PACTA for Banks Scenarios

Formatted scenarios provided as part of the PACTA for Banks Toolkit

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PACTA
Paris Agreement Capital Transition Assessment

Contents

Introduction

The PACTA for Banks methodology is scenario agnostic, meaning that any decarbonization scenario with sufficient data granularity can be used. While any scenario can be used, 2DII provides a preselected set of third-party decarbonization scenarios prepared to function as input into PACTA to be used with the PACTA for Banks Toolkit. The scenarios are formatted in such a way as to be read into the PACTA for Banks software. The set of scenarios includes scenarios covering a range of climate outcomes, but most importantly ones that look to achieve the goals set out by the Paris Agreement. This document gives a brief introduction to climate change scenarios in general, a description of the scenarios included in the toolkit, and explains the methodology as to how the scenario raw data is converted from the third parties' publications into scenarios ready to be used in the PACTA analysis. Note that this document should be read in conjunction with the PACTA for Banks methodology document, which is cited throughout.

The PACTA toolkit contains a collection of scenarios which can be used in the PACTA for Banks Software available at https://www.transitionmonitor.com/pacta-for-banks/.

Introduction to Decarbonization Scenarios

Decarbonization scenarios are potential pathways to reach a certain goal (e.g. Paris Agreement targets). They do NOT claim to predict the future. Climate change mitigation/transition scenarios, herein referred to as decarbonization scenarios, provide one possible pathway for the technology deployment and/or carbon emission that one or multiple sectors and the economy as a whole may follow to reach a targeted goal. As described in the Climate Scenario Primer,[1] "Human-made climate change is driven by a myriad of societal factors over decades and centuries to come. The future development of most of these factors is deeply uncertain and will be shaped by our actions. It is thus futile to ask, "What will happen?" and try to predict future climate change. But the future, while inherently uncertain, is not entirely unknowable. Scenarios can be used to explore "What can happen?" and even "What should happen?" given the fact that we are able to shape our future." Scenarios can thus provide pathways to reach a certain climate goal, for example to limit global temperature rise to well under 2°C as set out in the Paris Agreement.

The decarbonization scenarios provided as part of the PACTA for Banks toolkit look to translate sectoral carbon budgets into technology pathways for climate critical sectors. Note that for some sectors, technology pathways are not well defined and hence carbon budgets can only be set at the sector level. This is the case for both steel and cement.

Decarbonization scenarios are often the product of energy system models (ESM) such as the World Energy Model (WEM) which produces the scenarios given in the World Energy outlook (WEO[2]). Alternatively, Integrated Assessment Models (IAM[3]) combine socioeconomic, political and climate modelling to produce climate change scenarios such as the ones published by the IPCC (these are not included as part of the PACTA for banks toolkit – but could be used nonetheless).

Without going into too much detail, it is important to understand that:

1) these scenarios are not predictions of the future. Rather, they are projections of what the future may look like.
2) there are different assumptions behind each scenario – assumptions can be related to socioeconomic, political or climate factors and it is important to understand these when interpreting PACTA results.
3) PACTA is scenario agnostic, so any scenario or set of scenarios can be used to measure the alignment of a bank's portfolio. As PACTA aims to measure alignment to the Paris Agreement, it is imperative that at least one scenario used is "Paris aligned".

[1] https://climatescenarios.org/primer
[2] WEO model document can be found here https://www.iea.org/reports/world-energy-model
[3] How are IAM used to study climate change: https://www.carbonbrief.org/qa-how-integrated-assessment-models-are-used-to-study-climate-change

The preselected scenarios

All scenarios provided by 2DII in the PACTA for banks toolkit are developed by the International Energy Agency (IEA). The scenarios are part of two separate publications, the Energy Technology Perspective (ETP) 2017 and the World Energy Outlook (WEO) 2019. The ETP covers the buildings, transport and industry sectors. In PACTA, it is used for industry and transport, namely the steel, cement and automotive sectors. It provides pathways with a time horizon from 2017 to 2060. In contrast, the WEO-2019 extends from 2019 until 2040. It provides insight into the energy sector and its pathways for the fossil fuels and power sector are provided.

The key characteristics of each scenario are summarized below. It is advisable to read the fully documentation and assumptions behind each model before making decisions based of alignment to the respective scenarios (links are provided below).

It is also important to note that if you want the raw data underlying the scenarios as part of the PACTA for Banks toolkit you can access it though a paid contract with the International Energy Agency. It is not possible nor is it allowed to obtain the underlying data based off the information provided in the PACTA for Banks scenario files.

