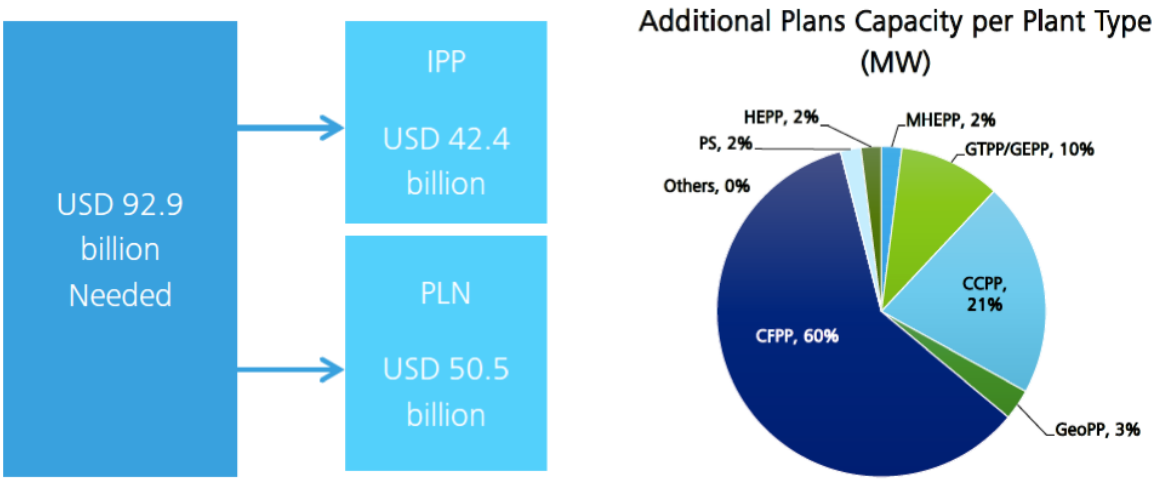

Figure 5: Funding proportion and energy mix for 35000 MW project (Deloitte, 2016). Note: CFPP=Coal, GeoPP=Geothermal, CCPP=Combined Cycle Gas, GTPP/GEPP= Gas Turbine/Gas Engine, MHEPP=Micro-hydro, HEPP=Hydroelectric, PS=Power Storage

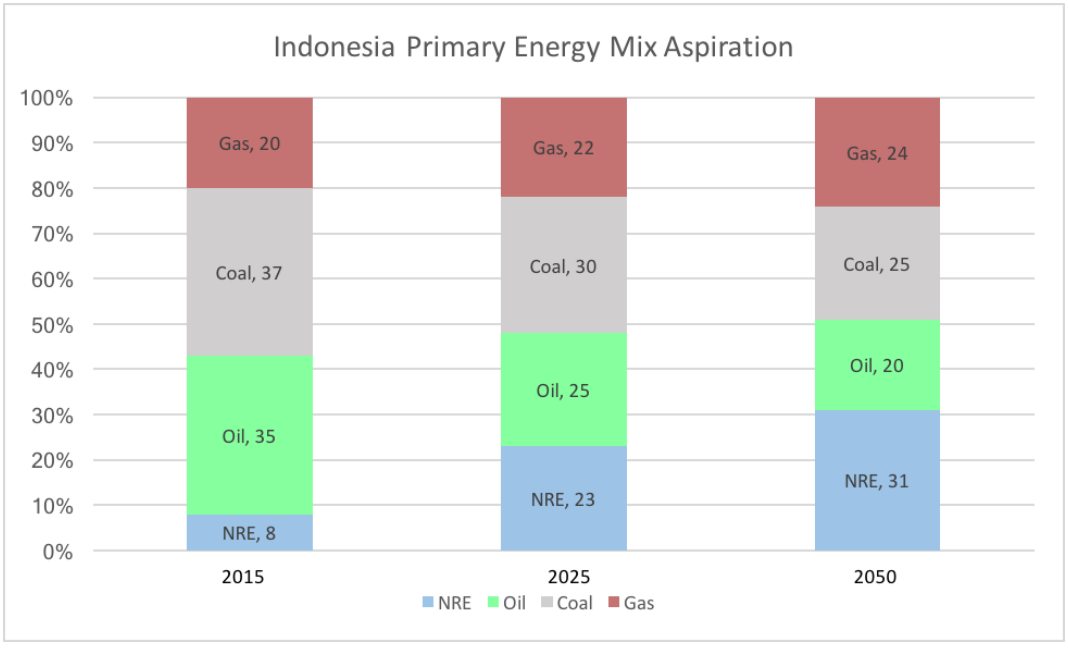

Figure 6: Indonesia energy mix aspiration in KEN (Government of Republic of Indonesia, 2014a). 2015 mix is from BPPT, 2016

2.3 Fuel Subsidy Reform

Fuel subsidy has become the government's staple policy since 1950s to protect citizens from inflation (Larasati, 2015). The subsidy became costly as the oil price is increasing: energy subsidy accounts for almost 20% of national budget in 2014 (BPPT, 2016). Despite the burden, efforts to remove it has met with resistance from the society.

