MINISTÈRE
DE L'ÉCONOMIE,
DES FINANCES
ET DE LA RELANCE
Liberté
Égalité
Fraternité

Tresor-Economics

No. 263 • August 2020

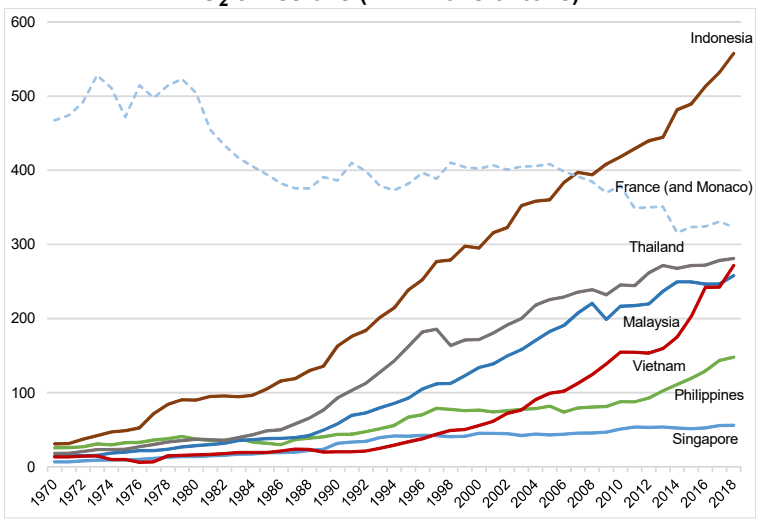
Direction générale du Trésor

Energy transition issues within ASEAN

Clément Payerols

- The economic expansion of the Association of Southeast Asian Nations (ASEAN) has been matched by an average annual increase in energy consumption of 3.4% since the turn of the century. Consumption is forecast to continue rising by an annual average of 2.2% until 2040. Fossil fuels generate three-quarters of the region's energy: oil (35%), coal (21%) and gas (19%).
- Higher energy consumption is primarily responsible for the fact that carbon dioxide (CO_2) emissions have risen, on average, by more than 4% per year since the year 2000. An additional two-thirds increase is expected between now and 2040. This is out of sync with International Energy Agency (IEA) scenarios that would ensure compliance with the Paris Agreement.
- In 2018, ASEAN produced 4.3% of global CO_2 emissions excluding deforestation as against only 1.8% in 1990. The most-populated country, Indonesia, is the main CO_2 emitter and accounts for one third of emissions, followed by Thailand, Vietnam and Malaysia.
- Nevertheless, ASEAN emits 50% less CO_2 per inhabitant than the world average, with divergences depending on the extent of the country's development. Moreover, due to the fact that it manufactures goods for the rest of the world and is a net exporter, the region "consumes" less CO_2 than it generates.
- Southeast Asia is especially vulnerable to the effects of climate change and could be confronted with economic losses of up to 11% of annual GDP by 2100 on the basis of current trends.
- In spite of the foregoing, the region's authorities appear to be focusing on economic development as the energy transition carries short-term costs with it. For instance, the energy mix is slated to still be comprised of three-quarters fossil fuels in 2040.
- A number of steps could be taken to speed up the energy transition in ASEAN such as the gradual phasing out of fossil fuel subsidies, carbon pricing, incentives for private investments in renewable energies and the preparation of a regulatory framework to bolster energy efficiency.

CO_2 emissions (in millions of tons)



Source : EDGAR (Emission Database for Global Atmospheric Research).

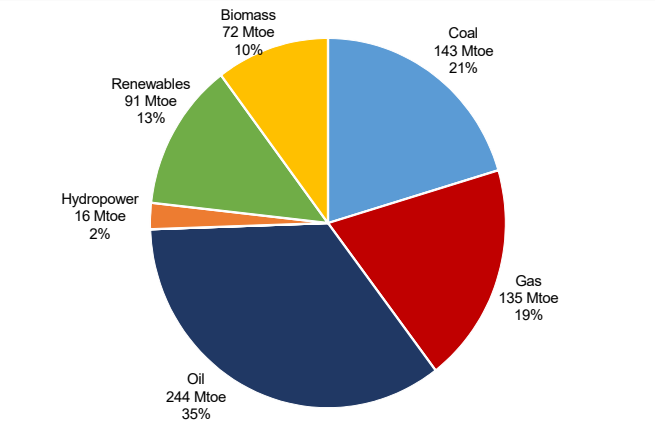
1. The increase in CO_2 emissions in Southeast Asia is still above the level for compliance with the Paris Agreement's goals

