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Achieving Global Carbon Neutrality Together with Economic Development

Abstract

This paper proposes a projection of macroeconomic and environmental conditions to 2030 in order to help clarify some of the likely major Economic and Environmental challenges facing Developing Economies in their efforts to achieve the Sustainable Development Goals. Using the United Nations Policy Model, the paper also assesses the dynamics and potential impact on Developing Economies of policy changes that could help the world to make substantial progress by 2040 in reaching the ambitious, but absolutely necessary, target of Zero Net Carbon Emissions by mid-century.

Key words: Global economy, economic development, climate change, macroeconomics, economic policy



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1. Introduction

In this paper we use the United Nations Global Policy Model (GPM) to make projections to **2030** in order to help clarify some of the likely major Economic and Environmental challenges facing Developing Economies in their efforts to achieve the Sustainable Development Goals (SDG). The paper also describes the dynamics and potential impact on Developing Economies of changes that could help the world to make substantial progress by **2040** in reaching the ambitious, but absolutely necessary, target of Zero Net Carbon Emissions by mid-century.

We start by projecting what we call a **Business as Before Scenario** of the trends in both Real Income Per Capita (RIPC) (measured in \$2015 purchasing power parity terms) and CO₂ Emissions (measured in millions of tons) as a result of an assumed recovery over the period 2023-30 following the COVID-19 crisis and its immediate aftermath in 2020-22.

This projection of a Business as Before Scenario will provide a basis for more clearly understanding the scale of change required to reach the SDG targets, especially those for Economic Growth and Decent Work, and for a large reduction of CO₂ Emissions. The Business as Before Scenario is structured around the momentum imparted by established pre-COVID trends and the impact of the COVID crisis on trade, investment, employment, budget deficits and debt on the assumption that governments would strive to recoup budget losses and bring debt down towards pre-crisis levels. Importantly, this scenario incorporates no assumptions about new policy directions.

On the basis of the projections produced by the Business as Before Scenario, we can then identify and articulate changes in key economic variables that would generate substantially new and improved directions of change, for Real Income Per Capita, CO₂ Emissions and other development indicators.

As a consequence, this paper is structured as follows. We first produce a **Business as Before Scenario**, projecting initial outcomes for 2020-2022 and then generating longer projections for 2023-30 in order to highlight the scale of the development challenges that must be addressed. This scenario projects **continued increases** in CO₂ emissions despite a slowdown in global GDP growth. If the **Business as Before Scenario** were extended to 2040, the increase in emissions would continue unabated.

Our second scenario shoulders the challenge of achieving the objective of **Global Carbon Neutrality**. Thus, it is intended to substantially reduce global CO₂ Emissions by 2040 and put the Global Economy on track to reach the admittedly ambitious but absolutely necessary target of Net Zero Emissions by 2050. But this second scenario assumes **Market-Driven Decarbonization**, with taxes and other restrictive demand-side mechanisms implemented in order to cut the demand for fossil fuels (which are the main source of emissions) to a level at which production would scarcely remain profitable. Understandably, this scenario projects a highly adverse impact on GDP growth and income levels in Developing Economies that are net exporters of coal and oil. In a context of slow global economic growth, the outcomes of **Market-Driven Decarbonization** for developing regions are little better than those for the **Business as Before Scenario**.

The third and final scenario (which we label the **Alternative Development Scenario**) covers three elements that we believe are required to overcome the development problems associated with the first two scenarios.

- i) **Concerted Decarbonization**, which avoids the pitfalls of Market-Driven Decarbonization through a programmed period of transition offering positive opportunities for Developing Economies that have to diversify away from current

reliance on coal and oil. This programme would seek an orderly reduction in fossil fuel extraction and distribution, based on stable producer prices, through the cooperation of major producer governments and corporations. The aim of this initiative is to match reductions in demand and supply through improvements in the efficiency of energy use and the substitution by alternative cleaner sources.

- ii) **Regional Development**, which promotes closer economic cooperation among Developing Economies in five geographic regions (South America, Africa, South-East Asia, West and Central Asia, and South Asia). The purpose is to advance development-oriented ‘De-Globalization’ among such economies, i.e., reducing their counter-productive economic and financial dependency on Developed Economies.
- iii) **The Containment of Financialization**, particularly with regard to constraining increases in Government Debt and avoiding the destabilizing build-up of External Financial Liabilities as the growth of Developing Economies accelerates.

We start our analysis with an examination of the income effects generated by our first Scenario, **The Business as Before Scenario**.

2. Business as Before Scenario

2.1 Projected Trends in Real Income Per Capita

This Scenario is highlighted first precisely in order to gauge the ensuing importance of any results generated by the introduction of changes of direction in our **Market-Driven Decarbonization Scenario** and our three-pronged **Alternative Development Scenario**. The results of the two latter scenarios will be tracked through both 2030 and 2040. Both of these latter scenarios require time to establish new directions and realize their full impact, especially with regard to environmental progress.

We start our analysis with the trends in **Real Income Per Capita** (\$2015 pp) associated with the **Business as Before Scenario**. **Table B1** highlights global results for this variable for 1) the historical period of 2011-2019, 2) the projected outcomes for the period of the pandemic and immediate aftermath during 2020-22, and 3) the ensuing period of 2023-30.

At the **Global level**, Real Income Per Capita grew annually by 2.1 per cent between 2011 and 2019. But it is **projected** to fall by an average of -0.6 per cent per year in 2020-2022—before recovering to achieve an income growth rate of 1.6 per cent in the period 2023-30.

The focus of **Table B1** is on the Business as Before Scenario for 19 Major **Developing Economies**. Thereafter **Table B2** will examine the results from this Scenario for 9 **Developed Economies**.

Table B1 shows that The **People’s Republic of China** is among the minority of Developing Economies that is expected to maintain positive economic growth during 2020-2022. Its Real Income Per Capita is projected, for example, to grow by 3.7 per cent. During 2023-30 China’s growth of Real Income Per Capita is projected to average 4.6 per cent, through more reliance on its domestic market. Since China’s exports are already very large, there will be limited opportunities for their growth in the future. Thus, this projected growth rate would be lower than China’s historical average of 6.7 per cent during 2011-19.

**Table B1. Real Income Per Capita (\$2015)
Business as Before - Annual Growth Rate
19 Major Developing Economies (pp percentage p.a.)**

Country	2011-19	2020-22	2023-30
World	2.1	-0.6	1.6
Argentina	-0.4	-3.2	0.5
Brazil	-0.5	-2.1	0.6
Chile	1.7	-1.9	1.2
Mexico	0.8	-4.0	0.2
Saudi Arabia	-0.6	-0.7	0.5
Iran (Islamic Rep. of)	-2.3	-2.5	-0.3
Pakistan	2.2	-1.5	0.8
India	5.1	-1.2	2.3
Bangladesh	5.1	1.4	3.0
China	6.7	3.7	4.6
Viet Nam	5.8	4.8	7.3
Philippines	4.7	-0.8	2.5
Indonesia	3.5	0.3	2.4
Egypt	1.8	-1.4	-0.1
Nigeria	-1.9	-2.1	1.0
Ethiopia	4.5	-0.5	2.5
Tanzania (United Rep. of)	4.3	0.8	3.0
Congo (Democratic Rep. of the)	2.8	-2.8	0.8
South Africa	0.2	-3.2	0.3

Viet Nam, being a much smaller economy with rising shares of markets in the United States, Europe and the Far East, is expected to exceed China's performance with an income growth rate of 4.8 per cent through the crisis in 2020-22 and 7.3 per cent in 2023-30. It has a much smaller economy than China but it is projected to secure a rising share of export markets in the United States, Europe and the Far East.

In contrast to China, **India** is expected to suffer a -1.2 per cent average annual contraction in Real Income Per Capita during 2020-22, after having recorded 5.1 per cent annual income growth in 2011-19. Moreover, India's projected, longer-term per capita income growth in 2023-30 would average only 2.3 per cent per year.

Both **South Africa** and **Brazil** are projected to do worse than India during 2023-30. **South Africa** already experienced a very slow 0.2 per cent growth of Real Income Per Capita during 2011-19, and during 2020-22 its income is expected to contract by an average of -3.2 per cent per annum. Moreover, its annual income growth over the recovery period of 2023-30 is projected to be a meagre 0.3 per cent.

Brazil's projected annual growth of Real Income Per Capita would be only 0.6 per cent over 2023-30 after having declined by -2.1 per cent annually during 2020-22. Even during the historical period of 2011-2019, its RIPC had declined yearly by -0.5 per cent.

Argentina, Saudi Arabia, Islamic Republic of Iran and Nigeria all experienced negative yearly growth rates of RIPC during 2011-19 and these rates are expected to worsen during 2020-22. For example, Argentina's annual growth rate of Real Income Per Capita would drop to -3.2 per cent and Islamic Republic of Iran's to -2.5 per cent during 2020-22. And all four economies are projected to 'recover' only modestly, if at all, during 2023-30: by 0.5 per cent for Argentina and Saudi Arabia, 1.0 per cent for Nigeria and -0.3 per cent for Islamic Republic of Iran.

Table B2 provides information on the historical trends in Real Income Per Capita (\$2015 pp) for **Nine Developed Economies** for 2011-19 and projected trends for 2020-22 and 2023-30.

Averaging 1.8 per cent, the **United States** is close behind the global annual average of 2.1 per cent growth in Real Income Per Capita during 2011-2019. But its economy is assumed to contract by -1.4 per cent annually during 2020-22. Thereafter, it is projected to manage only a dismal income growth rate of 0.3 per cent during 2023-30.

This pattern is projected to be similar for the recovery of the growth of Real Income Per Capita in **France** and **Germany**. While France grew each year by only 0.9 per cent during 2011-2019, it is assumed to contract yearly by -2.0 per cent during 2020-22. Similarly, while Germany grew by 1.5 per cent during 2011-2019, it is assumed to contract yearly by -0.3 per cent during 2020-22. During the recovery period of 2023-30, France's Real Income Per Capita is expected to grow at the meagre yearly rate of 0.2 per cent and Germany's RIPC by 1.0 per cent.