The new administration took actions by increasing the price of subsidized gasoline and diesel to Rp8500 and Rp7500 per liter respectively in November 2014, followed by a Perpres (Government of Republic of Indonesia, 2014b) that pegged gasoline price to international price and a subsidy cap of Rp1000 for diesel. The government still subsidize the distribution cost of fuel in rural areas so the price would be the same all over Indonesia. The fuel subsidy reform liberated Rp 211.3 trillion (USD 16 billion) from the national budget (Office of the President of Republic Of Indonesia, 2015). Figure 7 shows the reallocation of the subsidy in national budget.

Figure 7: Reallocation of fuel subsidy (Pradiptyo et al., 2016)

2.4 COP21 Commitment

As of 2013, Indonesia emits 2160.4 $MtCO_2e$ of greenhouse gases (GHG) from all sector, or 747.3 $MtCO_2e$ if land use, land-use change, and forestry (LULUCF) sector is excluded (World Resources Institute, 2015). This makes Indonesia as 10th biggest emitter in the world without LULUCF. Figure 8 breaks down the emission per sector.

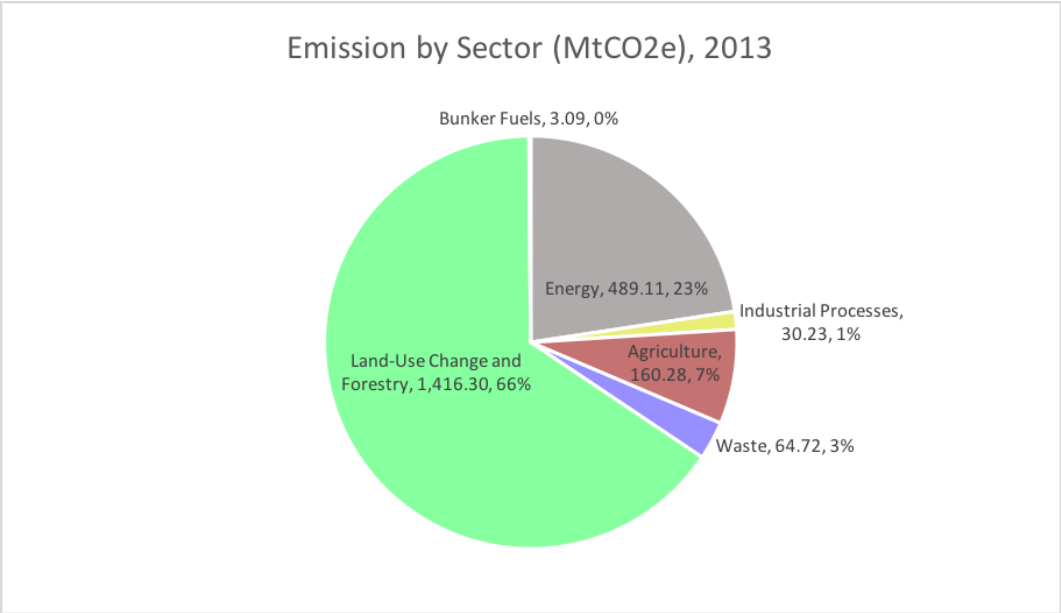

Figure 8: Indonesia GHG emission by sector in 2013. Data is from World Resource Institute, 2015

Indonesia submitted its INDC in accordance with the COP21 Paris Agreement. The government further demonstrate their commitment by making it as an UU (Government of Republic of Indonesia, 2016b). Indonesia pledged to reduce the GHG emission from all sector by 29% from business as usual (BAU) level by 2030. It also expects to increase its contribution up to 41% with international cooperation. The country planned to develop legal instruments for its efforts and building on existing climate change frameworks such as RAN-API and commitments from previous COPs stipulated in a Perpres (Government of Republic of Indonesia, 2011). Previous implementation of this commitment including the moratorium of primary forest clearing and peat land conversion from 2010-2016.

3 Considerations for the Current Policies

The policy highlights mentioned above have their own pros and cons for its implementation. This section will try to analyze the policies broadly and in accordance to established climate science knowledges whenever possible, then discuss the consequences, both intended and unintended.

