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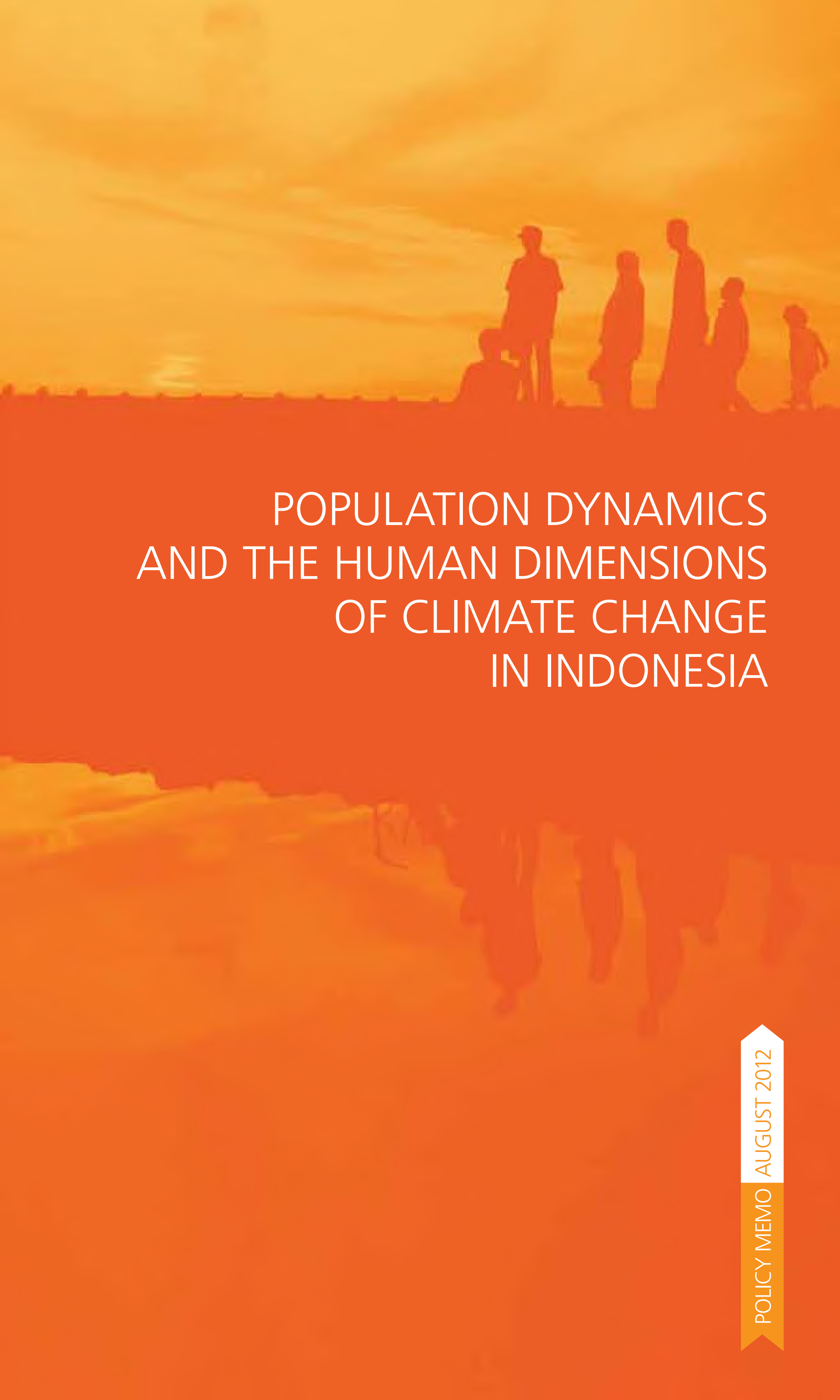
UNFPA INDONESIA

POPULATION DYNAMICS AND THE HUMAN DIMENSIONS OF CLIMATE CHANGE IN INDONESIA

POLICY MEMO AUGUST 2012



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FOREWORD

Climate change is already affecting Indonesia, as evidenced in the recently-released report "Indonesia Country Report on Climate Variability and Climate Change" (Ministry of Environment, 2007). This report, prepared by a group of leading Indonesian experts from all relevant sectors and institutions, presents an analytical overview of climate impacts in Indonesia. The results presented in this report are consistent with the Intergovernmental Panel on Climate Change (IPCC).

The impacts of climate change pose a challenge not only to Indonesia's environment, but to the achievement and sustainability of its socio-economic development goals. We need to make society more resilient to the risks posed by climate change. To counter present threats and plan a more secure future, we must embed in our systems of development planning measures that help populations mitigate and adapt to the effects of climate change.

UNFPA would reiterate the ICPD principle on the sustainable development, population and environment inter-linkages: "Sustainable development as a means to ensure human well-being, equitably shared by all people today and in the future, requires that the interrelationships between population, resources, the environment and development should be fully recognized, appropriately managed and brought into harmonious, dynamic balance. To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate policies, including population-related policies, in order to meet the needs of current generations without compromising the ability of future generations to meet their own needs" (ICPD Programme of Action, Chapter II, Principle 6).

Experts agree that population issues are closely linked with climate change. Population dynamics concerns have even been expressed through international forum such as United Nations Conference on Sustainable Development - Rio+20 in June 2012. In this occasion, President of the Republic of Indonesia, Susilo Bambang Yudhoyono, also expressed in his speech the importance to address the issue of population in the context of sustainable development and sustainable environment including climate change. However, current policy dialogue on climate change—both at international and country levels—have not included consideration of population dynamics. If addressed at all, population is usually countenanced in a very narrow scope that reduces 'population' to a single number, attributed as a causative factor of climate change. To better understand the role that population plays in climate change, one must look at the human dimensions of the issue. Such perspective informs discussion of climate change in terms of population 'dynamics,' which includes changes in age structure, migration and urbanization patterns. By including these issues in mitigation and adaptation strategies, the effectiveness and efficiency of such measures will be strengthened.

Cooperation among DNPI (*Dewan Nasional Perubahan Iklim* — National Council on Climate Change), BKKBN (*Badan Kependudukan dan Keluarga Berencana Nasional* – National Population and Family Planning Board), and UNFPA (United Nations Population Fund) has resulted in this policy memo: "Population Dynamics and Human Dimensions of Climate

Change in Indonesia." It is targeted toward a broad audience, with the aim of creating awareness and support among policy makers and the general public alike.

This policy memo concisely illustrates how population dynamics influence both causes and consequences of climate change, through an analysis that examines population structure and geographical distribution, as well as size and growth rates. This document demonstrates innovative thinking and contributes significantly to the climate change agenda, prompting us to account for population dynamics as Indonesia builds its national response to climate change.