1.1 Economic expansion has been matched by an increase in energy consumption

Since the 2000s, ASEAN countries[1] have been posting robust growth of 5.1% of GDP on average per year with significant industrial expansion resulting in an increase of 3.4% per year in energy consumption according to the International Energy Agency (IEA).[2] The jump in consumption is set to continue in the medium term as development progresses. The IEA[3] forecasts an additional rise of almost 60% between 2018 and 2040.

Demand for electricity is growing significantly and the IEA predicts that it will double by 2040. By the same date, due to improvements in the standard of living and urbanisation, air conditioning could come to account for 30% of electricity consumption peaks.

Chart 1: Primary energy sources in ASEAN in 2018



Source: International Energy Agency.

In order to meet demand for energy, ASEAN countries essentially resort to fossil fuels (see Chart 1). In 2018, these fuels comprised three-quarters of the region's energy mix: 35% for oil, 21% for coal and 19% for gas. Renewables are gaining ground but their contribution remains secondary (15%, of which 2% is hydropower). Three-quarters of electricity are generated using fossil fuels.[4]

1.2 A trend incompatible with the Paris Agreement's goals

With an energy mix with a predominance of fossil fuels, higher energy consumption is primarily responsible for the rapid increase in greenhouse gas emissions, in particular those of carbon dioxide[5] (CO_2), which have risen, on average, by more than 4% per year since the year 2000. Within ASEAN, energy (mainly for electricity, transportation and heating) accounts for two-thirds of CO_2 emissions excluding deforestation. The remainder is due to agricultural and industrial activities (producing cement, oil refining, etc.).

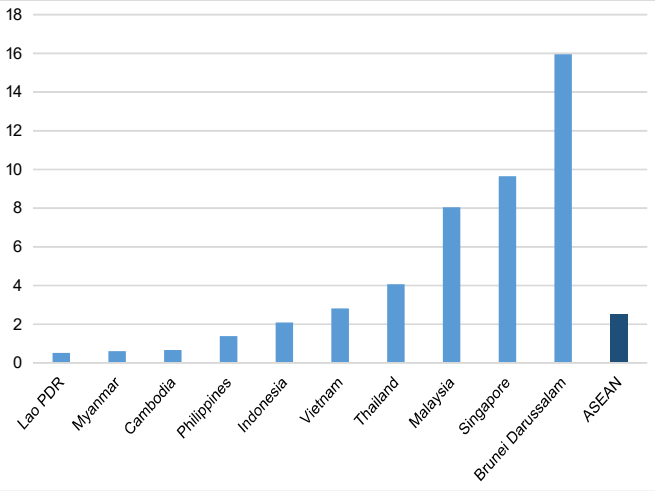
In 2018, ASEAN accounted for 4.3% of global CO_2 emissions excluding deforestation. The region's most-populated country, Indonesia, is the main CO_2 emitter (34% of emissions) followed by other emerging economies: Thailand (17%), Vietnam (17%), Malaysia (16%) and the Philippines (9%).

It should nevertheless be noted that owing to its net exports of manufactured goods to the rest of the world, the region generates more CO_2 than it "consumes" (see Box 1).

With almost 650 million inhabitants (9% of the world's population), ASEAN remains below the global average as regards per capita CO_2 emissions (2.5 tons/per capita/year as against 5.0 tons/per capita/year worldwide), with divergences depending on the extent of the countries' development (see Chart 2).