**Table B2. Real Income Per Capita (\$2015)
Business as Before - Annual Growth Rate
Nine Developed Economies (Percentage p.a.)**

	2011-19	2020-22	2023-30
World	2.1	-0.6	1.6
United States	1.8	-1.4	0.3
Germany	1.5	-0.3	1.0
Australia	1.1	-1.0	0.3
Canada	1.0	-1.3	0.4
France	0.9	-2.0	0.2
Japan	1.2	-0.1	1.3
United Kingdom	1.1	-1.5	1.1
Korea (Republic of)	2.5	1.8	3.2
Russian Federation	1.3	-0.4	1.1

Japan, the **United Kingdom** and the **Russian Federation** are also expected to recover only slowly during 2023-30: Japan with a 1.3 per cent average yearly increase of Real Income Per Capita, the Russian Federation and the United Kingdom with a 1.1 per cent increase. However, the United Kingdom is projected to suffer a sharp drop in per capita income averaging -1.5 per cent per year during 2020-22—a decline only exceeded among these nine major economies by France.

Average yearly growth rates during 2023-2030 of Real Income Per Capita documented above for Developing and Developed Economies under the 'Business as Before' assumptions will serve as an underlying point of comparison for projected growth rates under our two 'Policy-Change' Scenarios: 1) a 'mainstream' **Market-Driven Decarbonization Scenario** and 2) a more progressive **Alternative Development Scenario**, which advances **Concerted Decarbonization** along with enhanced **Economic Development** buttressed by improved **Regional Cooperation** among Developing Economies.

Before we proceed with a description of the above two **policy-oriented** Global Scenarios, we utilize our **Business as Before Scenario** to sketch out the projected increases by 2030 as well as 2040 in **CO₂ Emissions** across both Developed and Developing Economies—in the absence, we stress again, of major new initiatives to achieve Decarbonization.

2.2 Projected Trends in CO₂ Emissions

The projected economic trends already highlighted by our **Global Business as Before Scenario** do not bode well for the mitigation of future CO₂ Emissions. We focus here on the results of this Scenario with regard to the projections to both **2030** and **2040** of CO₂ Emissions—and compare them to those for **2019** (see **Table B3**).

Note again that this **Business as Before Scenario** makes no assumptions about major changes in Environmental Policies beyond the continuation of present trends of energy savings and increased supply and use of cleaner sources. Later in this report we will explicitly compare and contrast these projected ‘Business as Before’ results for CO₂ Emissions to those achieved by a **Market-Driven Decarbonization Scenario** and our **Alternative Development Scenario**. These latter are geared explicitly to achieving real progress *towards* Global Carbon Neutrality by **2030 as well as achieving a global rate of progress by 2040 that would make feasible reaching Zero Carbon Emissions by mid-century**.

As a sharp contrast, our **Business as Before Scenario** highlights the possibility that CO₂ Emissions (expressed in million tons) would not, in fact, be reduced at the global level, even by 2040. Instead, without changes of direction of our **GPM** model projects an increase from 36,670 million tons in 2019 to 41,930 by 2030 and then a further increase to 45,870 by 2040.

Note that our modelling of CO₂ relies on the evidence of annual country-by-country time-series data calculated by the United States Oak Ridge National Laboratory. The figures cover estimated emissions from the burning of fossil fuels (coal, oil and gas) and from the manufacture of cement, which releases CO₂ into the atmosphere.

Also, these results do not net out activities that reabsorb CO₂ from the atmosphere and thus could help to achieve some progress towards carbon neutrality. But in any case, the global emissions statistics would have to be reduced to a relatively low level before the atmospheric concentration of CO₂ could even stabilize.

2.2.1 Developing Economies

Among Developing Economies, **China** is projected to show the largest increase in CO₂ emissions: they would rise, for example, from 11,540 million tons in 2019 to 14,330 million in 2030—or by 2,790 million tons. With a lower income level and slower growth, **India** (the second largest Developing Economy) is projected to increase its CO₂ Emissions by 590 million tons, i.e., from 2,600 million in 2019 to 3,190 million in 2030.

Table B3 also projects forward to **2040** with regard to each Developing Economy’s expected CO₂ emissions. For example, **China** is projected to emit 16,100 million tons by 2040—a stark increase of 1,770 million tons with regard to 2030. In comparison, **India** would emit a further increase of 510 million tons—to 3,700 million—from 2030 to 2040.

Viet Nam, which is projected to grow rapidly over the next two decades, would more than double its CO₂ emissions—from 310 million tons in 2019 to 760 million tons in 2040. With slower growth, **South Africa** is projected to increase its CO₂ emissions by 2040 to 560 million tons from 490 million tons in 2019. The Latin American economies of **Argentina, Brazil and Chile** are all projected to increase their CO₂ emissions by 2040. Notably, **Brazil** is predicted to increase its emissions from 480 million tons in 2019 to 550 million tons in 2040.

It is worth noting here that many lower-income Developing Economies in Africa and South Asia actually make little use of fossil fuels and are thus already closer to being ‘carbon-neutral’ than higher income economies. The Democratic Republic of the **Congo** is a prime example, as are **Ethiopia** and United Republic of **Tanzania** (as shown for 2040 in **Table B3**).

Table B3.CO₂ Emissions
Business as Before - Growth Scenario
19 Major Developing Economies (million tons)

	2019	2030	2040
World	36,670	41,530	45,870
Argentina	200	210	230
Brazil	480	520	550
Chile	90	110	120
Mexico	490	500	520
Saudi Arabia	610	670	710
Iran (Islamic Rep. of)	700	790	830
Pakistan	220	320	390
India	2,600	3,190	3,700
Bangladesh	110	150	180
China	11,540	14,330	16,100
Viet Nam	310	540	760
Philippines	150	190	240
Indonesia	630	710	800
Egypt	260	320	370
Nigeria	100	120	130
Ethiopia	20	30	40
Tanzania (United Rep. of)	10	20	30
Congo (Democratic Rep. of the)	0	0	10
South Africa	490	520	560

2.2.2 Developed Economies

The trends in CO₂ Emissions among **Developed Economies** are projected to be somewhat different from those for **Developing Economies**. **Table B4** provides information for the CO₂ trends in **nine** of them. It is noteworthy that five are projected to increase or maintain their current level of CO₂ emissions up to 2040 (**United States, Australia, Canada, the United Kingdom and the Republic of Korea**). Four (**Germany, France, Japan and the Russian Federation**) are projected to marginally decrease their CO₂ emissions. **France** and the **United Kingdom** are noteworthy because they already have a relatively low level of emissions.

Table B4.CO₂ Emissions
Business as Before - Growth Scenario
Nine Developed Economies (million tons)

	2019	2030	2040
World	36,670	41,930	45,870
United States	5,110	5,620	5,930
Germany	700	680	670
Australia	430	490	530
Canada	580	620	650
France	320	310	320
Japan	1,150	1,100	1,050
United Kingdom	370	370	380
Korea (Rep. of)	650	720	760
Russian Federation	1,790	1,680	1,620

At the global level, projected CO₂ Emissions would remain high in **2040**—namely, 45,870 million tons. This total amount would significantly exceed, in fact, the **2019** amount of 36,670 million tons.

2.3 The Projected Gendered Impact on Women's Employment

The COVID-19 pandemic has had a particularly serious impact on the **employment rates of women**, especially for service subsectors that have been heavily affected by restrictions on human movement, proximity and face-to-face contact. **Table B5** shows the projected changes in women's employment rates before and after the pandemic in our group of **19 Major Developing Economies**.

A **fall in the employment rate** for women is projected in all 19 economies during the period **2020-22**. There would be a **-2 per cent** loss for **China** and **losses** would exceed **-3 per cent**, for example, in **Argentina, Brazil** and **Mexico** and reach as low as **-4.7 per cent** in **South Africa**. The projected employment outcome is mixed for the post-crisis period, 2023-30, as the projected changes reflect trends in urbanisation, ageing and secondary and tertiary education as well as labour demand.

Table B5. Women's Employment Rate*
Business as Before Scenario
19 Major Developing Economies (change each period)

Country	2011-19	2020-22	2023-30
World	-1.4	-2.0	0.0
Argentina	2.0	-3.9	3.2
Brazil	-1.1	-3.3	0.5
Chile	5.4	-1.2	1.8
Mexico	1.8	-3.5	2.7
Saudi Arabia	1.8	-0.7	-1.0
Iran (Islamic Rep. of)	1.8	-1.4	-0.9
Pakistan	-0.7	-0.8	-0.4
India	-5.6	-1.1	1.6
Bangladesh	5.4	-0.9	1.4
China	-3.4	-2.0	-1.8
Viet Nam	0.8	-1.0	-1.7
Philippines	-0.1	-0.5	0.9
Indonesia	2.6	-1.5	-0.5
Egypt	0.1	-0.5	0.7
Nigeria	-8.0	-1.7	-0.5
Ethiopia	-0.2	-0.2	0.6
Tanzania (United Rep. of)	-2.8	-0.9	-0.4
Congo (Democratic Rep. of the)	-3.3	-1.1	-0.2
South Africa	1.8	-4.7	-1.6

* Per cent of population aged 15 and over.

It is noteworthy that further reductions in the employment rate of women are projected for **ten economies**, especially **China** (-1.8 per cent), **Viet Nam** (-1.7 per cent), **South Africa** (-1.6 per cent), **Saudi Arabia** (-1.0 per cent) and Islamic Republic of **Iran** (-0.9 per cent).

There are projected gains in women's employment rate in Latin America, namely, for **Argentina** (+3.2 per cent), **Mexico** (+2.7 per cent) and **Chile** (1.8 per cent). And there are projected gains as well for some Asian economies: **India** (+1.6 per cent) and **Bangladesh** (+1.4 per cent).

Large reductions in female employment in **2020-22** are projected for most of our **Nine Developed Economies** (see **Table B6**). The largest loss, **-4.8 per cent**, is projected for the **United States**, followed by losses in **France** of **-4.6 per cent**, in the **United Kingdom** of **-3.8 per cent**, in **Canada** of **-3.7 per cent** and in the **Russian Federation** of **-2.9 per cent**. The Republic of **Korea**, uniquely, is projected to maintain female employment across the crisis period.

The picture for the recovery period of **2023-30** is again mixed but it is highlighted by further reductions in the employment rate of women in the Russian Federation (-2.1 per cent), Germany (-1.8 per cent), France (-0.6 per cent) and the United Kingdom (-0.1 per cent).