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EXECUTIVE SUMMARY

Climate change is about people as well as climate. This Policy Memo presents a preliminary evidence-based understanding of the ways in which population dynamics – i.e. the interrelated ways in which a population can change in size and composition – may be contributing to the rapidly growing greenhouse gas (GHG) emission rates in Indonesia from burning fossil fuels (FF). Many popular discussions focus on population growth but we argue that population composition is equally important; to focus on one without the other gives a distorted picture. A population perspective also helps integrate the many human dimensions of climate change – economic, political, social and cultural, as well as demographic – into a common framework which can be used in policy formulation. We consider the implications of trends in urbanization, population growth, age structure, and the growth of the middle class for anthropogenic climate change.

President Susilo Bambang Yudhoyono has committed the country to reducing GHG emissions by 26 percent by 2020 relative to a business-as-usual (BAU) scenario, and an additional 15 percent if suitable international assistance is forthcoming. Addressing population dynamics cannot achieve such ambitious targets on its own but it can make the task easier, especially over the long term.

Based on our understanding of the causal links between population dynamics and GHG emissions we identify a number of population-based policy options for reducing GHG emissions:

- Improving energy efficiency in urban areas by better spatial planning, infrastructure and allied interventions; this policy also has significant co-benefits for population health and well-being. A golden opportunity for implementation is presented by the launch of the new Masterplan on Acceleration and Expansion of Economic Development 2011-2025.
- Revitalizing the national family planning program can make a major contribution to Indonesia's GHG mitigation efforts over the next 40 years, and beyond. The family planning program needs to be revitalized to protect the health and reproductive rights of citizens; that this will also contribute to a reduction in GHG emissions is a fortunate co-benefit.
- Investing heavily in the education of today's youth is essential for ensuring the higher human capital and sustained economic growth which are needed for a smooth transition to a green economy.
- Much can be done to promote – especially among the young rising middle-classes – the benefits of green choices and sustainable lifestyles to help reverse the current steep rise in the country's carbon intensity.

Further data collection is needed for a more comprehensive analysis, but hopefully the preliminary analysis presented in this Memo is sufficient to start the process of incorporating population dynamics systematically in the formulation of Indonesia's national response to climate change.

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I also want to thank José Ferraris and his staff at the United Nations Population Fund (UNFPA) for their support and guidance.

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Finally I want to acknowledge the support received from the Australian National University and the Australian Research Council: some of the analysis used in this Policy Memo draws on the as yet unpublished findings from original research I am undertaking as part of an ARC Discovery Grant awarded to Professors Terry Hull, Zhongwei Zhao and myself.

The views expressed in this Policy Memo are, unless otherwise stated, my own, and do not necessarily reflect those of UNFPA, DNPI, or any other stakeholder.

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This Memo develops population-based policy options which the Government of Indonesia can consider as part of its strategy to reduce greenhouse gas emissions from the combustion of fossil fuels.

1 Introduction

Climate change is about people as well as climate. During the last 20 years climate scientists have confirmed that global warming over the last century is "unequivocal" and that human activities are "very likely" the major cause (IPCC 2007). It is important now to study in more depth the anthropogenic causes and consequences of climate change. Many of these are grounded in demographic change (O'Neill et al. 2010).

This Policy Memo presents a preliminary evidence-based understanding of the ways in which population dynamics may be contributing to the rapidly growing greenhouse gas (GHG) emission rates in Indonesia from burning fossil fuels (FF).[1] Many popular discussions focus on population growth but we argue that population structure is equally important; indeed, to focus on one without the other gives a distorted picture. We use the term "population dynamics" to refer to ways in which both the size and structure (or composition) of a population change over time. In particular we consider changes in urbanization, population growth, age structure, and the growth of the middle class.

The anthropogenic causes (and consequences) of climate change have many dimensions, including economic, political, sociological, and cultural. A population perspective helps integrate these into a common framework which can be used in policy formulation. Based on our preliminary understanding of the links between population dynamics and GHG emissions we suggest ways in which Indonesia's mitigation strategies can be strengthened by taking these linkages into account.

President Susilo Bambang Yudhoyono has committed the country to reducing GHG emissions by 26 percent by 2020 relative to a business-as-usual (BAU) scenario, and an additional 15 percent if suitable international assistance is forthcoming. Addressing population dynamics cannot achieve such ambitious targets on its own but it can make the task easier, especially over the long term.

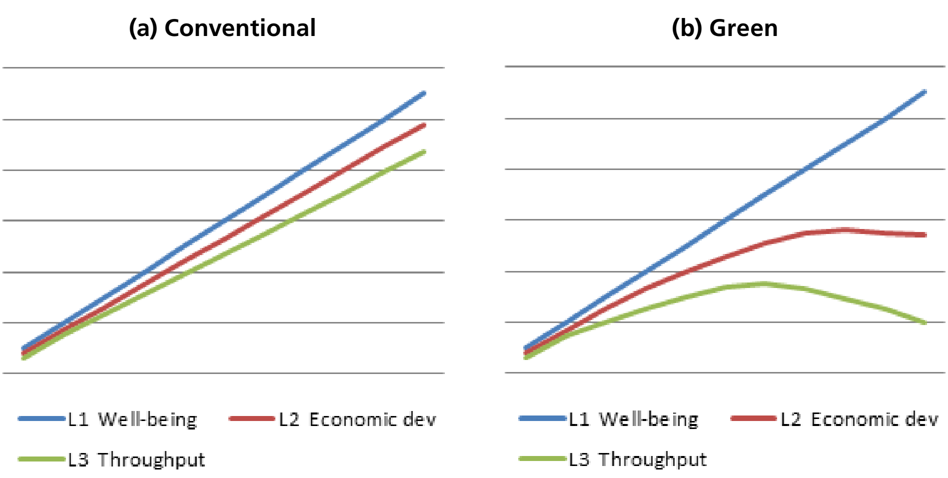
1 This Memo focuses on greenhouse gas emissions from the combustion of fossil fuels. Reducing emissions under the REDD+ scheme is considered in a previous Policy Memo (Busch et al. 2010). The current Memo builds on Hayes (2011).

2

Reducing emissions:
TWO SOLUTIONS

People everywhere strive for a better quality of life and the goal of development is usually seen as to facilitate improved well-being and the elimination of poverty. Figure 1a (left panel) gives a stylized representation of what usually happens in the course of national development. Line 1 represents the rise in overall well-being of the population over time. Invariably improvements in well-being (i.e. people living longer, eating better, enjoying the benefits of better housing and sanitation, education, more personal freedoms, etc.) require the production and consumption of more goods and services, in other words, economic development. This latter rise is represented by Line 2.[2] Finally, economic development is based to a large extent on exploitation of natural resources and results in the generation of more environmental impact and pollution. The rise in "throughput" of materials and energy is represented by Line 3.