(1) The ASEAN (Association of Southeast Asian Nations) was set up in 1967 and has ten Member States: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. East Timor, which gained independence from Indonesia in 2002, is the only Southeast Asian country that is not a member of the ASEAN, although it is a candidate for accession. The ASEAN Secretariat is based in Jakarta.
(2) Figures for energy consumption records come from the IEA's database.
(3) *Southeast Asia Energy Outlook 2019*, International Energy Agency.
(4) It should be noted that hydropower enables generation of three quarters of Lao PDR's electricity. The figures are over 50% in Myanmar and Cambodia, and 9% in Malaysia.
(5) We used the EU's EDGAR (Emission Database for Global Atmospheric Research) which provides data up to 2015 for greenhouse gases and up to 2018 for CO_2 emissions. It includes CO_2 emissions related to combustion and to agricultural and industrial processes. Emissions related to deforestation, which are excluded from this paper, have a strong adverse effect on the carbon footprint of a number of the region's countries (by the release of CO_2 stored within the biomass into the atmosphere). According to the Food and Agriculture Organization (FAO) of the United Nations, this is especially marked in Indonesia where deforestation is thought to have released the equivalent of 364 Mt of CO_2 in 2017 (compared to 532 Mt from other sources).

Chart 2: Per capita CO_2 emissions in 2018 (tons)



Source: EDGAR.

However, the region does emit more CO_2 per unit of GDP than the global average (it only represents 3.5% of worldwide GDP), with 0.5 kg CO_2/unit of GDP compared to 0.4 kg CO_2/unit of GDP at global level in 2017 according to the IEA. For instance, Malaysia emits almost as much CO_2 as France (258 Mt vs. 323 Mt in 2018) although its GDP is seven to eight times lower. The region's poor performance levels are attributable to the significant presence of fossil fuels in the energy mix, its facilities' lack of energy efficiency and the scope of certain polluting activities.

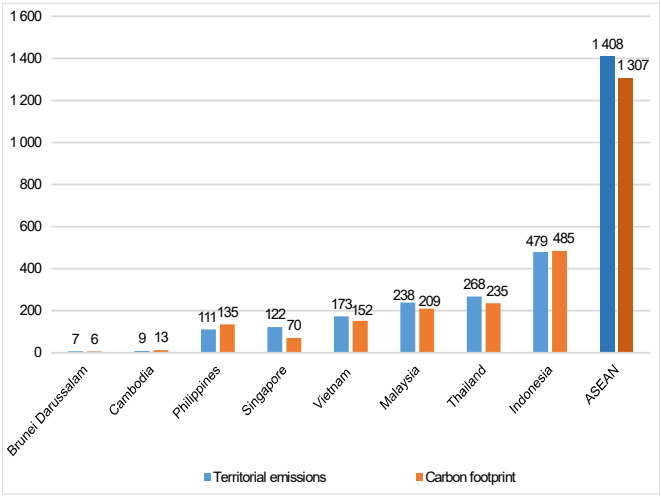
As there have been no fresh commitments from the countries, ASEAN's CO_2 emissions are set to increase faster than the pace set by the IEA as being aligned with the Paris Agreement which aims to hold the increase in the global average temperature to below 2°C above pre-industrial levels.[6] It is estimated that energy-related emissions will rise by two-thirds by 2040 (i.e. more rapidly than energy consumption owing to an increase in the proportion of coal). According to the IEA, in order to comply with the Paris Agreement, the region needs to cut 2040 emissions in half compared to current forecasts by striving for both heightened energy efficiency and a transition towards low-carbon energies. The updating in 2020 of national commitments could provide an opportunity to strengthen them or make them more concrete.[7]

Box 1: Territorial emissions or carbon footprint?

The most common method (as is the case in this paper) for measuring the CO_2 emissions of a geographical area is to assess the volume of greenhouse gases that are actually emitted in the territory in question. This method is the most directly checkable and is favoured at international level.

A second so-called "carbon footprint" method involves considering the CO_2 emissions caused by consumption by the population living in the geographical area under review. It therefore includes emissions from the production of goods and services imported by the territory and deducts those deriving from the production of exported goods and services. This method is more complicated especially as the various countries' supply chains are often highly fragmented.

Chart 3: Territorial emissions and carbon footprint in 2015 (Mt)



Source: OECD, 2015.

(6) Whilst all the ASEAN Member Sates made commitments as part of the Paris Agreement, these primarily cover a reduction of greenhouse gas emissions in relation to Business-as-Usual (BAU) scenarios, or even in terms of carbon intensity (greenhouse gas emissions per unit of GDP). No country has undertaken to reduce its greenhouse gas emissions in absolute terms before 2030 with Singapore looking to reach a peak around that date).

(7) For the moment, in the region, only Indonesia and Singapore have submitted new contributions. Indonesia's targets remain unchanged whereas Singapore has provided further details without altering the global emission reduction goals.