3.1 Discussion

As described in the Introduction, we can see that the current framework of climate change adaptation has established the scientific basis of climate change impact in In-

donesia. With the scientific basis in mind, the government acknowledges that the most vulnerable populations tend to live in high risk areas such as coastal zones (Government of Republic of Indonesia, 2016b). However, as one of the emerging economy, it also has to sustain the high economic growth which associated with more energy consumption and GHG emissions. Indonesia faces the challenge to balance between the future development needs and mitigating the climate change, which reflected in the highlighted policies.

The decision to build additional coal power plants is inconsistent with Indonesia's climate change policy. Assuming an average lifespan of around 40 years (Burnard et al., 2016), it means Indonesia's power generation will be coal-dependent until 2050s. The addition of 10 GW of coal power plant will add approximately 55 $MtCO_2$ per year (Mujiyanto and Tiess, 2013), equivalent to additional 11.2% from 2013 energy sector emission. In terms of emission intensity, in 2013 the country's electricity generation has the highest aggregate emission intensity in ASEAN with 0.754 $kgCO_2/kWh$ (Ang and Goh, 2016). Figure 9 shows that Indonesian coal power plant efficiency still lags behind world and Asian standards.

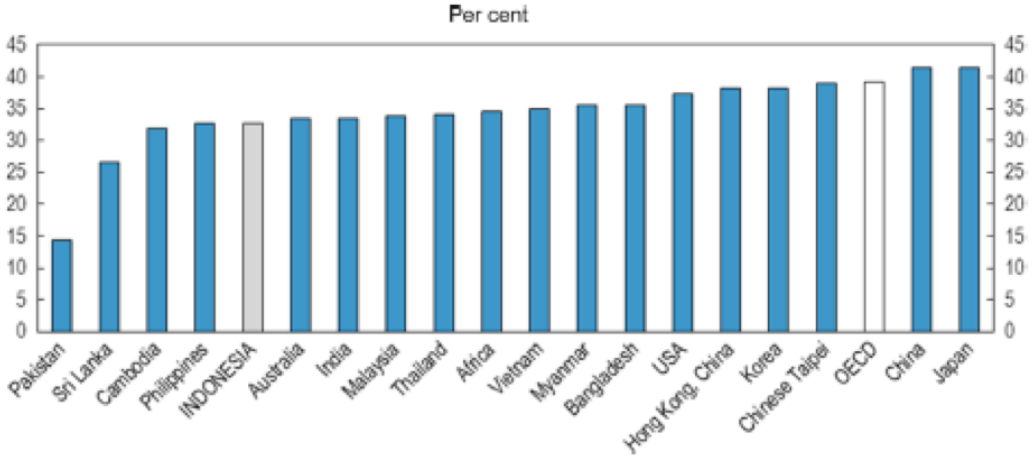

Figure 9: Thermal efficiency of coal fired power plants in various countries (Dutu, 2016)

Further emission from coal could be reduced by stopping the construction of new plants, but due to the abundance of cheap coal, it might not economically feasible. To utilize coal as a cheap energy source, the inefficiency problem has to be addressed. Government's encouragement for private sector to invest in gasified coal technology for combined-cycle gas power plant can be one of the solution to increase efficiency (Dutu, 2016).

Encouragement of NRE by up to 31% in 2050 is a positive signal for future energy security. However, the inclusion of unconventional fossil fuel in the NRE initiative will be counterproductive for GHG mitigation efforts. The concept of carbon budget is described as the maximum amount of anthropogenic CO_2 that can be emitted to limit warming below 2°C (Steffen, 2015). Figure 10 shows the world's historic CO_2 emission and the corresponding temperature anomaly, where CO_2 emission must be limited to

around 3000 $GtCO_2$ to have 50% chance of achieving the 2°C target. This means a remaining carbon budget of 1112 $GtCO_2$ from 2012 (Steffen, 2015). Burning of all current conventional fossil fuel reserve is estimated to emit 2860 $GtCO_2$, therefore 62% of world's conventional current fossil fuel reserves is unburnable in order to achieve the target with 50% chance (Steffen, 2015).

The carbon budget approach strongly discourages unconventional resources exploration by not including it in the calculation, as the additional reserve will easily exceed the current budget if burned. It is understandable to encourage unconventional fossil fuel exploration to increase domestic supply, but the initiative and incentives should be separated from other carbon-neutral NREs. Further separation of new energy and renewable energy aspirations will give clear signal of government's commitment in clean electricity generation.