Figure 1. Comparison of conventional and green development scenarios



Source: *Inspired by Raskin et al. (2002: 48) and Robinson and Tinker (1996).*

In this Memo the "pollution" we are focusing on is the emission of greenhouse gases (GHG) into the atmosphere, from the combustion of fossil fuels (FF) including coal, oil, and natural gas. Reducing these emissions is a challenge of epic proportions since modern industrial

2 Forty years ago the association between increasing well-being and economic development was so strong in the minds of many experts that "development" was often identified as economic development by definition. Nowadays economic development is more likely seen as a necessary condition rather than sufficient for improving well-being.

society was built historically on the basis of cheap energy from coal (and later oil and gas), and to a large extent economic development today continues to rely on the availability of cheap energy from FF.

From Figure 1a we can see that if we want to reduce GHG without compromising the rise in well-being we must explore either or both of two solutions (Figure 1b, right panel). The first solution is to drive a wedge between Lines 2 and 3, so that Line 3 goes down even while Line 2 goes up. The second solution is to drive a wedge between Lines 1 and 2, so that Line 2 goes down while Line 1 continues to rise. In what follows we discuss the role of population dynamics in each solution, and illustrate how taking a population perspective helps clarify the social dimensions of mitigation efforts.

3

Accounting for GHG emissions: THE KAYA IDENTITY

In order to assess these solutions and the role of population dynamics quantitatively we need a framework with which to partition total emissions so as to help attribute different portions to different causes or determinants. One useful approach is the so-called Kaya identity[3]: in the case of carbon dioxide, the most important GHG, it can be expressed as follows:

$$CO_2 = \text{Population} \times \text{GDP/Population} \times \text{Energy/GDP} \times CO_2\text{/Energy}$$

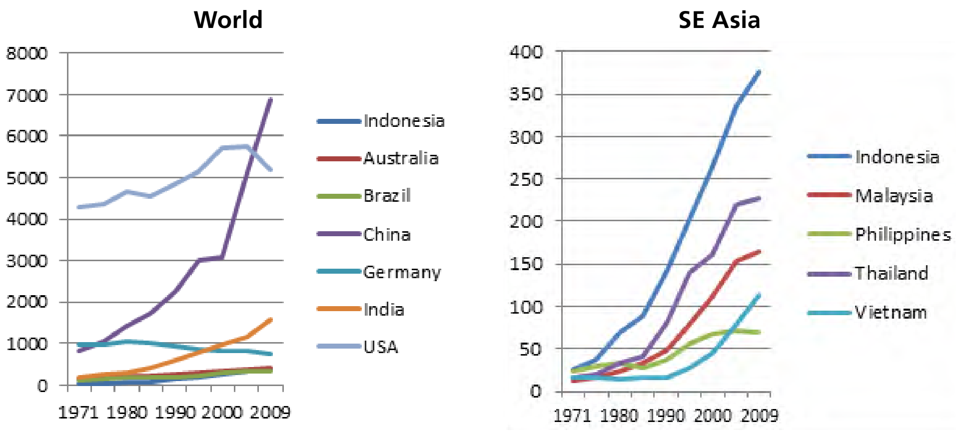
In words: The amount of carbon dioxide emitted is equal to the size of the population, times GDP per capita (as a measure of the average affluence among the population), times the amount of energy used to produce one unit of GDP (a measure of "energy intensity" of the economy), times the amount of carbon dioxide released into the atmosphere per unit of energy (the "carbon intensity" of the energy supply).

The Kaya identity derives from a long tradition in population-and-environment research which sees the environmental impact of a population as the product of total economic activity times environmental impact per unit of activity (Ehrlich and Holdren 1971). GDP can be regarded as a measure of economic activity, so the

3 This approach informs much of the discussion in the IPCC's Special Report on Emissions Scenarios (Nakićenović et al. 2000).

first two terms on the right-hand side of the Kaya identity can be interpreted as a decomposition of total economic activity into average activity per capita times size of population; and the last two terms as a decomposition of environmental impact per unit of activity (CO_2 per unit of GDP) into energy intensity and carbon intensity. Thus what was described as Solution 1 in the previous section requires manipulating the last two terms on the right-hand side of Kaya while Solution 2 requires manipulating the first two.

Figure 2. CO_2 emissions from fossil fuel combustion ($MtCO_2$), Indonesia and selected countries in the World and SE Asia, 1971-2009



Source: *IEA (2011).*

GHG emissions from burning FF are increasing rapidly in many countries around the world, especially in developing countries. The left-side panel of Figure 2 shows the trend lines over the last 40 years for Indonesia, three BRICS countries (Brazil, China and India) and three OECD countries (Australia, Germany and the USA); the right-side panel compares Indonesia with four other SE Asian countries. All the countries shown except one have increased their FF emissions during the last 40 years, with Indonesia's increase being the most dramatic in relative terms – from 25.1 $MtCO_2$ in 1971 to 376.3 $MtCO_2$ in 2009, a 15-fold increase in 38 years. In absolute terms the increases of China and India are much larger, but they start from a much larger base: China's increase is by a factor of 8.5, from 809.6 $MtCO_2$ in 1971 to 6877.2 $MtCO_2$ in 2009; and India's increase is by a factor of 7.9, from 200.2 to 1585.8 $MtCO_2$. Germany is one of a handful of European countries that have managed to reduce their emissions over the last 40 years.[4] Among the countries of SE Asia shown in Figure 2, Indonesia's increase in CO_2 emissions is the largest in both absolute and relative terms.

4 The current global financial crisis has been impacting emissions trends since 2008 but 2009 is the most recent year in the time series data published to date by the International Energy Agency.

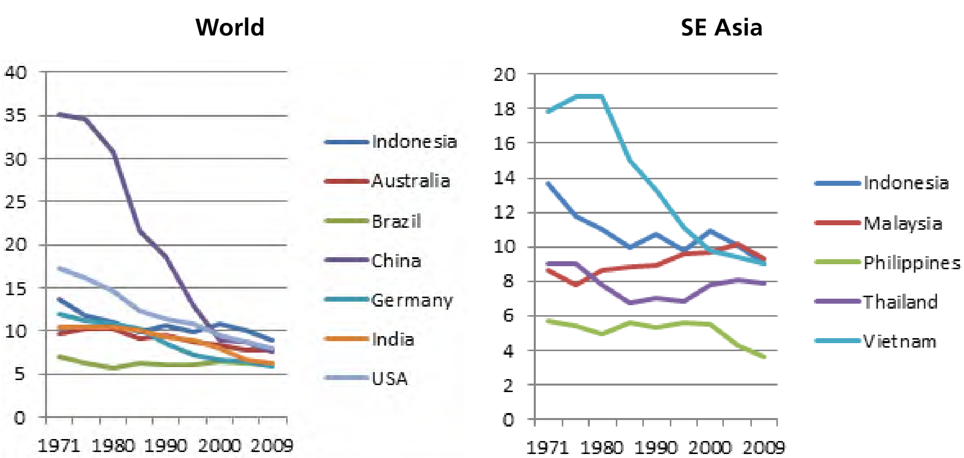
Simple arithmetic dictates that if we want to reduce the term on the left-hand side of the identity (i.e. CO_2 emissions) we must reduce at least one of the terms on the right-hand side. In the following sections we examine how population dynamics in Indonesia can influence the Kaya determinants, and suggest ways in which policymakers can take advantage of these linkages so as to strengthen mitigation efforts and reduce carbon emissions.