The carbon footprint method enables imports of polluting products from abroad to be factored in. By including carbon leakage – the relocation of polluting manufacturing activities to countries with less stringent environmental requirements – it allows for a better assessment of the climate-related effects of environmental policies.

According to the OECD, in 2015, within ASEAN, emissions were 7.2% higher than the carbon footprint of the region (see Chart 3), which can therefore be considered as a net exporter of carbon. This situation can be explained by the region's trade surplus which is driven by exports of numerous manufactured goods: 3rd largest exporter of electronic goods after China and the EU and 2nd largest exporter of textiles after China. The gap is most apparent in the most industrialised countries: Thailand, Malaysia, Vietnam and Singapore.

2. Despite the regional climate risks, ASEAN's involvement in the energy transition remains weak

2.1 High vulnerability to the physical impacts of climate change[8]

According to the main international organisations and the Intergovernmental Panel on Climate Change (IPCC), Southeast Asia is especially vulnerable to the impacts of climate change. It has been confronted with a temperature increase of 0.14°C to 0.20°C per decade since the 1960s, a change in rainfall and drought trends, and rising sea levels.[9]

From an economic standpoint, the Asian Development Bank (ADB) considers that ASEAN will be one of the regions most affected by climate change with losses that could reach up to 11% of GDP per year in 2100 according to current trends. This would have impacts on agriculture, tourism and fishing, as well as on health and labour productivity. Many people suffering from poverty, who are more vulnerable as regards access to water, food, health services and housing, would be especially exposed.

The fact that the population and economic activity is highly concentrated in coastal areas means that ASEAN countries are particularly vulnerable to rising sea levels. A number of the region's major cities are already affected by this phenomenon (Jakarta, Manilla, Bangkok, etc.). Soil salinisation is also a risk for the agricultural sector. For instance, in Vietnam, the 3,200 kilometres of coastline, which are home to 70% of the population, are being gradually eroded by the sea, and saltwater intrusion is increasingly frequent in the Mekong delta plains where most agricultural production is focused.

Climate change is also driving down crop yields and altering marine ecosystems. This constitutes a further risk factor in view of the importance of the agricultural and fishing sectors for certain countries (up to 25% of GDP in Myanmar and 22% in Cambodia).

The region is also highly vulnerable to natural disasters (drought, flooding, cyclones, etc.) and the occurrence of extreme events could increase as a result of climate change. Between 1998 and 2018, the OECD considers that the average annual cost of natural disasters accounted for 0.9 points of GDP in Vietnam and in Thailand. The 2011 floods in Thailand, which caused 800 deaths and affected 13 million people, provoked a sharp downturn in growth (0.8% after 7.5% in 2010) as well as substantial financial losses for the country, which the World Bank estimated at USD 47 billion.[10]

2.2 Few incentives for the energy transition

The physical impacts of climate change will put a drag on medium- and long-term economic activity whereas the economic risks (and opportunities) of the energy transition are evident in the short term. Also, climate change-related financial losses will be shared by all countries (albeit unevenly) whilst the cost of the energy transition is borne at national level.

(8) The Task Force on Climate-related Financial Disclosures (TCFD), which was set up in 2015 by the Financial Stability Board (FSB), has put forward a categorisation of climate-related financial risks so that the financial markets take better account of them. Two types of risk have been pinpointed: risks related to the physical impacts of climate change and risks related to the transition to a lower-carbon economy. We have applied this categorisation to the ASEAN countries.

(9) *Climate Change 2014: Impacts, Adaptation*, and Vulnerability, IPCC.

(10) *Thai flood 2011: rapid assessment for resilient recovery and reconstruction planning* (Vol. 2): Final report, World Bank, 2012.

Mitigating climate change therefore represents a "prisoner's dilemma" (see Box 2), in which each country can benefit by being a "freerider" in the global energy transition.

One particular risk concerning the energy transition is the technological risk due to problems with low-carbon energy take-up, or conversely, to being locked into a fossil fuel technology if the cost of low-carbon energies were to fall below that of fossil fuels or if the stock of fossil resources became depleted.