WEO 2020 and ETP 2020 scenarios are forthcoming and will be accessible at:
https://www.transitionmonitor.com/

Energy Technology Perspective (ETP) 2017

The Reference Technology Scenario (RTS): This is a baseline scenario that considers ambitions as reflected by current policies. This scenario misses the targets set in the Paris Agreement but is considerably better than a business as usual scenario. The RTS is most similar to the STEPS scenario in the WEO (discussed below). (IEA, 2020)

The 2 Degrees Scenario (2DS): This scenario sets out a rapid decarbonization pathway in line with the Paris Agreement. It is not as ambitious at the B2DS described below. If all the targets are achieved as set out by this scenario there would be at least a 50% chance of limiting global temperature rise to 2°C by 2100. This scenario is most similar to the SDS from the WEO described below. (IEA 2020)

The Beyond 2 Degrees Scenario (B2DS): Aims to limit with a 50% chance global temperature rise to 1.75°C above pre-industrial levels. This scenario does not necessarily follow the most economically efficient pathway. However, it does not depend on the breakthrough of unforeseen technologies. I.e. all technologies included in the ETP are already commercially available or will be within the time frame of the scenario.[4] The energy sector emission reach net zero around 2060 which is achieved through a heavily reliance on bioenergy with carbon capture and storage. (IEA, 2020)

IEA (2020), ETP Model 2017, IEA, Paris https://www.iea.org/reports/etp-model-2017

World Energy Outlook 2019

Current Policies Scenario (CPS): This is a business as usual scenario. I.e. it explores what the future may look like based on what is happening today and assuming no policy changes. In the CPS energy demand rises by 1.3% each year to 2040. (IEA, 2019)

Stated Policies Scenario (STEPS): This scenario incorporates policies declared today (2019). The goal with this is to assess what the world may look like in the future based on policies that have currently been announced. In contrast to the CPS, in the STEPS energy demand rises by 1% per year until 2040. More than half of this growth in demand is met by solar photovoltaics (PV) and natural gas enabled by trade in

[4] Note that this is what the authors (i.e. the IEA) define as being breakthrough or unforeseen technologies. This is of course subjective so it should be noted as an assumption.

liquefied natural gas (LNG) accounts for a third. Oil demand plateaus in 2030. Despite this, the global economic and population growth means that there is no peak in global emissions ahead of 2040 and hence globally shared sustainability goals (like that set out in the Paris Agreement) are missed. (IEA, 2019)

Sustainable Development Scenario (SDS) This scenario aims to meet sustainable development goals. This requires rapid and widespread changes across all parts of the energy system. It is aligned with the goals set out in the Paris Agreement as well as objectives relate to universal energy access and cleaner air. These efforts are shared amongst multiple fuels and technologies. (IEA, 2019)

IEA (2019), World Energy Outlook 2019, IEA, Paris https://www.iea.org/reports/world-energy-outlook-2019

Methodology

The following section covers how the numbers given in the IEA publications are converted into input files as presented in the PACTA for Banks toolkit.

While the methodology to convert the scenarios into PACTA inputs is defined, i.e. the use of the market share approach (see section 1.10 of the PACTA for Banks methodology document), for some sectors (steel and cement and automotive) 2DII makes some assumptions in preparing the scenario files. These are documented below. It follows that a user may choose their own assumptions and can still use the scenario in PACTA given that the market share approach is still followed. Note that it is important that these assumptions are documented in the same way that they are here.

Power and Fossil Fuels

For these sectors, the technology roadmaps provided in the IEA WEO-2019 are used in the PACTA for Banks Toolkit. The market share approach is used to calculate scale the macro-economic targets to micro-economic actors (companies, bank portfolios, etc.); the definition of the market varies between high carbon and low carbon technologies to ensure the approach solves for the global target and to ensure laggards need to do their share. Please refer to section 2.3 of the PACTA for Banks Methodology document for a full description.

Steel and Cement

For the cement and steel sectors, no technology pathways exist in the current scenario literature. However, targets for absolute carbon reduction as well as total production values do exist. It follows that a sector level methodology is needed. This is the emission intensity metric as detailed in section 2.4 of the PACTA for Banks methodology document. As this metric focuses on the emission intensities, the same unit is needed form the scenarios. Given that the ETP provides production and absolute carbon emission targets, these can be converted into sector wide carbon intensities. The following section outlines how market-wide scope 1&2 carbon-intensity targets are calculated for the steel and cement sector.

Scenarios from the IEA ETP 2017 are used. The IEA ETP 2017 (B2DS scenario) lays out absolute figures for CO_2 emissions and production figures for the steel and cement sector and the power sector.

Calculating scope 1 emission intensity

Material production (Mt) for both cement and crude steel are taken from the IEA As are Scope 1 CO_2 emissions (Mt CO_2) for cement and iron and steel.

Scope 1 carbon-intensity targets in tons of CO_2 per ton of product for each given year are then calculated as follows:

$$I^{\text{in scope1}} = \frac{E^{\text{in scope 1}}}{P^{\text{in}}}$$

where “in” denotes the industry, “I” is emission intensity, E is absolute emissions (CO_2) and P is production

Calculating scope 2 emission intensity

To calculate scope 2 emission intensities two inputs are needed:

- The total electricity consumption of the sector being assessed
- The emission intensity of the power sector

The total electricity consumption (in PJ) for each sector is provided by the ETP.