4

First Solution:
TOWARDS A GREEN ECONOMY

The first solution requires that pollution (in this case CO_2) generated by the production of energy from FF (which is required for economic development) be reduced even though the level of economic development continues to rise. This can be done by one or both of two ways: (i) by reducing the amount of energy needed to produce a unit of economic development (here measured by Energy/GDP); and (ii) by reducing the amount of pollution generated in the production and use of energy needed for economic development (here measured by CO_2/Energy). Either pathway makes the economy more "green."

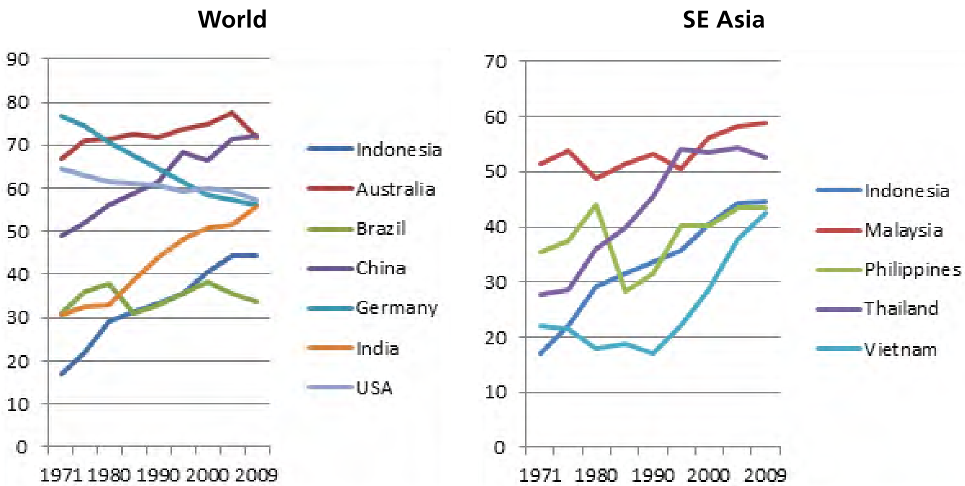
Figure 3. Energy/GDP (million joules per Yr 2000 US dollar), Indonesia and selected countries, 1971-2009



Source: *IEA (2011).*

Figure 3 shows Energy/GDP (i.e. energy intensity) for Indonesia and selected countries. It is a near-universal trend that as countries develop they learn to use energy more efficiently and energy intensity declines. OECD countries are still improving their energy efficiency: in the US in 1971 it took on average 17.2 million joules to produce each dollar of GDP (in purchasing power parity terms pegged to the value of the dollar in 2000); in 2009 it took only 8 million joules. Much of this change is due to structural shifts in the economy from manufacturing to service industries ("de-industrialization") which require less energy in the production of wealth. When countries initially industrialize and do so rapidly they may be inclined to use energy very inefficiently to begin with but they soon learn to economize: The improvement in energy efficiency of China in Figure 3 is striking, from 35.1 million joules per dollar in 1971 to 7.7 million joules in 2009. Among the countries of SE Asia shown, Vietnam has experienced a similar improvement in energy efficiency, from 17.8 million joules per dollar to 9.0. The trend in Indonesia has been a gradual improvement from 13.7 in 1971 to 9.0 million joules per dollar in 2009. Malaysia is unusual in that in now requires more energy per unit of GDP than in did in 1971.

Figure 4. CO_2/Energy (tCO_2 per trillion joules), Indonesia and selected countries, 1971-2009



Source: *IEA (2011).*

The second pathway to a clean economy is through substituting cleaner energy sources for dirtier and relying more on solar, hydro, geothermal, biofuels, etc. Figure 4 shows trend lines for the selected countries in terms of the amount of CO_2 emitted per unit of energy produced (i.e. carbon intensity). OECD countries have typically lowered the carbon intensity of their energy production over the last 40 years: The US emitted 64.6 tonnes of CO_2 for every trillion (i.e. million million, or 1012) joules in 1971, whereas the figure for 2009 is 57.4. The same figures for Germany are 76.6 and 56.3, respectively. Australia is unusual among OECD countries for trending in the opposite direction: 66.7 tonnes of CO_2 for every 1012 joules in 1971, up to 72 in 2009. The carbon intensity of Indonesia's energy production has risen steeply from 17.1 tonnes of CO_2 for every 1012 joules in 1971 to 44.5 in 2009.

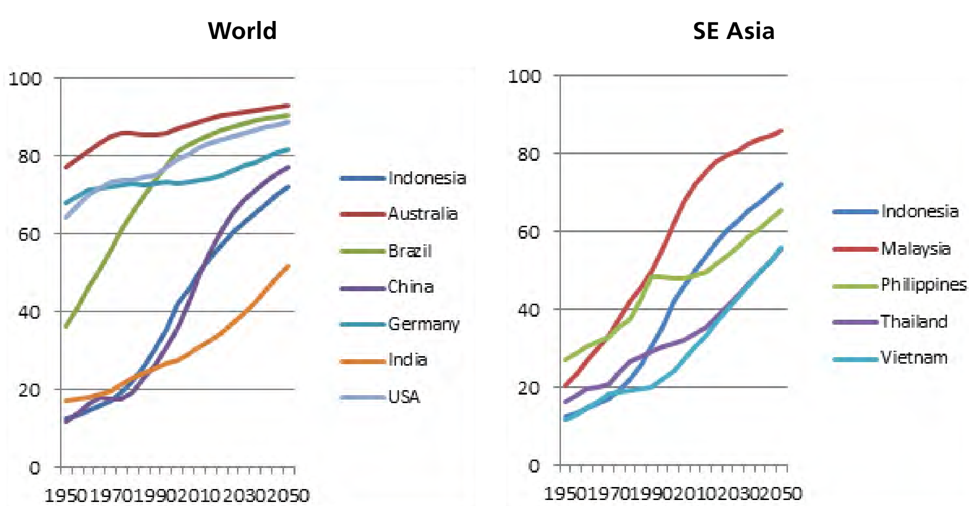
In 2009 its carbon intensity is significantly below China (72.3 tonnes of CO_2 for every 1012 joules), India (56.0t), Malaysia (58.7t) and Thailand (52.7t).

In the remainder of this section we show how population dynamics are interconnected with trends in energy intensity and carbon intensity.

Urbanization

The main incentive to reduce energy intensity (or improve energy efficiency) is economic – i.e. to produce wealth at less cost – but other human dimensions play a role as well. There are significant health and amenity reasons for reducing the combustion of FF in order to reduce the resulting pollution, for example, especially in densely populated areas. Energy security is an important political consideration; and fuel and energy subsidies of one kind or another are present in many countries, including Indonesia, ostensibly for social equity reasons. Demographic factors are also important in influencing trends in energy intensity; this is especially true in the case of urbanization.