Table B5. Women's Employment Rate*
Business as Before Scenario
Nine Developed Economies (change each period)

	2010-19	2020-22	2023-30
World	-1.4	-2.0	0.0
United States	1.6	-4.8	1.9
Germany	4.5	-0.7	-1.8
Australia	1.5	-1.5	0.5
Canada	0.2	-3.7	0.0
France	0.4	-4.6	-0.6
Japan	5.4	-0.6	2.0
United Kingdom	3.7	-3.8	-0.1
Korea (Rep. of)	3.1	0.0	2.4
Russian Federation	0.1	-2.9	-2.1

* Per cent of population aged 15 and over

Next, we examine the results of our first 'policy-driven' Global Scenario, which we call a **Market-Driven Decarbonization Scenario**. Only thereafter will we examine a more ambitious policy-oriented scenario that has the potential to put our planet **on track** to reach the admittedly ambitious—but absolutely essential—target of Net Zero Emissions by 2050.

3. Scenario of Market-Driven Decarbonization (MDC)

As just mentioned, this section examines the results of a Global Scenario based on **Market-Driven Decarbonization**. Unlike the **Business as Before Scenario**, this Scenario assumes major changes of direction. The changes are focused on market mechanisms that could 1) drive up costs to users associated with polluting activities because of negative externalities and 2) drive down the costs of pollution-reduction initiatives that have positive externalities. The policy instruments could include **carbon taxes**, whose revenues could be used to subsidize green developments, including energy savings and the expansion of alternative energy sources. Also, **regulatory standards** that restrict inefficient or heavily-polluting products and processes would be another line of approach.

In this section we pay attention to the differential impact of market-driven decarbonization on the economies of producer and consumer countries. The relative effect would be based on the

current level of dependence of each economy on fossil fuels and the potential for energy savings and the development of non-carbon energy sources. Countries that currently **import** coal, oil and gas **could improve their trade balance** and per capita income level if decarbonization reduces energy costs and replaces imports with cleaner domestic sources. But those countries that **export fossil fuels** would face declining markets and falling prices, resulting in the **closing-down of extraction, processing and distribution activities** that have been important sources of income – but **with no compensation** from the carbon tax revenues and levies in countries to which they export.

3.1 Projected Trends in CO₂ Emissions

This section starts by reporting on the million tons of CO₂ Emissions taking 2019 as the base year. First, we discuss the *global impact* of CO₂ Emissions measured in million tons (see **Table E1**). Then we examine the *country results* for nine Developed Economies.

While **total global emissions** of CO₂ were 36,670 million tons in 2019, this total would be reduced marginally, through market mechanisms, to 32,250 million tons in 2030. But by 2040 global emissions would decline more appreciably, reaching 19,320 million tons. Thus, the total reduction in emissions between 2019 and 2040 would be 17,350 million tons.

Note that delay in the achievement of major reductions in emissions should be expected, not only because time is required to agree and implement new policy measures that have important effects on business networks and daily life but also because adaptation to far-reaching technical change invariably follows an **s-curve profile**, starting slowly and picking up speed as new products and services become more widely available and costs fall correspondingly in an extended chain reaction.

We now look more closely at the projected trends for **Nine Developed Economies** (see **Table E1**). Globally, the **United States** is currently the second-largest emitter of CO₂ (after **China**, which will be covered in **Table E2**). In 2019 the **United States** accounted for 5,110 million tons—about 14 per cent of the world's total. This amount of CO₂ is projected to fall to 4,470 million tons in 2030. This would represent a 13 per cent reduction. However, by 2040, the US emissions of CO₂ would fall to 2,940 million tons. This would represent an overall decline, from 2019 to 2040, of over 40 per cent. Note that the projections for **Australia** and **the Republic of Korea** are worse with overall reductions less than 40 per cent by 2040.

Table E1. CO₂ Emissions
Market-Driven Decarbonization
Nine Developed Economies (million tons)

Country	2019	2030	2040
World	36,670	32,250	19,320
United States	5,110	4,470	2,940
Germany	700	530	300
Australia	430	390	270
Canada	580	470	250
France	320	230	100
Japan	1,150	870	520
United Kingdom	370	290	160
Korea (Rep. of)	650	580	400
Russian Federation	1,790	1,310	740

The Russian Federation and **Japan** represent the next two largest Developed-Economy emitters of CO₂ in 2019—after China and the United States. The Russian Federation emitted 1,790 million tons and Japan 1,150 million tons in 2019. Both economies are projected to reduce their emissions more rapidly by 2030. Japan's emissions would decline to 870 million tons

(representing a 24 per cent reduction) and the Russian Federation's emissions would drop from 1,790 million tons to 1,310 (representing a 27 per cent drop). Both economies are projected to end up cutting their CO₂ emissions by more than one half between 2019 and 2040—the Russian Federation to 740 million tons and Japan to 520 million tons.

Germany and **Canada** were substantial emitters of CO₂ in 2019. Germany accounted for 700 million tons and Canada for 580. However, both countries are projected to reduce CO₂ emissions by 57 per cent by 2040, namely, to 300 million tons in Germany and 250 million tons in Canada.

Table E2. CO₂ Emissions
Market-Driven Decarbonization
19 Major Developing Economies (million tons)

Country	2019	2030	2040
World	36,670	32,250	19,320
Argentina	200	160	90
Brazil	480	370	170
Chile	90	80	50
Mexico	490	390	230
Saudi Arabia	610	530	360
Iran (Islamic Rep. of)	700	610	390
Pakistan	220	240	160
India	2,600	2,390	1,350
Bangladesh	110	110	60
China	11,540	10,960	6,480
Viet Nam	310	410	330
Philippines	150	140	90
Indonesia	630	520	270
Egypt	260	250	160
Nigeria	100	80	40
Ethiopia	20	20	10
Tanzania (United Rep. of)	10	10	10
Congo (Democratic Rep. of the)
South Africa	490	410	260

France and the **United Kingdom**, already low emitters in 2019 are projected to achieve large reductions of 69 per cent for France and 57 per cent for the United Kingdom, since they both have considerable potential for the expansion of non-carbon electricity.

Table E2 records the progress of **19 Major Developing Economies** in reducing CO₂ Emissions from 2019 to 2030 and then from 2030 to 2040—as was previously reported for 9 Developed Economies. **China** represents the world's major emitter of CO₂. In 2019, it accounted for 11,540 million tons, namely, **31 per cent of the global total**. In our projection to 2030, China's contribution would fall marginally—to 10,960 million tons. However, by 2040 China's contribution would fall dramatically to 6,480 million tons of CO₂. This would represent an overall reduction of over 40 per cent.

The third largest emitter of CO₂ in 2019 was **India**, emitting a total of 2,600 million tons. This amount could be reduced 8 per cent by 2030, when it would emit 2,390 million tons. But by 2040, there would be a noticeable 48 per cent decline to 1,350 million tons.

Among Developing Economies alone, **Islamic Republic of Iran** had the third-highest total emissions in 2019—namely, 700 million tons. While it managed to reduce its total emissions only

marginally by 2030—namely, to 610 million tons—by 2040 its total would be reduced overall by 44 per cent to 390 million.

Saudi Arabia was another major emitter of CO₂ in 2019, accounting for 610 million tons. This figure would be reduced to 530 million tons by 2030, and by 2040 an accelerated reduction would bring Saudi Arabia's emissions down to 360 million tons, representing a 40 per cent decline overall.

Indonesia would perform even better by 2040—reducing its CO₂ emissions to 270 million tons from 630 million tons in 2019. This would represent an impressive 57 per cent overall reduction.

Brazil is also projected to achieve a dramatic reduction in CO₂ emissions. While it emitted 480 million tons in 2019, it would reduce this amount by more than half, to 170 million tons, in 2040.

Mexico would have a similar record, reducing its 490 million tons in 2019 all the way down to 230 million tons in 2040.

However, **South Africa**'s progress would be less dramatic: reducing its CO₂ emissions by about 47 per cent by 2040. Its emissions would only be reduced to 410 million tons in 2030 from 490 in 2019. But between 2030 and 2040, another 150 million tons would be eliminated. So, its 2040 total would be 260 million tons.

Other than South Africa, **Egypt** was the largest African emitter of CO₂ in 2019—accounting for 260 million tons. This amount is projected to reduce slightly by 2030. However, by 2040 this total is projected to decline—to 160, or by about 38 per cent.

3.2 Projected Changes in Income Per Capita

Having charted the progress of major economies in reducing Carbon Emissions as part of a **Market-Driven Decarbonization Scenario**, we now focus on assessing the resultant impact on their growth of income. Our primary question: what are the corresponding trends in the Annual Growth of Real Income Per Capita (in purchasing power parity) with regard to the projected reductions in CO₂ Emissions identified above? The answer depends in part on the degree to which the producer prices of fossil fuels would be held down by falling demand and in part on the opportunity for individual countries and their trading partners to gain from energy savings and the exploitation of renewable sources in place of fossil fuels.

Table E3 presents the results for our nine **Developed Economies** while **Table E4** presents the results for our eighteen **Developing Economies**. For each period **2020-30** and **2031-40**, the tables show the projected growth of Real Income per Capita (in 2015 purchasing power terms) in the Market-Driven Decarbonization (MDC) scenario and the gain (+) or loss (-) that this would represent relative to the Business as Before projection.

As an initial point of reference, the low average income growth rates of 1.0 per cent p.a. projected for the **World Economy** over the period 2020-30 and 1.2 per cent for the period 2031-40 are not significantly different from the Business as Before projection.

3.2.1 2020-30

The three Developed-Economy carbon exporters in **Table E3** would suffer income losses due mainly to the reduction in the world prices for carbon fuels as demand would begin to contract and a more rapid transition to other sources would be anticipated. **The Russian Federation** would take the biggest *annual* loss of -0.6 per cent. **Canada** and **Australia** would take smaller hits of -0.2 per cent and -0.3 per cent per year respectively. Since the **United States** is a large consumer as well as producer of carbon fuels, it would avoid a significant reduction in income growth. **Japan** and the **Republic of Korea** would show very small gains. Growth in **Germany**, **France** and the **United Kingdom** would be the same as in the Business as Before scenario.