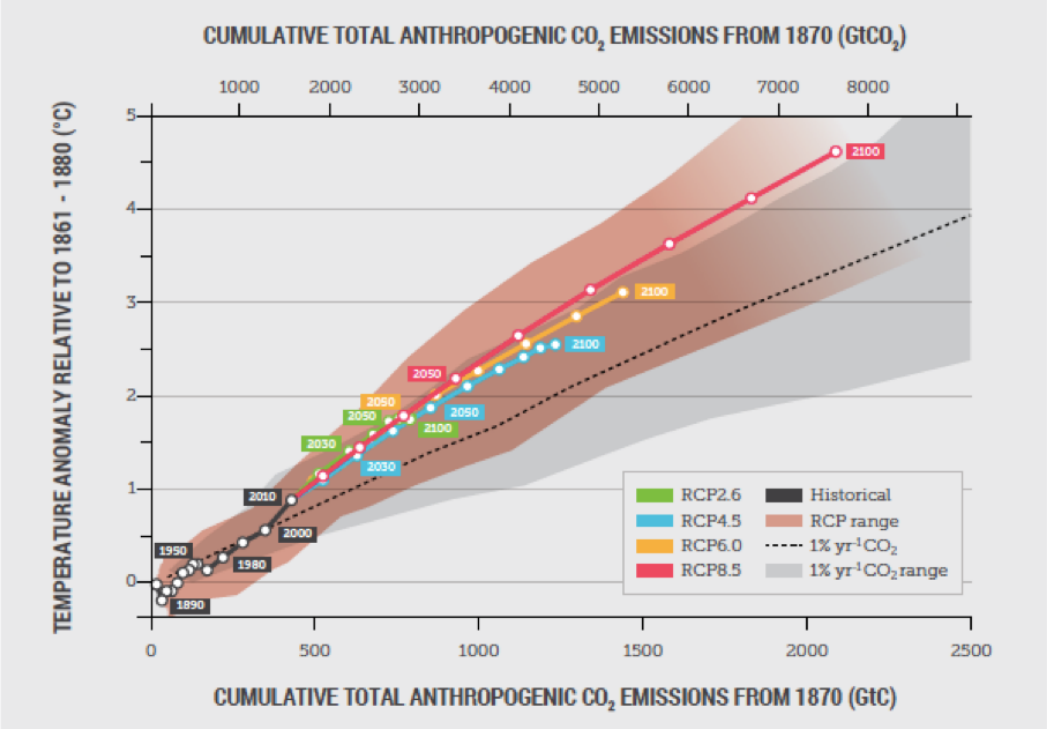

Figure 10: Cumulative anthropogenic CO_2 emission from 1870 (Steffen, 2015). Only 1112 $GtCO_2$ can be emitted from 2012 onwards to achieve 2°C target with 50% probability

It is safe to say that fuel subsidy in Indonesia is not an effective way to solve purchasing power problem of the lower income group. Around 30% of subsidized fuel goes into passenger cars (DEN-National Energy Council, 2015). In fact, the society's richest 20% received 51% of the subsidy, while the poorest 20% only consumed 7% of it (Office of the President of Republic Of Indonesia, 2015). A survey by Pradiptyo et al shows that the positive perception of subsidy in Indonesia is associated with higher

vehicle ownership due to lower fuel price and lower education level due to the loss of education opportunity (Pradiptyo et al., 2015), which ultimately reinforces the public perception towards the subsidy itself (Figure 11). It is counterproductive with efficiency measures as it drives vehicle ownership.

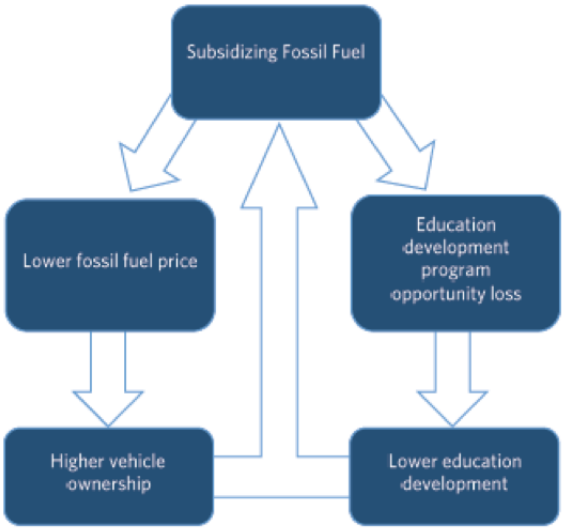

Figure 11: Subsidy will reinforce the positive public perception towards it (Pradiptyo et al., 2015)

Indonesia can potentially reduce 7-12% of GHG emission by reallocating the subsidy to renewable energy projects and energy efficiency initiatives (Merrill et al., 2015). The decision to reform fuel subsidy policy has to be appreciated. Reallocation of subsidy to infrastructure projects and to improve the economy can't be delayed to protect the society in case of oil price surge in the future.