Figure 5. Percent of population urban, estimates and projections, Indonesia and selected countries, 1950-2050



Source: *UN Pop. Div. (2012).*

Urbanization is a major global trend at present, especially in developing countries (Figure 5), and it is estimated that by 2010 just over 50 percent of the world's population resided in urban areas (UN Pop. Div. 2012). In most countries the rate of growth in urban areas is considerably higher than for the population as a whole. According to the 2010 Population Census in Indonesia the urban population has reached 50 percent; the UN estimates that even if the rate of population growth in

Indonesia goes down to 0.1 percent per annum by 2050 (as expected according to the UN medium projection) the urban population will still be growing by about 1.0 percent a year (i.e. about 8 or 9 million persons per year).

The growing urban population is responsible for an increasing proportion of the country's GHG emissions. The efficiency of energy use in urban areas depends greatly on the design of urban infrastructure. At the same time rapid urbanization means that the urban building stock and infrastructure are also expanding rapidly. If policymakers could ensure that new urban areas are designed and built to be much more energy efficient than the old this could contribute significantly to reducing future emissions. This can be done by introducing new building codes; more energy efficient use of space for work, living and recreation; and by developing more options for personal movement that do not depend on private cars (Rosenzweig et al. 2011). The current pattern of urban sprawl around Jakarta and other large cities is very inefficient from the point of view of using space and energy (Dick and Rimmer 1998).[5]

There are many co-benefits to well-being from reducing the use of FF in terms of population health, amenities and quality of life; reducing emissions from FF, for example, leads to cleaner air and less sickness due to air pollution. If these reforms are not implemented as new urban areas are planned and developed – for example in the new economic corridors envisioned in the Government's new *Masterplan for Acceleration and Expansion of Indonesia Economic Development 2011-2025*, MP3EI (Government of Indonesia 2011) – it will be far more difficult and expensive to do so later through retrofitting. The built environment is public policy in concrete and not easy to change.[6]

Poverty and inclusive development

It is also important to take population dynamics into account when assessing alternative development pathways towards increasing use of cleaner energy (i.e. reducing carbon intensity), although this is a subject which requires much more analysis. Many commentators continue to view the shift to clean energy as simply a technological issue but there are demographic and human dimensions which need to be addressed. Technological change always involves some changes in behaviour and social organization, and even if the change brings benefits to most

5 Fuel subsidies continue to contribute to this inefficiency.

6 Considerable thought needs to be put into developing population polices to complement MP3EI to ensure the accelerated economic growth is climate- and environment-friendly and the benefits are spread equitably.

there will always be some losers. It is important that the paths chosen should be socially inclusive and that the poor should not be among the losers. The poor typically use less energy than the non-poor, and to bring them out of poverty they need to use *more* energy not less (Royal Society 2012). It is important that the time and investment needed to shift to cleaner sources of energy not be used as an excuse for not promptly improving the poor's access to reliable sources of energy.[7]

It is generally agreed that market forces acting alone are not likely to be sufficient in the immediate future to support the development of new energy technologies to the point where they are economically competitive, and that the judicious use of public funds will be required to supplement private funds (Stern 2007). The mobilization of these funds inevitably entails wealth transfers within and between populations, and within and between generations. These are areas fraught with difficulties for politicians (and the international diplomatic community), and the population aspects of the issue are currently under-appreciated and under-studied. A visionary political leader would be well-served by a clear analysis of who benefits by the new technologies, by what amount, when and where; and who loses, by how much, when and where.

5

Solution 2:
TOWARDS A GREEN SOCIETY

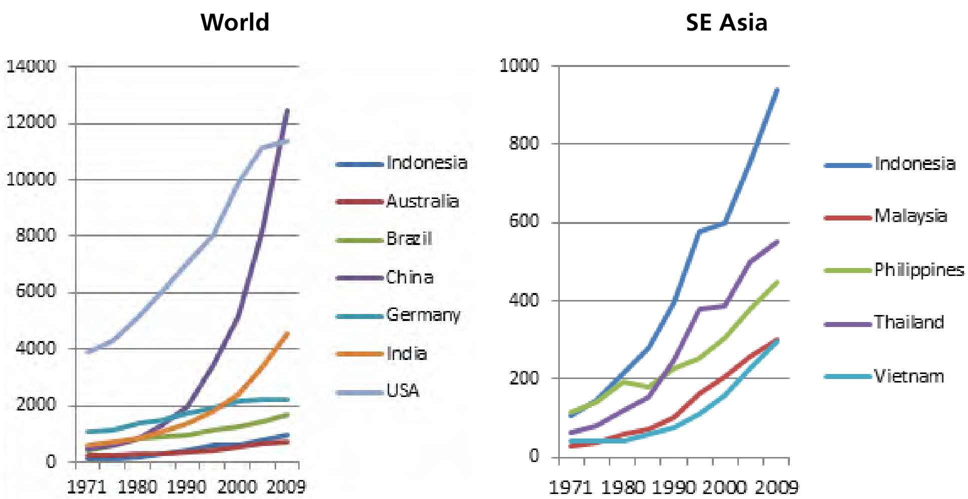
Stern's conclusion is that markets and government regulation alone are not likely to mitigate against climate change enough, at least in the near future. Crucially it will involve changing people's attitudes and "preferences": "Dangerous climate change cannot be avoided solely through high level international agreements; it will take behavioural change by individuals and communities, particularly in relation to their housing, transport and food consumption decisions" (Stern 2007: 448). This is the domain of Solution 2.

Solution 2 requires that movement along Lines 1 and 2 in Figure 1 be de-coupled, so that a continuing rise in well-being of a population does

7 The most important imperative regarding the poor and climate change is, or course, that measures be taken to reduce their vulnerability to the effects of climate change, but this Policy Memo focuses on population dynamics in relation to the causes and mitigation of climate change, not adaptation.

not necessitate a never-ending rise in economic activity (at least in the sense the latter is currently understood). Most who propose a solution of this type argue that a certain level of economic activity is essential for well-being; but that beyond a certain point continued growth is unnecessary for further well-being, and that the pattern of economic growth in developed countries has already proved to be unsustainable (Jackson 2009). Essentially this solution is about transforming society and moving towards more sustainable lifestyles so that advances in human development do not always require an additional quantum of economic development.[8]

Figure 6. GDP using PPP (billion 2000 US dollars) for Indonesia and selected countries, 1971-2009