**Table E3. Real Income Per Capita
Market-Driven Decarbonization (MDC) versus Business as Before
Nine Developed Economies (growth rate, percentage p.a.)**

	2020-30		2031-40	
	MDC	gain/loss	MDC	gain/loss
World	1.0	0.0	1.3	-0.1
United States	-0.1	0.0	0.3	0.0
Germany	0.7	0.0	0.5	-0.1
Australia	-0.4	-0.3	-0.5	-0.3
Canada	-0.2	-0.2	0.3	-0.1
France	-0.4	0.0	0.3	-0.1
Japan	1.1	0.1	1.6	0.0
United Kingdom	0.4	0.0	1.1	-0.1
Korea (Rep. of)	3.0	0.1	2.7	0.0
Russian Federation	0.1	-0.6	0.2	-0.5

3.2.2 2031-40

**Table E3. Real Income Per Capita
Market-Driven Decarbonization (MDC) versus Business as Before
19 Major Developing Economies (growth rate, percentage p.a.)**

	2020-30		2031-40	
	MDC	gain/loss	MDC	gain/loss
World	1.0	0.0	1.2	-0.1
Argentina	-0.4	0.1	0.9	0.2
Brazil	-0.2	0.0	0.7	-0.2
Chile	0.6	0.3	1.4	0.0
Mexico	-0.7	0.2	1.1	0.2
Saudi Arabia	-1.1	-1.2	-2.3	-2.0
Iran (Islamic Rep. of)	-1.6	-0.7	-1.2	-0.8
Pakistan	0.6	0.5	1.8	0.6
India	1.5	0.2	2.0	0.0
Bangladesh	2.6	0.0	3.1	0.0
China	4.4	0.0	3.3	0.0
Viet Nam	6.5	-0.1	4.4	-0.1
Philippines	1.6	0.0	2.3	-0.1
Indonesia	2.1	0.2	3.2	0.5
Egypt	-0.2	0.3	0.0	0.4
Nigeria	-0.6	-0.6	-2.9	-1.8
Ethiopia	2.0	0.3	3.6	0.3
Tanzania (United Rep. of)	2.4	0.0	3.1	-0.2
Congo (Democratic Rep. of the)	-0.2	0.0	1.9	-0.1
South Africa	-0.7	0.0	0.5	-0.1

During the period **2031-40**, in which Global CO₂ Emissions are projected to decline more rapidly, the three developed economy carbon exporters, the **Russian Federation, Canada** and **Australia**, would continue to suffer low growth rates—but with Real Income Per Capita falling in **Australia**. In this period, **Germany, France** and the **United Kingdom** would have slightly

reduced income growth rates compared with the Business as Before Scenario while income growth in the **United States, Japan** and the **Republic of Korea** would be unaffected by the Market-Driven Decarbonization changes.

Table E4 shows the corresponding results for 19 Major Developing Economies. It is noteworthy that the economies of the **major oil exporters, Saudi Arabia, Islamic Republic of Iran and Nigeria** (Table E4) are projected to suffer losses larger than or comparable to those of the **Russian Federation** (Table E3). This effect would result in significantly **negative growth** rates of Real Income Per Capita through both periods 2020-30 and 2031-40. For example, during 2031-40 **Saudi Arabia's** income per capita is projected to decline annually by -2.3 per cent per year, **Islamic Republic of Iran's** income per capita by -1.2 per cent and **Nigeria's** by -2.7 per cent—rates that would obviously be unsustainable.

The above projections described for Market-Driven Decarbonization highlight major political-economy issues. For example, how could major fossil-fuel producers join energy users in managing a mutually beneficial transition to a non-carbon future?

Table E.4 shows that, in contrast to oil-producing economies, **China and India** are projected to go through the period of decarbonization without significant reductions in the growth of their real income per capita. Also, six other major Developing Economies, **Argentina, Mexico, Egypt, Ethiopia, Pakistan and Indonesia**, might realize small gains. But the projected impacts are **slightly negative** for **Brazil, other African countries, Viet Nam** and the **Philippines**.

4. An Alternative Development Scenario: Concerted Decarbonization Combined with Regional Development

In this section we turn our attention to investigating the projected outcomes of a progressive **Alternative Development Scenario** that is based on Concerted Decarbonization (more state-led and ambitious than the Market-Driven variant) and novel growth-promoting Regional Development programs for Developing Economies.

By **Concerted Decarbonization** we mean management of the global energy market, OPEC-style, by cooperation among major producers and distributors in holding the prices of fossil fuels at a fixed level while demand declines and production is reduced. **Regional Development** in our Alternative Scenario is promoted by close trade and investment ties among Developing Economies in each major region, aided by supportive industrial policies, public infrastructure and services. Such changes would require concerted efforts to coordinate sizeable public investment projects across each region and negotiate agreements on a common basis with major corporates and governments outside the region.

For this analysis, we focus, ambitiously, on economic and financial outcomes for five regional groups, each of which includes major Developing Economies that are identified individually—as well as other unnamed smaller economies in the same region. The results in the tables below are shown for the region as a whole and for major economies.

In **South America**, Argentina, Brazil and Chile are highlighted; in **Africa**: Egypt, Ethiopia, Nigeria, the Democratic Republic of the Congo, United Republic of Tanzania and South Africa; in **South-East Asia**: Indonesia, the Philippines and Viet Nam; in **West and Central Asia**: Turkey, Saudi Arabia and Islamic Republic of Iran; and in **South Asia**: India, Pakistan and Bangladesh. We do not include the **Russian Federation** as a member of the **West and Central Asia** group nor China in the **South-East Asia** group. Nevertheless, it is obvious that support for the Regional Development Groups by the governments and firms of these very large economies would be important for their success.

We start with a focus on **Growth Rates in Real Income Per Capita** (\$2015 pp) in **Table A1**, comparing Real Income Per Capita in 2040 in the new **Alternative Development Scenario** with the corresponding level for 2040 for the **Business as Before Scenario**.

4.1 Trends in the Growth of Real Income Per Capita

**Table A1. Real Income Per Capita in 2040: Business as Before Scenario versus Alternative Development Scenario (ADS)
Five Regional Groups of Developing Economies (\$2015 pp)**

<i>Region / Country</i>	<i>Business as Before</i>	<i>ADS</i>	<i>Percentage Gain</i>
South America	13,870	20,300	45
Argentina	18,550	26,310	42
Brazil	15,040	22,130	47
Chile	27,570	43,520	58
Africa	4,720	8,200	74
Egypt	12,130	19,310	59
Ethiopia	3,410	5,050	48
Nigeria	4,670	10,390	122
Congo (Democratic Rep. of the)	1,070	2,140	100
Tanzania (United Rep. of)	4,930	8,760	78
South Africa	11,830	20,980	77
South-East Asia	20,780	31,310	51
Indonesia	18,410	30,880	68
Philippines	13,980	21,520	54
Viet Nam	27,930	37,780	35
West and Central Asia	21,930	30,630	43
Turkey	35,340	38,920	10
Saudi Arabia	45,770	63,670	39
Iran (Islamic Rep. of)	10,890	20,210	86
South Asia	9,140	13,080	43
India	9,930	14,230	43
Pakistan	5,910	8,950	51
Bangladesh	9,170	12,420	35

In **South America** as a whole, the projected gain in Real Income Per Capita is 45 per cent when we compare the outcome in 2040 from a Business as Before Scenario to that of the Alternative Development Scenario (ADS).

Under the *Business as Before Scenario*, **South America's** average Real Income Per Capita would remain at an average level of \$13,870 in 2040 (slightly lower than the estimated level of \$14,220 in 2019). But in the *Alternative Development Scenario*, Real Income Per Capita would reach \$20,300. This represents a **45 per cent improvement** over the Business as Before scenario.

Next, we examine the impact on three major economies in South America, namely **Argentina**, **Brazil** and **Chile**. **Brazil** is projected to gain significantly i.e., a 47 per cent increase in its Real Income Per Capita, based on the differential between \$15,040 for the Business as Before Scenario and \$22,130 for the Alternative Development Scenario (ADS). **Argentina's** relative gain

between the two Scenarios is projected to be slightly lower, at 42 per cent. But **Chile**'s relative gain would be 58 per cent.

In **Africa** as a whole, there would be a projected gain in Real Income Per Capita of **74 per cent** under the Alternative Development Scenario compared to the Business as Before Scenario. **Nigeria**, which would risk a large fall in Real Income Per Capita under Business as Before or even Market-Driven Decarbonization, would gain the most in percentage terms, i.e., a **122 per cent** higher level of Real Income Per Capita in 2040 than with Business as Before. **Egypt** and **Ethiopia** would gain the least but their percentage improvements would still be **59 per cent** and **48 per cent** respectively.

In the Developing Economies of **South-East Asia**, the percentage improvement in the regional average would be similar to that for South America, i.e., **51 per cent**. **Indonesia** in particular would experience a large relative increase, namely, **68 per cent**.

We have included the higher-income group of countries in **West and Central Asia** because this region would be highly vulnerable to the loss of income in the period of decarbonization and thus would face the challenge of building a new post-carbon economy. Without an Alternative Development Strategy, the region would risk long-term stagnation in Real Income Per Capita. But the potential relative gain by 2040 from an Alternative Development Strategy is projected in Table A1 to be **40 per cent**, with **Islamic Republic of Iran** gaining an 86 per cent relative improvement and **Saudi Arabia** a 39 per cent improvement.

Lastly, **South Asia** would also do well. Its overall relative gain in Real Income Per Capita would be **43 per cent**. **Pakistan**'s relative gain would be the highest, at **51 per cent**.

4.2 Trends in Intra-Regional Trade in Manufactures

Table A2 reports on all-important developments in each region's projected **Growth Rate of Intra-Regional Trade in Manufactures**. This table examines the differences in the percentage growth rates of such trade over the period from 2026 to 2040, by which time the changes in policy direction are projected to take full effect. Again, the focus is on the differences in growth rates between those for a **Business as Before Scenario** and those for an **Alternative Development Scenario**.

The projected growth rates of **Intra-Regional Trade in Manufactures** under the Alternative Development Strategy in all five Regional Groups would be striking. This is an important objective since cross-border trade within the region expands the market for local producers and enhances opportunities to benefit from economies of scale as well as specialization. Without a new focus on intra-regional trade, there would be a risk that countries in each region would resume efforts to link up with external partners at the expense of the investment needed to effectively build intra-region networks.