Prior to INDC, Indonesia has a Perpres on National Action Plan for Reducing Greenhouse Gas Emission (RAN-GRK). The INDC submitted for COP21 is committed to build upon the existing policy, including RAN-GRK. Figure 12 shows the emission reduction commitment by sector from RAN-GRK. We can see that the government is under-promising in energy and transportation sector despite its contribution of 23% to the total emission (Figure 8). It is compensated by adding commitment mostly in forestry and peat sector. By doing this, the government are mixing up land carbon and fossil fuel carbon mitigation plan.

Figure 13 illustrates how these two carbons have different cycle. Land system including forest and peat has been a part of Earth's natural carbon cycle while fossil fuel exploitation unlocked carbons that has been stored for millions of years and never entered the natural carbon cycle. The release of fossil fuel carbon leads to imbalance in the system. Fossil fuel combustion emitted 2-3 times more CO_2 than the land carbon sink could take (Steffen et al., 2016). Its addition to the Earth system is taken by atmosphere and ocean, increasing their CO_2 concentration and leads to climate change.

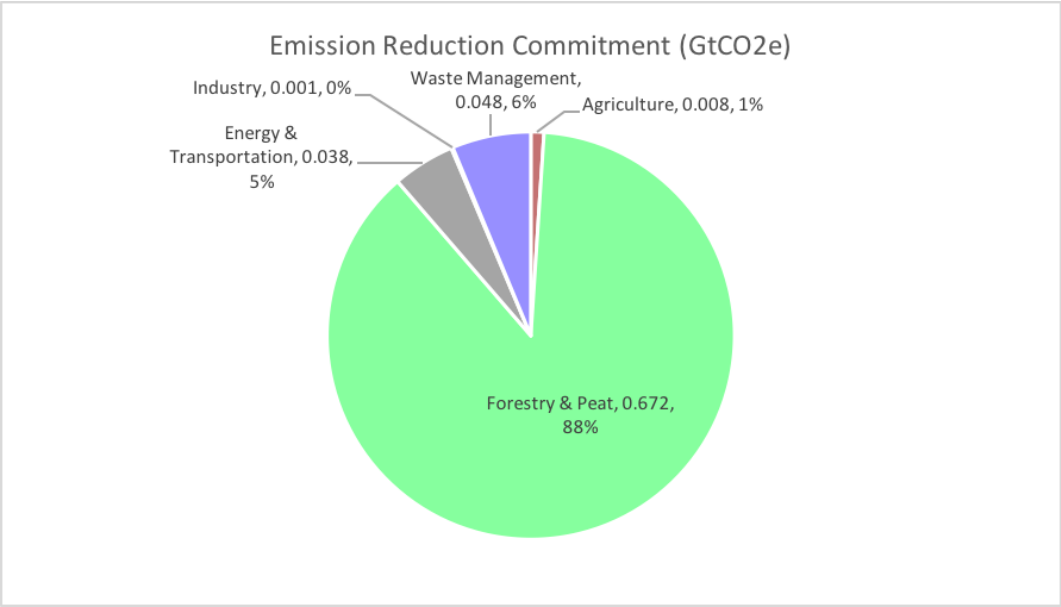

Figure 12: Emission reduction commitment in RAN-GRK. Data is from Government of Republic of Indonesia, 2011

While it is still important to restore the function of forest and peatlands as a carbon sink to reduce emission from LULUCF, there is no substitute for decreasing fossil fuel usage to reduce GHG emission from energy and transportation sector (Steffen et al., 2016). Different accounting and different measures has to be used to reduce the emission from energy sector.

3.2 Consequences of the Policies

If it is delivered on schedule by 2019, the 35000 MW project will ensure Indonesia's energy security and sustain the high economic growth. Delay in the project will pose bottleneck to economic activities (Saputra, 2015). The policy gives a clear signal for the private sector to invest in power generation and help the government to achieve the target. Without fuel subsidy, consumer will opt for a more efficient energy usage which will relieve some pressure in Indonesia's energy consumption and import requirement. The reallocation of subsidy to infrastructure projects including renewable power generation can help Indonesia to achieve the energy mix aspiration mandated in KEN.