Source: *IEA (2011).*

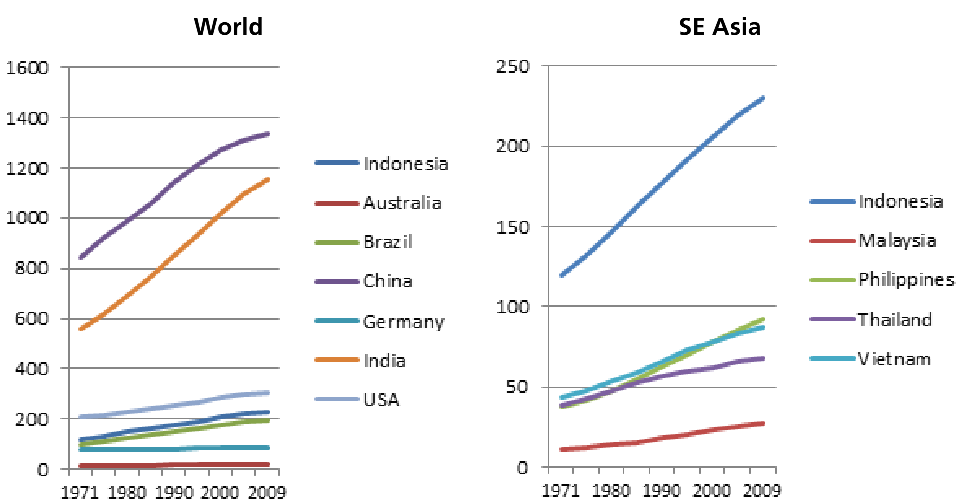
Figure 6 shows trends in GDP. Indonesia's increase in GDP (using PPP) from 107.2 billion dollars (in 2000 prices) in 1971 to 938.7 billion dollars in 2009 is impressive. We can decompose this into growth in population (Figure 7) and growth in GDP per capita (Figure 9), as suggested by the Kaya identity. During 1971-2009 Indonesia's population grew from an estimated 119.7 million to 230 million (using the figures used by IEA), and its GDP per capita grew from US$900 to US$4,100 (using PPP and year 2000 dollars). The question is whether we can reduce the rate at which either or both of these terms are increasing without compromising real or anticipated improvements in the population's well-being.

8 Much still needs to be worked out in this approach but an increasingly prominent group of economists and social critics argue that GDP per capita is not a good measure of "development" and that above a certain level of prosperity self-reported measures of happiness and well-being are not strongly correlated with income at either the group or individual level. Sen's work (1999) and the annual UNDP *Human Development Reports* build on these insights. In principle increasing a population's prosperity does not have to depend always on increasing GDP per capita, certainly after a certain threshold has been achieved (Jackson 2009).

Population growth

First we consider population growth. Population size is determined by the balance between births and deaths and in-migration and out-migration. In the case of Indonesia international migration is a minor factor; annual population growth is overwhelmingly the result of more births occurring each year than deaths. Figure 7 shows continuing population growth in most countries (although growth rates are declining); Germany is the only country among those selected that has barely grown in size during the period (from 78.3 million in 1971 to 81.9 million in 2009) and now exhibits negative growth (which would be higher still were it not for significant net in-migration).

Figure 7. Population (millions), Indonesia and selected countries, 1971-2009



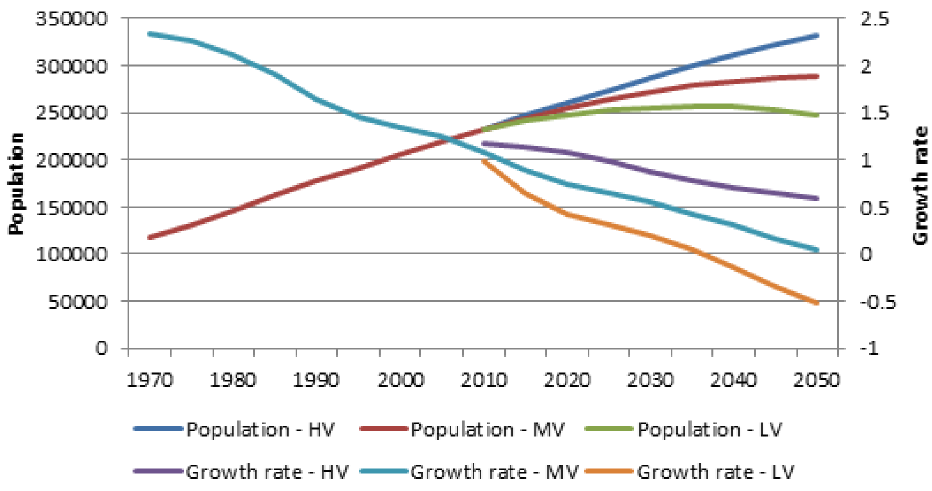
Source: *IEA (2011).*

Figure 8 gives UN statistics showing Indonesian trends in population size (plotted against the left vertical axis) and annual population growth rate (right vertical axis) over the last 40 years; it also includes the UN's low, medium and high variant projections until 2050. As a result of broad-based social and economic development and the government-supported family planning (FP) and reproductive health (RH) programs, the total fertility rate (TFR) has come down from an estimated 5.6 live births per woman per lifetime during 1965-70 to around 2.2 during 2005-10, and the population growth rate has declined from 2.4 percent per annum to about 1.2 over the same time periods.[9]

9 Detailed analysis of the 2010 Population Census results may lead to a modest adjustment of some estimates but is not likely to change the broad picture presented here. Fertility may indeed be a little higher than suggested in UN (2009). The 2007 Demographic and Health Survey measured a TFR of 2.6 live births per woman (15-49 years old) averaged over the previous 5 years; Hartanto and Hull (2009) argue on technical grounds that this measure is probably biased upwards and that the true value is closer to 2.3. Preliminary analysis of the 2010 Census results, using indirect estimation techniques, gives a TFR of 2.3 or 2.4.

Indonesia's population will continue to grow in the foreseeable future: under the assumptions of the medium variant projection we can expect population size to increase by 56 million during 2010-2050. It is important that any policies introduced to "manage" this growth be based on a sound understanding of its causes: most of the growth will be due to "population momentum" (i.e. the fact that there are large numbers of people in their childrearing ages due to high fertility in the past), not because fertility is especially high at present. Fertility has already come down in Indonesia, and the total fertility rate is now probably around 2.3 or 2.4 live births per woman (i.e. relatively close to replacement level). The Government's development plans need to acknowledge that a significant amount of population growth is inevitable and policies need to adjust to this fact. Under the UN medium variant project the population will continue to grow until around 2050, by which time the growth rate will have reduced to almost zero.

Figure 8. Population size (thousands) and growth rate (percent per annum), estimates and projections, Indonesia, 1970-2050



***Source**: UN (2009).*

Nevertheless future fertility trends are still important and need to be monitored closely. The medium variant projection assumes the TFR will be below replacement by 2020 and will stay constant at 1.9 until 2050. This scenario could prove to be overly "optimistic." If, for example, further analysis of the 2010 Census and other data confirms that the TFR is currently still slightly above replacement at around 2.3 or 2.4, and if the TFR were in fact to plateau at this level for the foreseeable future, then future trends will correspond closely to the UN high variant projection; in this case instead of adding another 56 million during 2010-2050 the population will grow by another 100 million and the population would still be growing in 2050 at about 0.6 percent per annum. Population growth of this magnitude would most likely impact negatively on the nation's development and poverty reduction efforts. It would almost certainly make it more difficult to maintain economic growth and curb GHG emissions at the same time.