In 2019, the German development agency, GIZ, estimated that, among renewables, only biomass and hydropower were competitive in ASEAN, due to the technologies' maturity, although solar photovoltaic (PV) and wind power could become so in the near future.[11]

The countries are also vulnerable to a market risk related to demand from consumers and investors. As the former are looking for low-cost energy and the latter for financial products that are as profitable as possible, opportunities are available due to the development of green finance and consumers' appetite for more sustainable energy. Nevertheless, finely-tuned government intervention is still required to capitalise on these trends. For instance, setting a competitive feed-in tariff for producers in Vietnam enabled solar power capacity to be increased from 10 MW in 2018 to 4.5 GW in 2020. Conversely, in Indonesia, private investment in renewables is still compromised by lower profitability than for fossil fuels (especially as the latter are subsidised), a weak position in tariff negotiations with the government-owned enterprise, PLN, which holds a monopoly for electricity distribution, a lack of solidity of intermittent energy networks and the uncertainty surrounding regulation of the renewables market.

Despite these risks, the energy transition could bring short-term benefits for a number of major ASEAN cities by reducing local fine particulate pollution which is harmful to health.

At present, the authorities appear to be focusing on growth and seem disinclined to bear the short-term cost of the energy transition. Within ASEAN, the energy mix is set to continually comprise three-quarters fossil fuels up to 2040 with increased use of coal and gas at the expense of oil (30% oil, 24% coal and 22% gas).

On the basis of the commitments made under the Paris Agreement, Singapore, which is the region's most developed country and whose energy mix is almost entirely fossil, will continue to increase its emissions until 2030. Indonesia, which is the largest greenhouse gas emitter and main coal producer in ASEAN, has not made any undertakings regarding the maximum proportion of coal in its energy mix. A number of countries, such as the Philippines, Thailand and Vietnam, appear to be taking a bolder approach, in particular for the development of renewable energy sources. Lao PDR, which is aiming to become the "battery of Southeast Asia", is ramping up hydroelectric dam projects which have a positive impact as regards greenhouse gas emissions but nevertheless carry risks due to irrational development.[12]

Some of the region's countries have also committed to larger emission reductions contingent on external assistance.[13] It would appear to be opportune to set up energy transition incentive mechanisms, in particular financial incentives or technology transfers to the least developed countries.

In addition, ASEAN countries have rolled out climate change adjustment initiatives which are part of infrastructure expansion. As an example, the Indonesian government has undertaken construction of a giant sea wall to protect Jakarta from rising sea levels and has announced that the capital will be moved to Borneo. The ASEAN favours short-term adjustment to climate-related risks over a long-term climate change mitigation strategy.

(11) *Levelised Costs of Electricity for Selected Renewable Energy Technologies in the ASEAN Member States II*, GIZ, ACE, 2019. According to the report, on average, the cost of 1 MWh generated from hydropower is around USD 50 in the ASEAN, compared to USD 100 for biomass, USD 150 for wind power and USD 180 for solar PV. By way of comparison, in 2019, 1 MWh was sold for USD 50/MWh in Lao PDR (which already makes intensive use of hydropower), USD 90 in Malaysia, USD 100 in Indonesia and USD 150 in the Philippines. The agency drew no conclusions for the prices of geothermal power which is expanding, especially in Indonesia.

(12) For the biodiversity of flooded areas or safety. For instance, in 2018, the collapse of a dam led to hundreds of people dying or disappearing.

(13) In its nationally determined contribution (NDC), Vietnam undertook to reduce its emissions by 8% in 2030 compared to the Business-as-Usual (BAU) scenario and by up to 25% with international support. The same applies for Indonesia where the reduction could rise from 29% to 41% in 2030 and Thailand, from 20% to 25%. For Malaysia, it is set to increase from 35% to 45% in 2030 compared to 2005 emission levels.

Box 2: The energy transition and the "prisoner's dilemma"

In basic terms, there are four potential scenarios for the energy transition that are ranked here from the most to least advantageous for country X by only factoring in the financial aspects of the energy transition and climate change:

1. Transition by the rest of the world without country X: country X would benefit from lower climate change-related losses without bearing the cost of the energy transition.
2. Global energy transition: country X would avoid climate change-related losses but would bear the cost of the energy transition.
3. No transition: country X would only suffer the impacts of climate change.
4. Unilateral transition by country X: country X would bear both the additional cost related to the transition and the adverse effects of climate change caused by the rest of the world.