For example, while the projected annual growth rate of intra-region trade in manufactures in **South America** would average only 0.7 per cent during **2026-40** under the Business as Before Scenario, it would rise to 6.5 per cent for the Alternative Development Scenario. The difference would be **5.9** percentage points additional growth year by year. **Chile** in particular would contribute an acceleration of **7.0** percentage points a year to its imports of manufactures from other countries in the region—with **Brazil** contributing **6.4** percentage points and **Argentina 5.2**.

Table A2. Growth of Intra-Region Imports of Manufactures Business as Before vs Alternative Development Scenario Five Regional Groups of Developing Economies (growth rates 2026–40, percentage p.a.)

<i>Region / Country</i>	<i>Business as Before</i>	<i>ADS</i>	<i>Difference</i>
South America	0.7	6.5	5.9
Argentina	3.4	8.7	5.2
Brazil	0.3	6.7	6.4
Chile	2.7	9.7	7.0
Africa	1.8	7.7	5.8
Egypt	-2.1	3.9	6.0
Ethiopia	2.3	8.6	6.3
Nigeria	3.2	10.7	7.6
Congo (Democratic Rep. of the)	4.6	9.6	4.9
Tanzania (United Rep. of)	8.3	15.7	7.4
South Africa	1.9	8.9	7.0
South-East Asia	6.0	11.0	5.0
Indonesia	2.7	9.3	6.0
Philippines	4.8	7.7	5.5
Viet Nam	7.1	8.4	5.2
West and Central Asia	2.2	8.1	5.8
Turkey	3.1	9.3	6.2
Saudi Arabia	2.9	7.7	4.8
Iran (Islamic Rep. of)	0.5	8.4	7.9
South Asia	1.2	7.3	6.1
India	2.0	9.1	7.1
Pakistan	3.0	9.7	6.7
Bangladesh	0.8	7.9	7.0

Similarly, in **Africa**, the difference in the growth rates of Intra-Regional Trade in Manufactures between the Business as Before Scenario and the Alternative Development Strategy Scenario would be **5.8** percentage points, with **Nigeria** contributing, in particular, a **7.6** percentage-point relative increase in the growth rates of its imports of manufactures within the region and **United Republic of Tanzania** contributing a **7.4** percentage-point increase in such growth rates.

The **South-East Asia** Regional Group would see a gain in the growth rate of intra-regional trade in manufactures of **5.0** percentage points, starting notably from a higher level of intra-regional trade and better prospects under the Business as Before Scenario. **Indonesia** would contribute the largest improvement, adding **6.0** percentage points. **Viet Nam** would add **5.2** percentage points to an already impressive projected growth rate of **7.1 per cent** in 2026–40 under Business as Before.

The **West and Central Asia** Regional Group would see a relative gain of **5.8** percentage points in annual growth of intra-regional trade in manufactures between the two scenarios. **Islamic Republic of Iran** would contribute a **7.9** percentage-point improvement, reversing a slow decline projected under the Business as Before Scenario. **Saudi Arabia** and **Turkey**, which are included in this group despite being Higher-Income Economies, would triple growth of their imports of manufactures from other countries in the region, i.e., from 2.9 per cent to 7.7 per cent for Saudi Arabia and from 3.1 per cent to 9.3 per cent for Turkey.

Lastly, the **South Asia** Regional Group would see a **6.1** percentage-point gain in annual growth of intra-regional trade in manufactures. **India** would contribute the biggest increase in the growth rate of such imports, i.e., **7.1** percentage points, with **Bangladesh** close behind at **7.0** percentage points.

The remarkable surge in intra-regional trade in manufactures projected under the Alternative Development Scenario owes a great deal to the coordinated expansion of consumer demand, investment and government services in each region, support for cross-border trade and investment, and negotiation with external governments and firms as a regional bloc. We now must examine the potential impacts on Higher-Income Economies whose acceptance and support for the Regional Development approach would help all countries to realize substantial benefits and achieve Concerted Decarbonization.

4.3 Benefits to Higher-Income Economies under the Alternative Development Scenario

Support by governments and firms in Higher-Income Economies would be crucial for Developing Economies as each Regional Group needs to expand its participation in global value chains and service markets that would allow domestic consumers and producers to benefit from new products, technology and low-cost sources of supply.

To make the growth of trade sustainable in the longer term, Developing Economies in each Regional Group must avoid current-account deficits that increase their external debt to a level at which their financial systems become vulnerable. In other words, it is crucial for Developing-Economy Groups to increase income from exports to the rest of the world, for which they would require support from firms and governments in Higher-Income Economies that play a leading role in world markets.

We identify **three requirements** for policy in Higher-Income Economies that would make the Alternative Development Scenario genuinely effective on a global scale. The first is **Growth of Spending and Income** in Higher-Income Economies themselves. The growth of spending and investment in exploiting new technological opportunities and responding to 'green' imperatives would be needed, in any case, in order to expand employment opportunities and provide Decent Work in Higher-Income Economies. Crucially, such growth would also provide viable export markets for Regional Groups of Developing Economies.

A **second requirement** is for Higher-Income Economies to accept **Asymmetric Trade Relationships**. By this we mean that they would allow Regional Groups of Developing Economies to give preferential support to producers and investments in their own region.

Higher-Income economic partners would need to refrain from retaliation when Groups of Developing Economies strengthen their support for local producers and contribute to the promotion of production and the export of products and services from each Developing Region. The final requirement is that Higher-Income Economies should take steps to **avoid Current Account Surpluses** that, if sustained, would oblige Developing Economies to reduce their development expenditures or incur rising external debt.

Table A3 shows outcomes for Real Income Per Capita under our Alternative Development Scenario, assuming that Higher-Income Economies would coordinate domestic consumption and investment in order to achieve the recovery of income and employment and cooperate with Regional Groups of Developing Economies to expand overall trade and avoid large current-account imbalances.

Potential gains in **Table A3** by 2040 from economic recovery are almost as large for the High-Income Economies as those for the Developing Economies shown in **Table A1**. **Mexico** leads in **North America** with a **42 per cent** gain, followed by gains of **29-32 per cent** in the **United States** and **Canada**. The average gain in **Europe** would be **23** per cent, with **France**, **Italy** and the **United Kingdom** leading the field. **Germany** and the **Russian Federation** would trail with

gains of only **13-14 per cent** relative to the Business as Before Scenario. But Germany would still lead Europe in terms of its attained level of Real Income Per Capita.

**Table A3. Real Income per Capita in 2040
Business as Before Scenario
versus Alternative Development Scenario (ADS)
Three Regional Groups of Higher-Income Economies (\$2015 pp)**

<i>Region / Country</i>	<i>Business as Before</i>	<i>ADS</i>	<i>Percentage Gain</i>
North America	43,040	56,500	31
Canada	47,870	63,150	32
United States	61,650	79,730	29
Mexico	18,530	26,340	42
Europe	44,240	54,290	23
Germany	57,350	64,860	13
France	42,910	53,470	25
Italy	45,440	57,990	28
Other EU	50,930	61,320	20
United Kingdom	49,580	63,530	30
Russian Federation	29,140	33,360	14
North-East Asia and Pacific	38,330	50,110	31
China	35,310	47,450	34
Japan	56,150	61,420	9
Korea (Rep. of)	73,560	76,880	5
Australia	48,130	62,380	30

In the Far East (**North-East Asia and Pacific**) **China** and **Australia** are assumed to expand domestic demand sufficiently to achieve income gains of around **30 per cent**. **Japan** and the **Republic of Korea** would show only small income gains relative to the outcomes for **Business as Before**. In Japan's case, this outcome likely reflects an assumed preference for stability in the domestic economy. For the Republic of Korea the gain is small because the **Business as Before** scenario already projects high growth. In all cases with smaller growth effects—namely, **Germany, the Russian Federation, Japan** and the **Republic of Korea**—it is assumed that imports increase sufficiently to keep current-account surpluses down to a level that is sustainable for the rest of the world.

4.4 Comparing Countervailing Trends in Financialization Across Developing Regions

In this section we investigate the projected degree of 'Financialization' in **Developing Economies** across the five regions of South America, Africa, South-East Asia, West and Central Asia, and South Asia. This is the **third basis** on which we are attempting to gauge the value of the **Alternative Development Strategy** relative to the Business as Before baseline and the Market-Driven Decarbonisation Scenario.

We use two variables to gauge changes in Financialization: Government Debt as a Ratio to GDP and External Financial Liabilities as a Ratio to GDP. Our assumption is that a marked increase in either of these variables would expose a Developing Economy to financial risks and would tend to have a detrimental impact on its economic prospects.

Our focus in this section is on gauging the degree of Financialization across three of our Scenarios—namely, the Business as Before Scenario (i.e., no changes in policies); Market-Driven Decarbonisation; and our preferred option, an Alternative Development Scenario (ADS). Our

governing question is: would substantial improvements in environmental and economic outcomes (such as through the Alternative Development Scenario) be mitigated by intensified Financial Instability. Again, our two gauges of Financial Instability will be the extent of Government Debt and External Financial Liabilities (the latter including portfolio investment, trade credit and non-resident bank deposits).

4.4.1 Trends in Government Debt

Table F1 compares the trends in **Government Debt** (as a ratio to GDP) in 2040 across the five regions (South America, Africa, South-East Asia, West and Central Asia, and South Asia) and highlights the results for major Developing Economies within each region. Note again that the table focuses on the percentage differences in outcomes between three Scenarios: the Business as Before Scenario (no new policy directions), Market-Driven Decarbonisation and our Alternative Development Scenario.