However, the reliance on coal power plant comes with a price. Indonesia will be coal-dependent until at least 2050s. Future uncertainties such as volatile price and more stringent international regulation on carbon-intensive technologies would affect the country's energy security. Analysis by Climate Action Tracker in Figure 14 shows that with the current policies in place, Indonesia might achieve their unconditional INDC goal, but the effort is not good enough to keep global warming below 2C with a likely probability (Climate Action Tracker, 2016). The clear statement of intention for

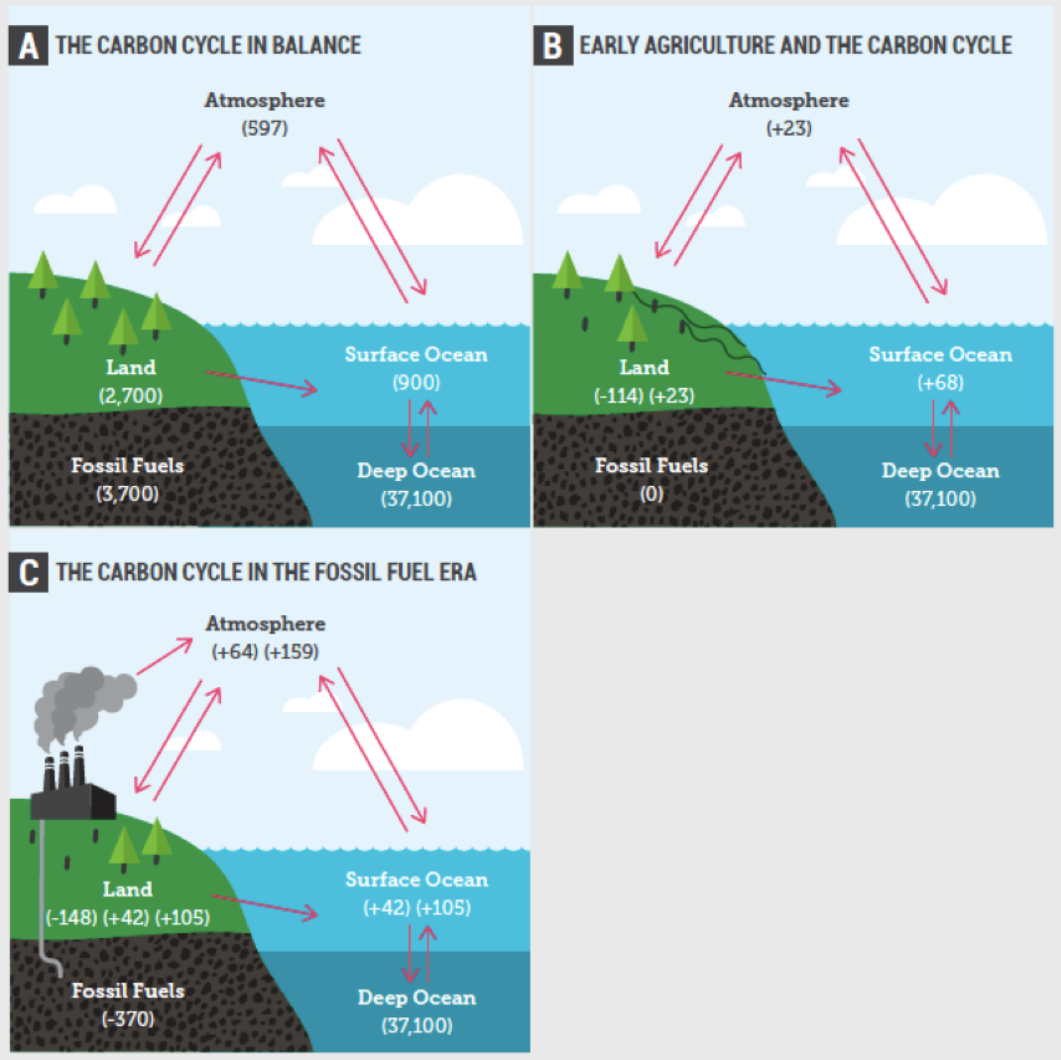

Figure 13: Earth's carbon cycle (Steffen et al., 2016). In A, numbers in the bracket represents total carbon stored in gigatons within each compartments while in B and C it represents the change in the amount stored. Prior to human interaction with Earth (A), the carbon cycle is in balance. Early agriculture era (B) shows the redistribution in land carbon cycle due to LULUCF, however the total carbon in the system is constant. In fossil fuel era (C), fossil fuel exploitation releases the carbon that has been buried for millions of year and increases the amount of the carbon in atmosphere and ocean.

international cooperation to achieve the conditional target could translate to projects which can reduce emission from fossil fuel based carbon, such as the ongoing Gundih carbon capture and storage project (Gundih CCS Project Consortium, 2015).