Revitalizing the national voluntary FP and RH programs (Hull and Mosley 2009) could therefore make a major contribution to the country's GHG mitigation efforts, in addition to contributing to all the other well-documented benefits of FP/RH in health status and family welfare (Hayes 2005). Demographic and Health Survey data (BPS and Macro 2008) show that contraceptive prevalence has plateaued at just over 60 percent during the last decade or so and that there is still significant "unmet need" for FP in the population (with considerable variation across provinces). A revitalized FP program, well-targeted to meet a fair proportion of this unmet need, could go a long way to ensuring that Indonesia's actual population trends during the next 40 years stay far closer to the medium variant projection than the high variant.

We are not suggesting here that the FP program in Indonesia should be revitalized simply because of the need to address climate change; the FP program should be revitalized because Indonesians have a basic right to access the full range of FP/RH information and services, and reducing unmet need to a minimum helps people exercise this right (UN 1994). Rather, we are pointing out that when the FP program is revitalized this will not only engender all the usual well-know benefits in health and welfare, but in addition it will contribute to the Government's goal of reducing GHG emissions. Policymakers should find ways to build on these synergies.[10]

Age structure

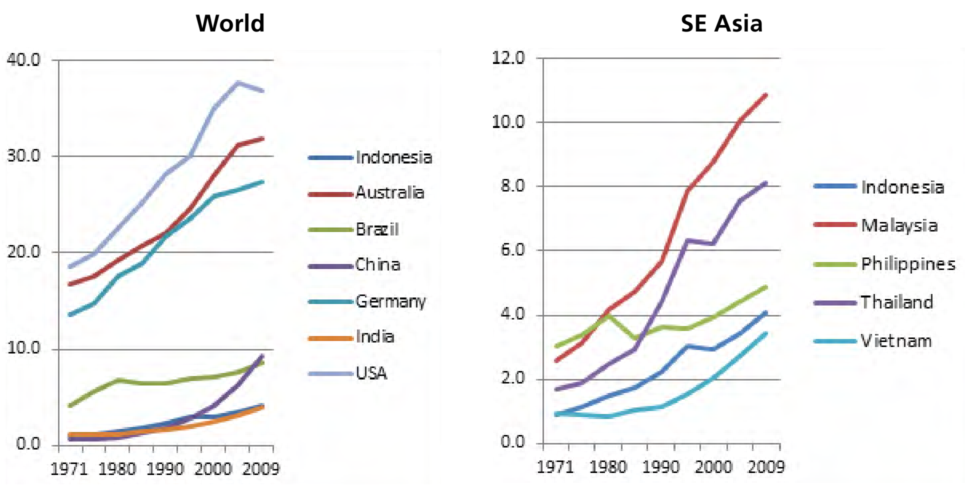
We now turn to growth in GDP per capita, and its relations to population dynamics and climate change. All the countries shown in Figure 9 have significant growth in GDP per capita, which demonstrates their growth in GDP outstripped their growth in population. The striking rise in GDP per capita in China during the last decade is especially noticeable. GDP

10 A crucial question is how much of a reduction in GHG emissions can be attributed to reducing unmet need for family planning? A clear answer to this question – or more precisely, a set of answers under a range of assumptions – requires detailed modelling which is beyond the scope of this Memo, but the Kaya identity can be used to give notional magnitude. If we assume the medium variant projection is the preferred population scenario and that addressing unmet need for FP avoids an additional 25 million to population growth by 2050, then a simple application of Kaya suggests that CO_2 emissions in 2050 would have been 8 percent higher if the additional 25 million population had eventuated. However the driving questions here are what will happen to Indonesian's fertility preferences in the future and how much can their unmet need for FP be reduced by better services?

per capita in Indonesia more than quadrupled during 1971-2009 while population size less than doubled.

Population dynamics are related to economic development in numerous ways and the topic has been studied extensively (Kelley and Schmidt 2001). "What matters most in identifying the impact of demographic change on economic performance," according to Williamson (2001: 111), "is the changing age distribution." As a country goes through its demographic transition, the resulting changes in age structure provide a one-time "window of opportunity," usually lasting several decades, when dependency ratios are most favourable for investment in development and poverty reduction.

Figure 9. GDP/Population (thousand 2000 US dollars per capita), Indonesia and selected countries, 1971-2009

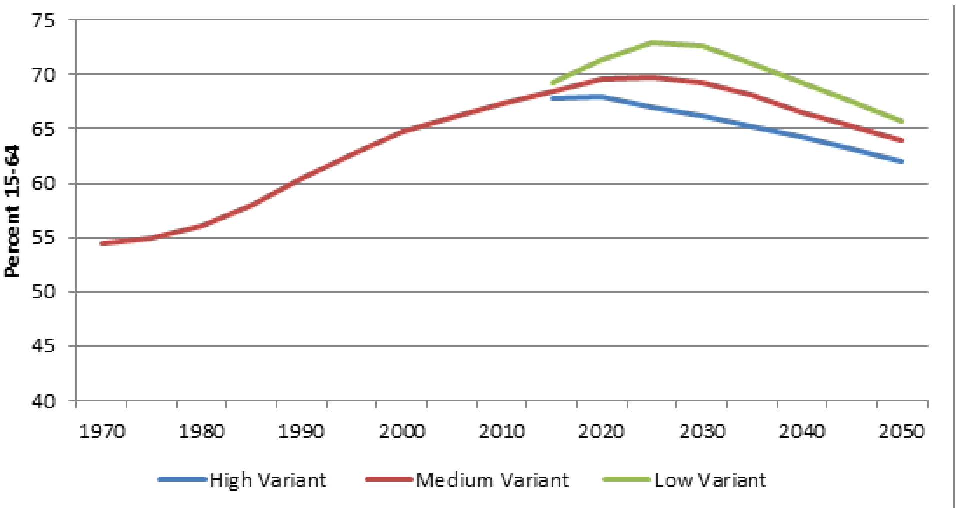


Source: *IEA (2011).*

In the first stage of a population's demographic transition mortality declines, usually especially for infants and children, with the result the dependency ratio of youth-to-working-age population increases. This is the period of rapid population growth, when the number of births significantly exceeds the number of deaths and the population grows rapidly. During the second stage fertility begins to fall; the dependency ratio gradually becomes more favourable for development as the ratio of working-age to dependent-youth increases. Of course this "demographic bonus" only translates into real economic growth if suitable economic policies are in place and the working-age population is productively employed. It is also important for a middle-income country like Indonesia that the working-age population is increasingly higher-educated and skilled.

Eventually the "baby-boom generation," born at the time of declining mortality but high fertility, passes through the working years and the population ages. The working-age population finally stops growing, and although the youth dependency ratio remains low the old-age-dependency ratio begins to increase. The window of opportunity, when the ratio of working-age people to dependents is high, closes.