**Table F1. Government Debt in 2040
Scenario Comparison
Five Regional Groups of Economies
(end-year debt as percentage of GDP)**

<i>Region / Country</i>	<i>Business as Before (Percentage)</i>	<i>Market-driven Decarbonisation (Percentage)</i>	<i>ADS Difference (Percentage)</i>	<i>difference</i>
South America	154	157	3	-43
Argentina	177	172	-5	-45
Brazil	168	173	4	-48
Chile	76	74	-2	-20
Africa	93	102	9	-32
Egypt	156	147	-9	-45
Ethiopia	81	81	0	-14
Nigeria	58	72	14	-26
Congo (Democratic Rep. of the)	76	77	1	-37
Tanzania (United Rep. of)	33	34	1	-13
South Africa	66	68	2	-29
South-East Asia	71	69	-2	-15
Indonesia	59	54	-5	-24
Philippines	60	61	1	-15
Viet Nam	77	78	1	-5
West and Central Asia	77	93	16	-15
Turkey	49	50	1	-5
Saudi Arabia	126	177	51	-23
Iran (Islamic Rep. of)	104	121	17	-38
South Asia	115	113	-2	-28
India	127	126	-1	-32
Pakistan	66	60	-7	-16
Bangladesh	40	40	0	-1

We start by **comparing** the level of **Government Debt/GDP** in the **South America** Regional Group. The average Debt-to-GDP level under the Business as Before Scenario would be 154 per cent and slightly higher, at 157 per cent, for the Market-Driven Decarbonisation Scenario. However, for the Alternative Development Scenario, the ratio would come down to **111 per cent**—still relatively high, admittedly, but substantially lower than for the other two scenarios.

For **Africa** the average Government Debt-to-GDP level in 2040 would be 93 per cent under the Business as Before Scenario and 102 per cent under the Market-Driven Decarbonization Scenario. In contrast, the ratio would come down significantly to **61 per cent** under the Alternative Development Strategy. **Egypt** would gain the most from the ADS, namely, a reduction of 45 percentage points compared to the Business as Before Scenario.

For the **South-East Asia** Regional Group, differences in the level of Government Debt-to-GDP ratio produced by the three scenarios would be smaller. The Alternative Development Strategy Scenario would lead to a ratio that is 15 percentage points lower, at 56 per cent, than for the Business as Before Scenario. **Indonesia** would appear to benefit the most, securing a Debt-to-GDP ratio that would be 24 percentage points lower.

For the **West and Central Asia** Regional Group (which includes higher-income economies), the Alternative Development Strategy Scenario would result in a Government Debt-to-GDP level that is **15 percentage points** lower than in the Business as Before Scenario and **31 percentage points** lower than in the Market-Driven Decarbonisation Scenario.

For the **South Asia** Regional Group, the Alternative Development Strategy Scenario would lead to a Government Debt-to-GDP ratio that would be **28 percentage points** lower than that for the Business as Before Scenario. Both India and Pakistan would benefit appreciably although the reduction for Bangladesh, which already has a low Government Debt-to-GDP ratio, would be minimal.

So, in brief summary, the trends in Government Debt as a Ratio to GDP reflected in either the Baseline Scenario or the Market-Driven Decarbonization Scenario would not match the results generated by the Alternative Development Strategy Scenario. There would be some differences across the five regions—as well as across individual Developing Economies—but the general trend would remain clear. The Alternative Development Strategy Scenario would generate the lowest Government Debt-to-GDP levels.

Note that lower 2040 Debt-to-GDP ratios in Table F1 would not be achieved by austerity in the form of expenditure cuts and higher tax rates. They would be the result of long-term, sustained growth of GDP. On the one hand, government revenues would rise and budget deficits would fall. On the other hand, the level of debt would be assessed against a higher level of GDP. Eventually, the Debt-to-GDP ratio would gravitate to a level given by the relationship between the Deficit-to-GDP ratio and the GDP growth rate. For example, with a 5 per cent annual GDP growth rate and a 3 per cent deficit in government accounts, the net Debt-to-GDP ratio would gravitate towards a stable level of 60 per cent.

4.4.2 Trends in External Financial Liabilities

In this section we examine the degree of potentially destabilizing **Financialization** in Developing Economies by tracking trends in the magnitude of **External Financial Liabilities**. Such liabilities typically include holdings of securities and deposits by foreign investors. So long as the Developing Economy offers prospects of economic growth and financial returns, capital inflows are often sufficient to cover current-account deficits as well as create pressure for exchange rate gains, amplifying the attraction to external investors.

But if the Developing Economy begins to experience larger deficits or risks economic slowdown, or if the investors need funds to meet obligations or take up more promising opportunities elsewhere, and the country's currency begins therefore to depreciate, short-term investment capital could flow out very quickly. Thus, if a Developing Economy harbours a large stock of such External Financial Liabilities, it leaves the stability of its financial system at the mercy of short-term international speculation.

Table F2 provides a comparison of the projected 2040 level of External Financial Liabilities—expressed as a ratio to GDP—for Developing Economies in South America, Africa, South-East Asia, West and Central Asia, and South Asia. As in Table F1, it does so by comparing the extent of liabilities accumulated up to 2040 across three major Scenarios: The Business as Before Scenario (which assumes no policy changes), the Market-Driven Decarbonization Scenario, and the Alternative Development Scenario.

**Table F2. External Financial Liabilities in 2040
Scenario Comparison
Five Regional Groups of Developing Economies
(end-year liabilities as percentage of annual GDP)**

<i>Region / Country</i>	<i>Business as Before (percentage)</i>	<i>Market-driven Decarbonisation (percentage)</i>	<i>ADS Difference</i>	<i>(percentage)</i>	<i>difference</i>
South America	114	115	1	77	-36
Argentina	136	132	-4	96	-40
Brazil	132	134	1	92	-40
Chile	82	77	-5	49	-33
Africa	73	87	13	40	-33
Egypt	118	97	-22	52	-67
Ethiopia	13	12	-1	6	-7
Nigeria	37	80	43	19	-18
Congo (Democratic Rep. of the)	68	68	1	34	-33
Tanzania (United Rep. of)	30	33	3	15	-15
South Africa	131	131	0	74	-57
South-East Asia	88	81	-7	49	-39
Indonesia	81	65	-15	44	-37
Philippines	30	30	0	21	-9
Viet Nam	5	5	0	4	-1
West and Central Asia	55	73	17	42	-14
Turkey	85	84	-1	66	-19
Saudi Arabia	36	54	18	32	-4
Iran (Islamic Rep. of)	40	72	32	23	-16
South Asia	33	29	-4	20	-13
India	26	23	-3	16	-10
Pakistan	60	37	-23	20	-39
Bangladesh	55	57	1	40	-15

Higher or lower ratios of external liabilities to GDP in 2040 shown in the table largely depend on the size of current account deficits or surpluses under each Scenario and the growth of GDP in the intervening period. Other factors such as capital gains or losses and external deposits or purchases of assets by residents would play a smaller role, except in countries that become international financial centres. As with Government Debt-to-GDP ratios, smaller external financial liabilities in Table F2 are generally a reflection, to some degree, of improved economic growth rates under the Alternative Development Scenario.

In **South America**, the ratio of External Financial Liabilities to GDP is consistently lower in the Alternative Development Strategy Scenario than in either the Business as Before Scenario (based on no policy changes) or the Market-Driven Decarbonisation Strategy.

For example, the difference between the Alternative Development Strategy Scenario and the Business as Before Scenario by 2040 is **-36 percentage points** of GDP. Argentina and Brazil would benefit somewhat more than Chile whose ratio of External Financial Liabilities to GDP is not projected to increase so much under Business as Before.

In **Africa**, the average difference between the Alternative Development Strategy Scenario and the Business as Before Scenario would be **negative 33 percentage points**. **Egypt** would benefit greatly, i.e., by **-67 percentage points**. In contrast, **Ethiopia** would show a very low level of external financial liabilities under all three scenarios.

In the Developing Economies of **South-East Asia** (Indonesia, the Philippines, Viet Nam and other smaller countries), there would be an overall reduction of **39 percentage points**, although **Viet Nam** would have minimal liabilities under all three scenarios. However, **Indonesia**, which would accumulate increasing liabilities under the Business as Before scenario, would benefit appreciably, by **37 percentage points**, from the Alternative Development Strategy.

In **West and Central Asia**, there would be some benefit from the Alternative Development Strategy Scenario—i.e., a **14 percentage-point** reduction in External Financial Liabilities. However, **Turkey** and **Islamic Republic of Iran** would benefit much more than **Saudi Arabia**.

Among the **South Asia** group, there would be a modest **13 percentage-point** reduction of External Liabilities under the Alternative Development Strategy. **Pakistan**, more at risk in the long term under Business as Before, would benefit the most with a reduction of **39 percentage points**.

4.5 Section Summary

Summarizing very broadly the trends highlighted in **Tables F1** and **F2** with regard to Government Debt and External Financial Liabilities, we note that, as a result of implementing the Alternative Development Strategy, there are projected to be significant reductions in **Government Debt as a ratio to GDP** compared with Business as Before. The reductions across South America, Africa, West and Central Asia, South Asia and South-East Asia, would range from -15 percentage points to -43 percentage points.

With regard to External Financial Liabilities, the **Alternative Development Scenario** would lead to notable reductions in unstable financial investment in South America, Africa and South-East Asia relative to the **Business as Before Scenario**. However, for West and Central Asia and especially for South Asia, the differences would be more moderate, around 14 percentage-points.

Nevertheless, these findings emphasize that potentially detrimental trends in financial variables such as Government Debt and External Financial Liabilities should be taken seriously. For example, Developing Economies are well advised to limit their External Financial Liabilities to avoid dependence on speculative investors from High-Income Economies, especially when such financial investment takes the form of short-term instruments such as deposits and marketable securities.

Trade-offs related to rising Government Debt are more complex. Pressures for fiscal consolidation in order to reduce such debt often take the form of putting financial objectives ahead of improved domestic incomes and decent work as well as the broader objective of achieving progress on the SDGs. Governments in Developing Economies should be encouraged to finance development initiatives, as much as feasible, with **sustainable levels** of domestic debt, so long as this debt is leveraged to promote economic development.

5. Summing Up and Policy Lessons

This Report has been ambitious in the breadth of **material** that it has sought to cover. Utilizing UNCTAD's **Global Policy Model**, it has incorporated three major **Global Scenarios**. These have been a **Business as Before Scenario** (which assumes no new policy changes going forward), and two Alternative, policy-oriented Scenarios, namely, a **Market-Driven Decarbonization Scenario** and an **Alternative Development Scenario**.

The time horizon for these Scenarios has varied. Some of the Scenarios are used to project results up through 2030; and others, such as for environmental projections, are also expected to cover results for 2040. In the process, these Scenarios have also made near-term projections for 2020-22, which at the time of writing this report were subject to considerable uncertainty.