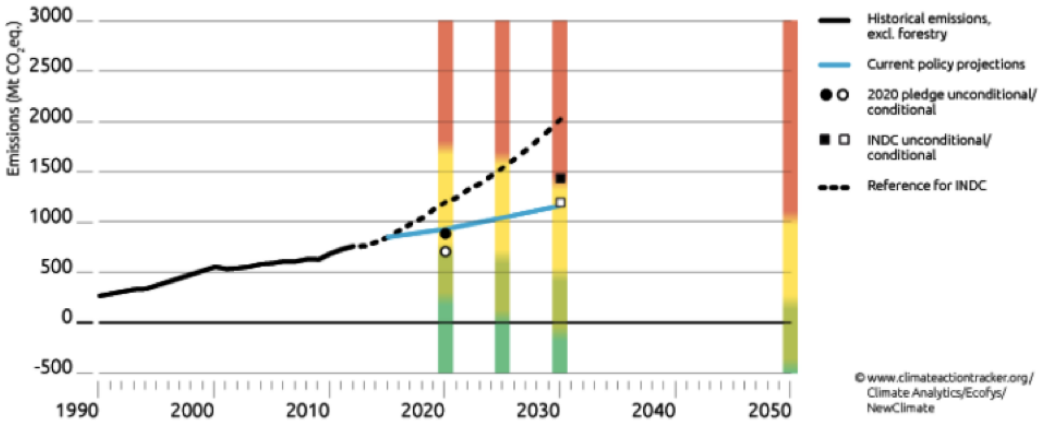

Figure 14: Indonesia's INDC commitment and emission projection (Climate Action Tracker, 2016). Indonesia's current policy projection is rated medium (yellow bar) where in this scenario, global warming is likely to exceed 2°C. Other ratings are inadequate (red bar) where global warming would likely exceed 3°-4°C and sufficient (olive) where global warming is likely to be limited below 2°C.

4 Recommendation

Based on the discussions in the previous sections, some recommendations can be made for the current policies:

- The unconventional fossil fuel, new energy and renewable energy target has to be differentiated. They have different emission impacts so the target and incentives has to be adjusted accordingly. The differentiation would also demonstrate government's commitment in carbon-neutral electricity generation.
- Fossil fuel subsidy reform has to be consistently implemented despite high political pressure. The reallocation towards infrastructure and renewable energy projects cannot be delayed to prepare the society to deal with high oil price environment and to reduce carbon emission.
- Different accounting in reduction commitments for land carbon sources and fossil fuel carbon sources. The acknowledgement of different carbon cycle will lead to effective carbon emission reduction policies.

5 Conclusion

Based on the current, well-established climate science facts, President Joko Widodo's energy and climate change policy have some inconsistencies. Some energy policies are found to be contradictory to climate change mitigation, such as the decision to build new coal power plants and the "new and renewable energy" initiative which includes the unconventional fossil fuel production in the target. The lack of differentiation between land carbon and fossil fuel carbon emission can render the GHG mitigation policy ineffective. However, the bold decision to reform the fuel subsidy should be appreciated, as it can lead to efficiency and reallocation of funds for infrastructure and carbon-neutral energy projects. Consistency of the new administration is needed to keep the effective policies in place and to revise the contradictory policies for effective climate change mitigation efforts.

References

Ang, B. W. and Goh, T. (2016). Carbon intensity of electricity in ASEAN: Drivers, performance and outlook. *Energy Policy*, 98:170–179.

BAPPENAS-National Development Planning Agency (2013). National Action Plan for Climate Change Adaptation (RAN-API) Synthesis Report. Available from https://gc21.giz.de/ibt/var/app/wp342deP/1443/wp-content/uploads/filebase/programme-info/RAN-API_Synthesis_Report_2013.pdf.

BPPT-Agency for Assessment and Application of Technology (2016). Outlook Energi Indonesia 2016. Available from http://repositori.bppt.go.id/index.php?action=download&dir=_data%2FDownload%2FOUTLOOK+ENERGI+2016&item=BPPT+-+Outlook+Energi+Indonesia+2016.pdf&order=name&srt=yes&lang=en.

BPS-Statistics Indonesia (2016). Statistical Yearbook of Indonesia 2016. Available from https://www.bps.go.id/publikasi/view/4238.

Burnard, K., Hsieh, S., Razali, N. M. M., Baruya, P., Hung, N. N., and Phuc, N. C. (2016). Reducing emissions from fossil-fired generation: Indonesia, Malaysia, and Viet Nam. Technical report, International Energy Agency.

Climate Action Tracker (2016). Climate Action Tracker: Indonesia assessments. Retrieved Mar 27 2017 from http://climateactiontracker.org/countries/indonesia/2016.html.