If the rest of the world carries out its energy transition, country X would have every interest in being a "freerider" (scenario 1). If the rest of the world does not carry out an energy transition, this country would also gain by not carrying it out (scenario 3), as it would bear the cost of the transition without a marked impact on climate change. In both cases, country X would not carry out a transition.

This situation resembles a "prisoner's dilemma", a standard example of game theory in which it is in the various players' best interests to cooperate (in this case, to all become involved in a global energy transition), but where, in the absence of effective cooperation, each player maximises his/her gains by going against the desirable outcome (in this case, by not carrying out the energy transition). In the case at hand, cooperation is made even more difficult due to the uncertainty surrounding the extent of the impacts of climate change and by the lack of a guarantee that successive governments would continue with this cooperation.

One solution to the prisoner's dilemma is to transform the gains attached to each scenario to increase the appeal of the desirable outcome. To encourage country X to agree to the energy transition, a scenario without transition can be penalised (e.g. introduction of a carbon tax on country X's exports) or a scenario with transition can be rewarded (e.g. development assistance contingent on transition goals), or even both.

3. Steps that would speed up the energy transition

Against a backdrop in which limited resources are earmarked for the energy transition, the progress made by ASEAN regarding a number of measures flagged up as being priorities in academic literature should be assessed: phasing out of fossil fuel subsidies, carbon pricing ("polluter pays" principle), instruments to steer private investments towards renewables and incentives for energy efficiency. Moreover, the energy transition should include measures to foster energy restraint which has, up until now, been rarely addressed by the region's governments.

3.1 A number of ASEAN countries still subsidise fossil fuels

Fossil fuel subsidies, whether on consumption (price control, tax exemptions) or production (preferential tax rates, tax incentives for producers), increase recourse to carbon-intensive energies. They exist to enable energy access targets for the poorest populations to be met but, as they are often poorly targeted, they actually mostly benefit richer citizens who consume more of these energies.[14] Although the amounts of these

(14) According to the IEA, in Indonesia, in 2016, only 5% of the poorest third of households benefited from fuel subsidies compared to 70% of the wealthiest top third of households as the richest Indonesians own more cars.

subsidies could be rechannelled towards more efficient expenditure (grants to the poorest households, expansion of energy infrastructure), their elimination is still a political minefield.[15]

According to the IEA, fossil fuel subsidies accounted for USD 35 billion, i.e. 0.5% of GDP, within ASEAN in 2018. They were especially high in Indonesia (3.1% of GDP), in Brunei Darussalam (1.7%), in Malaysia (0.6%), and, to a lesser extent, in Thailand (0.3%) and in Vietnam (0.3%). Although, in recent years, the majority of these countries have begun to reform the subsidies, they were pushed up in 2018 by rising energy prices. In the same year, Malaysia even reintroduced certain fuel subsidies.

3.2 The region has made little progress on carbon pricing

The IMF has pinpointed the introduction of carbon pricing[16] as the most effective way of cutting global emissions by making less carbon-intensive energies more competitive. To keep global warming below 2°C, the organisation advocates a global carbon tax at a rate of USD 75 USD per ton of CO_2 equivalent emissions by 2030.

As such a tax would automatically drive up the price of fossil fuels, it is essential that its effect on the poorest populations be assessed upstream and for the tax revenue to be channelled towards the latter. In Indonesia, for instance, such a tax would cause a 63% increase in the price of electricity in 2030 whilst increasing government revenue by almost 2% of GDP, which would allow for targeted energy access initiatives.

At present, within ASEAN, only Singapore has a carbon tax set at SGD 5 (around USD 3.5) per ton of CO_2 equivalent which is paid by major industrial emitters and which could rise to SGD 15 by 2030. Indonesia and Vietnam are considering introducing an emissions trading system (ETS),[17] whilst Thailand is thinking about adopting either emission allowances or a carbon tax.

3.3 Private investment can be steered towards renewables

ASEAN infrastructure, in particular for renewables, lacks funding which could be provided by the private sector. There are various types of initiatives to steer private investments towards these energies: subsidies, public-private partnerships (PPPs), green finance promotion or even extra-financial reporting requirements for businesses. Most of these measures are geared towards cutting the costs of renewables and reducing risks for investors. However, for a renewable energy market to emerge, government investment and development assistance are still crucial, especially in the least developed countries (Myanmar, Cambodia, Lao PDR). Furthermore, the expansion of renewables requires public investments to upgrade power grids as the intermittent nature of these energies creates a heightened need for flexibility and steering.