In order to provide worthwhile policy-relevant information on Environmental Trends, this report has used the **Alternative Development Scenario** to project results for both 2030 and 2040. The 2040 results are utilized as a basis to make reasonable assumptions about the ability of the global economy to attain the overridingly crucial target of reaching **Zero Net Carbon Emissions** by 2050, i.e., mid-century.

In addition, this paper tackles what it considers to be a very important (though neglected) objective, namely, promoting **Regional Cooperation** among economies *within Latin America, Africa, South-East Asia, West and Central Asia, and South Asia* in order to promote their mutual Economic Development. Implicitly, this Scenario assumes that breaking the shackles imposed by an increasingly Globalized Economy—in which capital flows and trade are relentlessly dominated by Developed Economies—would help boost the opportunities for Developing Economies to actively and sustainably cooperate with regional partners in advancing, in common, their Economic Development.

Having run the **Alternative Development Scenario** (geared to achieve Carbon Neutrality, promote Regional Development and spur Economic Development), this paper also investigates whether such an Alternative Development Strategy would entail major Financial Risks—especially since both Developed and Developing Economies across the globe have found themselves increasingly hamstrung by recurrent bouts of Financial Instability.

In this investigation, the paper examines the trends in **Government Debt** and **External Financial Liabilities** that could potentially impede the progress projected by its **Alternative Development Scenario**. It finds that with regard to Government Debt, the effects would not likely pose major problems for economies in South America, Africa, West and Central Asia, and South Asia. Government Debt would be significantly reduced in all four cases. However, for South East Asia, the reduction in Government Debt would be modest.

With regard to unstable **External Financial Liabilities**, the implementation of the **Alternative Development Scenario** would lead to significant reductions in these liabilities in South America, Africa, and South-East Asia. Regional reductions in such liabilities across West and Central Asia as well as South Asia, would be more moderate. Nevertheless, major economies such as Turkey, Islamic Republic of Iran and Pakistan could still benefit greatly.

Major Policy Implications

Our Alternative Development Scenario entails some major innovations in Development Policies. The debate on Environmental Policies has been intensifying in recent years, although the COVID-19 Pandemic over the course of 2020 has diverted attention away from the mounting urgency to directly and aggressively address Climate Change.

Obviously our Scenario for laying the basis in 2040 for achieving Carbon Neutrality by 2050 is very ambitious. But, just as obviously, there is no viable long-term alternative. The widespread

recessions occasioned by the spread of the Coronavirus have attenuated the impact of Carbon Emissions. But in the projected economic recoveries, *potentially* starting in 2021, a dominant priority has to be to again confront squarely our common Climate Crisis.

Identifying Viable Carbon Neutrality Policies

But what policies should be prioritized? This is a global debate that will continue to rage for a number of years. This paper's **priority** is to undertake massive direct **Public Investment** in low-carbon infrastructure *and* technology. Such an undertaking should, of course, provide a substantial stimulus to Economic Growth and Development. But this welcome benefit has to be combined with the dominant incentive to propel dramatic environmental change.

The campaign to champion the radical spread of innovative Green Technologies should also be judged, of course, by the degree to which such transformations are conducive to both economic growth and employment generation. These two major objectives—economic and environmental—should not be regarded as being inherently in conflict.

But there are bound to be heavy costs for some major economies—such as the Russian Federation, Australia, Saudi Arabia, Canada, Islamic Republic of Iran and Nigeria—which are major net exporters of coal, oil and gas. This trend highlights the priority that the means have to be found—through coordinated management of the reduction in fossil fuel production and export—to give adequate time to these producer economies to diversify towards other sources of income and growth.

One of the binding constraints on the ability of lower-income Developing Economies to diversify their production towards 'Green Growth' is the lack of financing. Hence, there will have to be some degree of medium-term recourse to Deficit Financing that would enable them to make such a transition.

Rising Public Debt as a result of such a transition need not be a long-term disincentive as long as the accompanying external financing is geared to support viable and environmentally-friendly economic alternatives. But governments should be wary of incurring unstable and unreliable External Financial Liabilities. This is why in this paper we have attempted to project and document the potential growth of such potentially destabilizing sources of short-term and erratic finance.

Promoting Regional Development

In this paper we have also introduced the novel proposal of seeking to advance Regional Cooperation as a promising Development Strategy. Such a strategic option has garnered, of course, very little attention in current debates about advancing Economic Development.

And such a proposal could indeed help advance potentially contentious, if not counter-intuitive, strategic options. But the powerful and seemingly unrelenting forces of Globalization need to be countered—especially in order to advance both economic and environmentally-friendly objectives. What is given short shrift in this discourse is the notion that Developing Economies could, actually, benefit significantly from 'deglobaling' to some degree.

The potentially feasible alternative that stares them in the face is greater Regional Cooperation. We have modelled this strategic option for five groupings of developing economies, i.e., in South America, Africa, South-East Asia, South Asia, and West and Central Asia. In our calculations (as illustrated in **Tables A1** and **A2**), the strategic option of consolidating regional free trade agreements could lead, in fact, to higher economic growth relative to our Business as Before projections.

Such a strategic option could include, for example, adopting common regional negotiating positions vis-à-vis global firms in order to increase benefits from inward Foreign Direct

Investment and ensure rising local content as markets and scale expand. Also prioritized could be common infrastructure to facilitate exports to other parts of the world.

This kind of potentially 'counter-intuitive' Strategic Option needs, no doubt, further close scrutiny and evaluation in order to properly assess its value and identify the most beneficial strategic options. Obviously, it runs counter to the common current fetish with 'Globalization' as the only promising avenue of success for Developing Economies.

Appendix:

Technical note

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1. Introduction

This note reports work to prepare a baseline scenario and two alternative scenarios for analysis of finance and development issues facing developing countries in the aftermath of the COVID-19 crisis. The scenarios have been prepared using an updated version of the world databank (WD 13.3) covering the period 1970 to 2019 and a modified version of the United Nations Global Policy Model (GPM 6.82) expanded to represent eleven developing countries that are not members of the G20. The databank and model have been updated to reflect estimates of the economic and financial impact of the pandemic as of end-November 2020.¹

The baseline assumption, here described as '**Business as Before**', reflects established pre-COVID trends and impacts of the COVID crisis on trade, investment, employment, budget deficits and debt on the assumption that governments strive to recoup budget losses and bring debt down towards pre-crisis levels through the 2020's.

The first alternative scenario adds major policy changes aimed at achieving a global carbon-neutral transformation by mid-century. Innovations in this scenario, '**Market-Driven Decarbonization**', include accelerated trends of energy efficiency and reduced carbon-intensity with taxes and other regulatory mechanisms cutting demand for fossil fuels (which are the main source of emissions) to a level at which production would scarcely remain profitable.

The third scenario, here termed the '**Alternative Development Scenario**', includes three elements that in combination could help to overcome development problems associated with the first two scenarios.

- I. **Concerted Decarbonization** through a programmed transition to achieve an orderly reduction in fossil fuel extraction and distribution, based on stable producer prices. The aim of this initiative is to match reductions in demand and supply of fossil fuels without violent fluctuations in the price at which fossil fuels are traded.
- II. **Regional Development**, which promoting closer economic cooperation among economies in five geographic regions (South America, Africa, South-East Asia, West and Central Asia, and South Asia). The purpose is to advance development-oriented 'de-globalization', reducing economic and financial dependence on developed economies.
- III. **Containment of Financialization** to avoid destabilizing build-up of external financial liabilities as growth of developing economies recovers and goes forward in coming decades.

To facilitate evaluation of longer-term consequences the scenarios have been extended to 2040, allowing time for implementation of policy changes that have far-reaching consequences for

¹ Initial updates of the databank and model with historical data for 1970 to 2019 and projected outcomes for 2020 and 2021 were prepared in July 2020 under a prior contract.

business and daily life and taking account of delayed, S-curve responses as people and institutions take advantage of new products and services and costs fall.

2. Outputs

The rationale, assumptions, results and policy implications of the three scenarios are described in a working paper.² The working paper includes tables B1-6 for the Business as Before scenario, E1-4 for Market-Driven Decarbonization, A1-3 for the Alternative Development Scenario and F1-2 comparing financial outcomes for developing countries under the three scenarios.

Tables in the working paper have been prepared in an Excel workbook G30s.xlsx using a GPM download of series for all three scenarios for 2010 to 2040 (see the Data worksheet).

Another Excel workbook, G30g.xlsx, contains graphs of the same series for 19 developing economies and 9 developed economies covering the period 2000 to 2040.

The scenarios may be reviewed in full detail in the EViews workbook ADS.wf1 where series are distinguished by suffix _0 for Business as Before, _1 for Market-Driven Decarbonization and _2 for the Alternative Development Scenario. Detailed analytical tables for each scenario are also available in html format in G30a.zip.³

3. Data sources

Historical data for 1970 to 2019 are taken from the GPM databank (WD13.3) updated with 2019 estimates based on latest available data from United Nations Statistics Division (UNSD), International Monetary Fund (IMF), World Bank (WB) and other selected sources up to end-November 2020. Adjusted series for G20 member countries and two country groups (Caribbean and 'Other West Asia') compiled by UNCTAD staff in the preparation of the Trade and Development Report 2020 have been used to improve historical estimates of primary and secondary income distribution.

Standard GPM programs for data preparation and econometric estimation of behavioural equations have been used with minor modifications to resolves issues arising from extension of the model to include eleven additional developing countries in South America, Africa and South and East Asia.

Projection of the impact of the pandemic in 2020 and 2021 relies largely on UNCTAD estimates for G20 member countries and WEO, International Labour Organization (ILO) and other sources for non-G20 countries and country groups. The projection incorporates a range of behavioural shocks with extended impact beyond 2021. The assumed shocks, imputed through an 'alignment' programme, capture known disruptions on activity and trade, as well as emergency policy measures taken by most world countries.

The 'alignment' programme fills-in the current period while official annual data is not yet published. It includes additional tuning assumptions for Islamic Republic of Iran (sanctions), Nigeria (additional oil export revenue) and Viet Nam (correction of estimated trends of energy demand and trade). These adjustments are maintained in scenarios.