Figure 10. Percent of population 15-64, estimates and projections, Indonesia, 1970-2050



***Source**: UN Pop. Div. (2009).*

Total age dependency in Indonesia has been declining for 40 years, providing conditions favourable for economic development, but the window of opportunity will pass. Figure 10 shows the population 15-64 years old has been growing as a percentage of total population since the 1970s and is expected to peak at around 70 percent (under the UN medium variant projection) sometime during the 2020s (or a little lower and earlier under the high variant, or a little higher and later under the low variant). Age dependency will reach an all-time low during 2020-30, and then it will slowly rise again as the population ages. After 2030 the changing age structure will, other things being equal, tend to dampen economic development. According to the Kaya identity these constraints, acting primarily through the second determinant, can be expected to have a flow-on effect on emissions.

People in Indonesia, as everywhere, do not want to reduce GHG emissions by slowing development or reducing their standard of living. GDP per capita is not normally regarded as a policy lever for GHG emissions mitigation. Nonetheless if population dynamics, acting through age structure, have an effect on GDP per capita, it is important to take this into account when modeling future development paths and emissions scenarios.

While the demographic bonus will, if appropriate policies are in place and the needed jobs created, have a positive effect on GDP growth and thereby add to GHG emissions, the Indonesian policymaker concerned with mitigation can still take advantage of this situation. It is important that some of the wealth created be re-invested in education and job training to improve productivity, and that some is used to create new green jobs and speed the transition to a green economy (Zaituni et al. 2010). Educated people stimulate innovation, and are often better equipped to adapt to it.[11] The same changes in age structure which increase emissions in the short term can help lay the foundation for substantial mitigation in the long term if there is sufficient investment in human capital. The demographic dividend can be used to stimulate sustainable development.

The changing age structure impacts on GHG emissions in other ways too. The household size and consumption patterns of the elderly are typically very different from those of the young. The built environment constructed under MP3EI needs to anticipate the needs of a growing number of elderly.

Growth of the middle class

Another major demographic change in Indonesia affecting the chances of driving a wedge between well-being and economic development (Lines 1 and 2 in Figure 1) is a change in the distribution of socioeconomic characteristics in the population; in particular the "middle classes" are rising in size, affluence, and influence (Robinson 1996; Gerke 2000).[12] The middle classes bring new values, attitudes 1and preferences.

It is sometimes noted that as countries industrialize pollution levels follow a "Kuznets curve" (UNEP 1997): in the early stages of industrialization pollution increases rapidly; once a country reaches a certain level of prosperity its citizens demand a cleaner environment and its new wealth means it can afford to put some environmental quality controls in place; as the society gets riches pollution levels begin to come down again.

According to UNEP (1997) the rate of pollution and environmental degradation is slower in some developing countries today than it was in Western industrialized countries when they were at a similar level of

11 See also the emphasis on human resources and science and technology in MP3EI (Government of Indonesia (2011).

12 There is still surprisingly little research on Indonesia's changing socioeconomic structure and the preferences of young people.

economic development. In Indonesia we already see NGOs working to raise public awareness about pollution and lobbying for reform. It is not unrealistic therefore to consider how policy interventions can be developed which foster environmentally-friendly consumption patterns among the rising middle classes, primarily in urban areas. Researchers and policymakers need to give more attention to changing lifestyles and to how they can be made more sustainable.

As Indonesia becomes more prosperous its citizens are likely to become more eco-friendly on their own but well-designed policy interventions can accelerate the process. Simple examples of such policies which can be introduced relatively cheaply and quickly are banning plastic bags (at least the non-biodegradable and non-recycled ones), making sure that new planning approvals require far more access to shops and amenities by dedicated walkways and bicycle paths, and fast-tracking development of public transportation. Public education campaigns aimed at reducing the ecological footprint through changing lifestyle and consumption values need to take demographics into account and could aim at facilitating change along generational lines.

6 Conclusions

We have shown in this Policy Memo how population dynamics are intimately involved in the causes of GHG emissions from the use of fossil fuels in Indonesia. The connections can be complex and indirect, and often cut across sectors and the different human dimensions of climate change. The major demographic changes we have focused on are (i) rapid urbanization, which may result in 65 percent of the population living in urban areas by 2050; (ii) population growth, which will continue for several decades at least, but at a progressively slower rate; (iii) changing age structure, which in recent decades has produced a growing bulge in the working ages but in future will lead to a growing proportion of elderly; and (iv) the changing socioeconomic composition of the population with a steadily growing "middle class." These changes need to be taken into account in constructing business-as-usual scenarios and in developing mitigation policies.

Based on our understanding of the causal links between population dynamics and GHG emissions we have identified a number of population-based policy options for reducing GHG emissions which we believe merit further development and implementation:

- Improving energy efficiency in urban areas by better spatial planning, infrastructure and allied interventions; this policy also has significant co-benefits for population health and well-being. A golden opportunity for implementation is presented by the launch of the new Masterplan on Acceleration and Expansion of Economic Development 2011-2025.
- Revitalizing the national family planning program can make a major contribution to Indonesia's GHG mitigation efforts over the next 40 years, and beyond. The family planning program needs to be revitalized to protect the health and reproductive rights of citizens; that this will also contribute to a reduction in GHG emissions is a fortunate co-benefit.
- Investing heavily in the education of today's youth is essential for ensuring the higher human capital and sustained economic growth which are needed for a smooth transition to a green economy.
- Much can be done to promote – especially among the young rising middle-classes – the benefits of green choices and sustainable lifestyles to help reverse the current steep rise in the country's carbon intensity.

Further data collection is needed for a more comprehensive analysis, but hopefully the preliminary analysis presented in this Memo is sufficient to start the process of incorporating population dynamics systematically in the formulation of Indonesia's national response to climate change.

7

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UNFPA, the United Nations Population Fund, is an international development agency that promotes the right of every woman, man and child to enjoy a life of health and equal opportunity. UNFPA supports countries in using population data for policies and programmes to reduce poverty and to ensure that every pregnancy is wanted, every birth is safe and every young person's potential is fulfilled.

DNPI (Dewan Nasional Perubahan Iklim), the National Council on Climate Change, established in July 2008, is a government organization mandated by the President to formulate national policies, strategies, programs and activities on climate change; coordinate activities in the implementation of climate change tasks; formulate national policies, mechanism and procedure on carbon trade; monitor and evaluate policy implementation on climate change management and control; and to support the negotiations on UNFCCC and compile Indonesia's position for each international negotiation meetings.

BKKBN (Badan Kependudukan dan Keluarga Berencana Nasional), the National Population and Family Planning Board is a government agency whose mission is to promote population-based development and achieve small, happy and prosperous family. Their responsibilities include the development of national plan and strategies on population and family planning, formulation of macro policies on fertility and mortality decrement, and formulation of guideline on family quality development.

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