The most encouraging policies within ASEAN to direct private investment appear to be the setting of a competitive feed-in tariff for private producers of renewable energies, which is the equivalent of subsidies, and the forging of PPPs.

According to the International Renewable Energy Agency (IRENA), the use of competitive feed-in tariffs has been very strongly correlated with growing investments in renewable energies within ASEAN over the past decade,[18] especially in the Philippines, Thailand and Malaysia.[19] In Vietnam as well, the renewable energy generation capacity has mushroomed since the introduction of a feed-in tariff in 2017.

These subsidies represent a cost for governments in spite of the fact that the feed-in tariffs can be revised on the basis of changes to the costs of renewables which tend to fall as the market reaches maturity. Taking the

(15) In Indonesia, the rise in fuel prices hurried along the fall of the Suharto government in 1998; in Myanmar, the increase of energy prices in 2007 triggered the Saffron Revolution which was quashed by the army.
(16) In the form of a carbon tax levied on the energy producer in proportion to the energy's carbon content. Fiscal Monitor: *How to Mitigate Climate Change*, October 2019, IMF.
(17) Unlike a carbon tax where the authorities directly determine a carbon price, ETSs enable them to define maximum emission levels and to allocate or sell emission allowances to businesses which may then exchange them amongst themselves. In this case, the carbon price is set by a market mechanism that derives, inter alia, from the emissions ceiling that has been set.
(18) *Renewable Energy Market Analysis*, Southeast Asia, IRENA, 2018.
(19) Malaysia has since replaced this system with net metering: a service enabling individuals or businesses to partly offset their consumption by generating renewable energy themselves and then selling it back to the electricity distributor (companies are offered tax credits for investments in the equipment).

example of Thailand, fixed feed-in tariffs are gradually being replaced by invitations to tender for renewable energy projects leading to purchase prices that are lower than fixed feed-in tariffs.

PPPs could also contribute to the expansion of the renewable energy market and channel investments toward projects that are, on the face of it, unprofitable and overly risky. However, there are very few PPP renewable energy projects in the region. More broadly, the main international organisations underscore the need for the countries to introduce a regulatory framework that holds more appeal for PPPs with improved risk-sharing between governments and investors.

3.4 Efforts in terms of energy efficiency need to be stepped up

The goals and initiatives unveiled by ASEAN governments should only marginally constrain (by around 10%)[20] growth in total energy consumption over the period to 2040. Only a very small proportion of final energy consumption is covered by energy efficiency requirements. Nevertheless, measures are being gradually rolled out (equipment certification, energy management obligations for industries, financial incentives, etc.), particularly in Singapore, Thailand and the Philippines.

Despite this, the transportation sector, which is the leading consumer of oil products by far, is set to increase its consumption at a much faster pace than the global average between now and 2040. But, there is substantial headroom in this area via the adoption of anti-pollution standards for vehicles and their effective verification or with tax incentives for purchasing low-emission vehicles and for replacing them on a regular basis.

The construction industry should also urgently rein in increasing energy demand by using more energy-saving equipment (essentially air conditioners) and fostering the design of green buildings that consume less energy.

(20) Southeast Asia Energy Outlook, 2017 International Energy Agency.

Publisher:
Ministère de l'Économie
et des Finances
Direction générale du Trésor
139, rue de Bercy
75575 Paris CEDEX 12

Publication manager:
Agnès Bénassy-Quéré

Editor in chief:
Jean-Luc Schneider
(01 44 87 18 51)
tresor-eco@dgtresor.gouv.fr

English translation:
Centre de traduction
des ministères économique
et financier

Layout:
Maryse Dos Santos
ISSN 1962-400X
eISSN 2417-9698

Derniers numéros parus

July 2020

No. 262 The economic effects of climate change
Benjamin Carantino, Nicolas Lancesseur, Mounira Nakaa, Mathieu Valdenaire

June 2020

No. 261 Private housing construction and renovation in France
Thomas Tardiveau

https://www.tresor.economie.gouv.fr/Articles/tags/Tresor-Eco

Direction générale du Trésor

@DGTrésor

Pour s'abonner à *Trésor-Éco* : tresor-eco@dgtresor.gouv.fr