Deloitte (2016). 35000 MW: A Light for the Nation. Technical report, Deloitte.

DEN-National Energy Council (2015). Executive Reference Data for National Energy Management. Available from http://www.den.go.id/index.php/publikasi/download/24.

Dutu, R. (2016). Challenges and policies in Indonesia's energy sector. *Energy Policy*, 98:513–519.

Government of Republic of Indonesia (2011). Peraturan Presiden Republik Indonesia Nomor 61 Tahun 2011 (Presidential Decree No. 61/2011). Available from http://www.bappenas.go.id/files/6413/5228/2167/perpres-indonesia-ok__20111116110726__5.pdf.

Government of Republic of Indonesia (2014a). Peraturan Pemerintah Nomor 79 Tahun 2014 (Government Regulation No. 79/2014). Available from http://www.den.go.id/index.php/publikasi/download/31.pdf.

Government of Republic of Indonesia (2014b). Peraturan Presiden Nomor 191 Tahun 2014 (Presidential Decree No. 191/2014). Available from http://jdih.esdm.go.id/peraturan/Perpres%20Nomor%20191%20Tahun%202014.pdf.

Government of Republic of Indonesia (2016a). Peraturan Presiden Nomor 4 Tahun 2016 (Presidential Decree No. 4/2016). Available from http://jdih.esdm.go.id/peraturan/Perpres_Nomor_4_Tahun_2016.pdf.

Government of Republic of Indonesia (2016b). Undang Undang Nomor 16 Tahun 2016 (Law No. 16/2016). Available from http://www.kemendagri.go.id/media/documents/2016/10/31/u/u/uu0162016.pdf.

Gundih CCS Project Consortium (2015). Pilot Study for Carbon Sequestration and Monitoring in Gundih Area, Central Java Province, Indonesia. Retrieved Mar 27 2017 from http://ccs-gundih.fttm.itb.ac.id/.

Hasan, M. H., Mahlia, T. M. I., and Nur, H. (2012). A review on energy scenario and sustainable energy in Indonesia. *Renewable and Sustainable Energy Reviews*, 16(4):2316–2328.

Larasati, A. (2015). Future of Indonesia's Energy Independency: Review on Fuel Subsidies Reform of Joko Widodo's Government. Graduate School of Public Policy, University of Tokyo.

Merrill, L., Bassi, A. M., Bridle, R., and Christensen, L. T. (2015). Tackling Fossil Fuel Subsidies and Climate Change: Levelling the energy playing field. Technical report, Nordic Council of Ministers.

Mujiyanto, S. and Tiess, G. (2013). Secure energy supply in 2025: Indonesia's need for an energy policy strategy. *Energy policy*, 61:31–41.

Office of the President of Republic Of Indonesia (2015). Realokasi Subsidi BBM (Fuel Subsidy Reallocation). Retrieved Mar 23 2017 from http://presidenri.go.id/prioritas/energi/realokasi-subsidi-bbm.html.

PLN-State Electricity Company (2015). 35000 MW Untuk Indonesia (35000 MW Infographics). Available from http://www.pln.co.id/wp-content/uploads/2015/04/35000-MW2.pdf.

PLN-State Electricity Company (2016). Rencana Umum Penyediaan Tenaga Listrik 2016-2025 (General Plan of Electricity Supply 2016-2025). Technical report, PLN-State Electricity Company.

Pradiptyo, R., Susamto, A., Wirotomo, A., Adisasmita, A., and Beaton, C. (2016). Financing Development with Fossil Fuel Subsidies: The Reallocation of Indonesia's Gasoline and Diesel Subsidies in 2015. Technical report, International Institute for Sustainable Development.

Pradiptyo, R., Wirotomo, A., Adisasmita, A., and Permana, Y. H. (2015). The Role of Information in Perception of Fossil-Fuel Subsidy Reform: Evidence from Indonesia. Technical report, The International Institute for Sustainable Development.

Saputra, E. (2015). Indonesia's Top 7 Energy Issues: Focusing on What Really Matters. Paper presented at the SPE/IATMI Asia Pacific Oil & Gas Conference and Exhibition, 20-22 October 2015, Nusa Dua, Bali, Indonesia.

Steffen, W. (2015). Unburnable Carbon: why we need to leave fossil fuels in the ground. Technical report, Climate Council of Australia.

Steffen, W., Fenwick, J., and Rice, M. (2016). Land carbon: No substitute for action on fossil fuels. Technical report, Climate Council of Australia.

World Resources Institute (2015). CAIT Climate Data Explorer. Available from http://cait.wri.org.