The initial version of the model with projections up to 2021 was prepared in June and July 2020 under a Phase 1 contract. Subsequent adjustments in this Phase 2 contract take full account of database updates (WD13.3) and 2020-21 alignment targets and shocks for G20 countries in the

² Terry McKinley "GPM Alternative Development Strategy", January 2021.

³ Tables can be opened directly from the zip file by selecting the folder for a country or group and clicking on htm files to display them in an internet browser.

COVID period and aftermath notified by UNCTAD in August 2020. Revisions to model equations and assumptions for 2020-21 after that point are the responsibility of the consultant.

4. Scenario specifications

Technical specification of model projections from 2022 onwards relies on the following inputs:

- a) exogenous demographic trends
- b) model identities and behavioural equations with estimated coefficients and error variance (same for all scenarios). This includes add factors carried forward from shock profiles imputed to generate the 'alignment' with the current period.
- c) behavioural adjustments for the BaB scenario which reflect the policy shifts discussed above, aiming at re-instating austerity and labour market flexibilization policies that followed from similar crisis episodes in the past. Likewise, the Market-Driven Decarbonization scenario and the Alternative Development Scenario include scenario-specific changes in policy stances as described further below. Programmed adjustments take two main forms:
 - I. additions or subtractions to add factors for specific behavioural equations⁴
 - II. imposed targets to be achieved by modification of add factors in specified behavioural equations⁵

4.1 Business as Before scenario

Conservative Gross Domestic Product (GDP) growth targets 2022-40 are set for all countries and country groups, achieved by adjustment of savings, investment spending and government service spending. Growth targets are broadly consistent with UNCTAD assumptions for the post-COVID period.

Baseline GDP growth assumptions and other targeted outcomes are not inherited by other scenarios. What does carry across by default is the value of computed behavioural adjustments required to achieve the given targets. Different outcomes in other scenarios are achieved by reversing or modifying adjustments brought across from the baseline scenario.

Although GDP growth rates in the Business as Before scenario are pre-determined, tuning is necessary to ensure plausible outcomes for the balance of payments and internal income distribution. This tuning is performed by direct adjustment of add factors for relevant equations and countries. In some cases the tuning by adjustment of add factors seeks to reflect the impact of 'new normal' patterns of production and exchange. In other cases it is required to correct unrealistic projections for individual countries affected by erratic movements of historical data recorded in United Nations (UN) and IMF databases. Tuning adjustments for the Business as Before scenario are listed in Table 1. Considering the number of countries and country groups represented in the model and the number of behavioural variables that can have significant impact on projected outcomes, the scope of tuning in this exercise is quite limited. Further tuning might be advisable after review with country experts.

⁴ Add factors are specified as constants or trend values modifying the intercept of a behavioural equations for a specific country or country group

⁵ Targets are specified as constant or time-series values to be taken by a single variable or an expression such as the ratio of two variables or growth rates of a variable or ratio. Annual convergence to a target value may be 100 per cent or partial (less than 100 per cent) and a target may itself be specified as a ceiling or floor.

The baseline tuning of add factors carries through directly into other scenarios and does not affect comparison between them.

Table 1. Business as Before: Country-specific tuning adjustments

<i>Topic</i>	<i>Adjustment</i>	<i>Countries / country groups</i>
exports of primary products	negative	Ethiopia, Tanzania (United Republic of)
	positive	Iran (Islamic Republic of), Other Africa, Other South America
exports of manufactures (market share)	negative	Mexico, Chile, Germany, Italy, Korea (Republic of), Japan
	positive	Indonesia, Congo (Democratic Republic of the)
exports of services	negative	Ethiopia, Tanzania (United Republic of), Turkey, North Africa, Viet Nam
	positive	Iran (Islamic Republic of)
external financial flows	negative	United Kingdom
	positive	China, Viet Nam
fiscal policy and investment	deflationary	Brazil, Viet Nam
	expansionary	Argentina, Congo (Democratic Republic of the), Iran (Islamic Republic of), Korea (Republic of), North Africa
government revenue	negative	Nigeria, Saudi Arabia
other adjustments	world	short/medium term depression of commodity prices
	Nigeria	increased oil revenue
	Iran	restricted oil export revenue
	Pakistan	reduced cost of oil and gas imports
	Mexico	increased government transfer spending
	Viet Nam	increased energy consumption, increased imports of manufactures and services

4.2 Market-Driven Decarbonization scenario

This scenario inherits behavioural adjustments from the Business as Before scenario as explained above. Behavioural innovations in this scenario include the following:

- a) changed trends in response to rising awareness of climate change commencing 2022 with increased intensity from 2024 through to the early 2030s. The following behavioural changes are assumed to apply in all countries and country groups:
 - reduced energy demand (increased efficiency of energy use)
 - increased supply of non-carbon energy (including biomass)
 - reduced intensity of CO₂ emissions arising from fossil fuel usage
- b) reduced carbon energy (fossil fuel) supply in China, India, Indonesia, Australia, Canada, Other West Asia and Other Europe from 2022 onwards
- c) acceleration of the above trends, reduced supply of fossil fuels and further reductions in CO₂ emissions driven by price incentives such as carbon tax, subsidies for carbon-saving technologies and equivalent regulatory measures. Such incentives and regulatory standards are assumed to be applied with increasing intensity up to the mid 2030's.

The combined effect of all the above is to reduce global CO₂ emissions in 2030 by little over 10 per cent and 40 per cent in 2040 relative to the level in 2019. The annual reduction in global

emissions accelerates from 2.5 per cent in 2030 to 6 per cent per year in 2040. The scenario pictures a huge change relative to Business as Before where CO₂ emissions are projected to continue increasing in most countries with more than 2 per cent annual GDP growth. But the scenario also brings the price of oil down to around \$20 per barrel as demand for fossil fuels dries up with heavy losses for developing economies that currently depend on fossil fuels as a major source of export revenue - in particular Nigeria, Islamic Republic of Iran and Saudi Arabia.

4.3 Alternative Development Scenario

Tuning adjustments and behavioural changes including a rising carbon tax modelled in the Business as Before and Market-Driven Decarbonization scenarios are carried through into the third scenario which introduces further behavioural changes and policy shifts that could potentially overcome development problems brought up by the two former scenarios.

Concerted decarbonisation

To reduce the severe impact of a contracting market for fossil fuels, the Alternative Development Scenario assumes global cooperation of producers and distributors to reduce supply without cutting the price of oil below a level of around \$65 per barrel. This provides interim relief for economies that are heavily dependent on fossil fuels as a source of export income although they will not be able to avoid rapid reductions in volume and hence revenue as decarbonization gathers momentum in the 2030's. All countries are assumed to participate in this programme to the extent that they produce coal, oil or gas, whether or not they are exporters.⁶

Regional Development Groups

Developing countries in each part of the world are assumed to cooperate with neighbouring states through membership of five regional groups listed in the table.

Table 2. Regional Development Groups

<i>Development Group</i>	<i>Member States</i>
South America	Argentina, Brazil, Chile, Other South America (country group)
Africa	Egypt, Other North Africa (country group), Ethiopia, Tanzania (United Republic of), Nigeria, Congo (Democratic Republic of the), South Africa, Other Africa (country group)
West and Central Asia	Turkey, Saudi Arabia, Iran (Islamic Republic of), Other West and Central Asia (country group)
South Asia	Pakistan, India, Bangladesh, Other South Asia (country group)
South East Asia	Indonesia, Philippines, Viet Nam, Other South East Asia (country group)

For evaluation purposes we have also defined three groups of higher income countries - North and Central America (includes the Caribbean), Europe (includes the Russian Federation) and North Asia and Pacific (includes China) - although no new assumptions about regional cooperation are made in their case.

Countries that are members of a Regional Development Group are assumed to extend preferences for imports of manufactures from other countries in the same group with increased cross-border direct investment. The members of each group also concert increased spending on investment and government services.

To avoid high dependence on external creditors and investors each group is assumed to adopt a target limit on net external liabilities (i.e. liabilities less assets). Implicitly, members of the group

⁶ The allocation of supply quotas would be a major issue in its own right. For simplicity we have assumed that reductions in supply are allocated in proportion to the historical volatility of fossil fuel production in each country.

agree to cooperate in resolving external vulnerabilities and take joint action to limit exposure of the group as a whole. Groups that start with net external liabilities above the limit (South America, Africa, South Asia) are assumed to restrict imports of manufactures and services to bring the ratio down to the target level. In the case of South America and South Asia the restrictions needed are temporary but the African group needs to maintain restrictions throughout the period up to 2040. The South East Asia group has no need to introduce restrictions as this group maintains a positive external position throughout.

The West and Central Asia group starts with a positive external investment position but risks crashing into the assumed limit on net liabilities in the late 2030's as the market for fossil fuel exports dries up. To mitigate this risk we have introduced a lower initial limit that requires restrictions on imports of manufactures and services to start sooner.⁷

Tuning adjustments have been made for two developing countries: Islamic Republic of Iran, to boost export revenue following an assumed end of sanctions; Pakistan, to reduce the high cost of imports of oil and manufactures in the baseline scenario.

Containment of Financialization

The third set of policy changes introduced in the Alternative Development Scenario require action by developed countries. From the perspective of developing countries these changes are needed to provide expanding export markets and contain pressures on developing countries to finance economic growth by accumulation of unsustainable external debt or high-risk inflows of portfolio investment. At the same time the policy changes have to be beneficial and within parameters that are acceptable to the developed countries that introduce them.

Firstly, high income countries are assumed to undertake a long-term increase in spending on investment and public services at a level which generates demand-led growth of real income ranging between 1.2 per cent p.a. (United Kingdom) and 3.2 per cent p.a. (Republic of Korea). Secondly, current account surpluses are restrained in highly competitive but slow-growing countries by real exchange rate increases and increased imports of manufactures and services (Japan, the Republic of Korea, European Union, the Russian Federation, Chile, Viet Nam and Other South East Asia).

Taken together these changes achieve a global environment in which developing countries can expand trade and take advantage of products and services from developed countries without incurring large current account deficits.

⁷ The lower initial limit implies a more gradual imposition of import restrictions, avoiding the need for dramatic cuts when the ceiling is reached. The target ceiling for all groups has been set at 32 per cent of GDP, roughly matching the current figure for South America and South Asia but somewhat lower than the current figure for Africa.