The emission intensity of the power consumed is calculated using the absolute CO_2 emissions as well as the gross electricity generation of the power sector:

Both, the direct CO_2 emissions (in Mt CO_2) as well as the gross electricity generation (in TWh) for the power sector are taken from the ETP's scenario table. With these two inputs the emission intensity (g CO_2 /MWh) for the power generation is calculated as follows:

$$I_{power}^{in\ scope\ 1} = \frac{E_{power}^{in\ scope\ 1}}{P_{power}^{in}}$$

Scope 2 absolute emissions for the steel and cement sector are then calculated by multiplying the electricity consumption of the respective sector by the power sector emission intensity:

$$I^{in\ scope\ 2} = \left(\frac{EC^{in}}{3{,}600} * I_{power}^{in\ scope1}\right) * 1{,}000$$

where dividing by 3,600 is converting Joules to Mega Watt hours

To get scope 2 emission intensity per unit of output for each sector the absolute scope 2 emissions are divided by the material production:

$$I^{in\ scope\ 2} = \frac{E^{in\ scop}}{P^{in}}$$

Combining scope 1 and scope 2 emissions

Finally, to obtain scope 1 and 2 emission intensity targets for the respective sectors the sum of both scope emission intensities is computed as:

$$I^{in} = I^{in\ scop} + I^{in\ scope2}$$

Automotive Sector

In principle, the same approach as used for the power and fossil fuel sector can be used as technology roadmaps are provided by the IEA ETP 2017. However, the scenarios provide solely stock values, while the asset-level data provides production values in number of produced cars. It follows that a conversion of stock values to a comparable unit of measurement must be performed for the scenario values. Sales figures

are the most intuitive link to the number of cars produced. The ETP 2015 publication provided both sales and stock values for the automotive sector and for the respective scenarios. From this, it is possible to calculate the number of cars that are effectively being taken off the road or retired. These retirement values are then applied to the stock values given in the ETP 2017 - hence converting the 2017 scenarios into sales figures and thus generating a comparable unit to the number of cars being produced.

The ETP 2017 scenarios required change in sales is calculated as:

(all changes (Δ_{t1-}) are calculated over a 1-year time horizon)

$$\Delta_{t1-t0} sales^{ETP2017} = \Delta_{t1-t0} stocks^{ETP2017} + retirements^{ETP2015}$$

where retirements are calculated from the ETP 2015 as follows:

$$retirements^{ETP2015} = \text{sales}^{\text{ETP2015}} - \Delta_{t1-t0}\text{stocks}^{\text{ETP2015}}$$

Finally, the market share approach is applied to these targets; this varies between high carbon and low carbon technologies. Please refer to section 2.3 of the PACTA for Banks Methodology document for a full description of this.

Calculating Yearly Targets

For most scenarios, the targets are given at 5-year time intervals. As PACTA is focused within a 5-year time horizon it is important to compare a portfolio's 5-year production trend / technology mix against targets for each year. To solve for this 2DII applies a linear interpolation between the 5 yearly data points.

Summary of Scenarios Provided in the PACTA for Banks Toolkit

Table 1. Shows the scenario provided in the PACTA for Banks Tool kit

Sector	Scenario Source	Scenario	Region
Steel	IEA - ETP - 2017	B2DS	Global
Cement	IEA - ETP - 2017	B2DS	Global
Power	IEA - WEO -2019	SDS	Advanced Economies, Africa, Asia Pacific, Brazil, Central and South America, China, Developing Economies, European Union, Eurasia, Europe, Global, India, Japan, Middle East, Non OECD, North America, OECD, Russia, South Africa, Southeast Asia, United States

Power	IEA - WEO -2019	STEPS	Advanced Economies, Africa, Asia Pacific, Brazil, Central and South America, China, Developing Economies, European Union, Eurasia, Europe, Global, India, Japan, Middle East, Non OECD, North America, OECD, Russia, South Africa, Southeast Asia, United States
Power	IEA - WEO -2019	CPS	Advanced Economies, Africa, Asia Pacific, Brazil, Central and South America, China, Developing Economies, European Union, Eurasia, Europe, Global, India, Japan, Middle East, Non OECD, North America, OECD, Russia, South Africa, Southeast Asia, United States
Power	IEA - ETP - 2017	B2DS	Association of Southeast Asian Nations, Brazil, China, European Union, Global, India, Mexico, Non OECD, OECD, Russia, South Africa, United States
Oil and Gas	IEA - WEO -2019	SDS	Advanced Economies, Africa, Asia Pacific, Central and South America, Developing Economies, European Union, Eurasia, Europe, Global, Middle East, Non OECD, North America, OECD, OPEC
Oil and Gas	IEA - WEO -2019	STEPS	Advanced Economies, Africa, Asia Pacific, Central and South America, Developing Economies, European Union, Eurasia, Europe, Global, Middle East, Non OECD, North America, OECD, OPEC, Non OPEC
Oil and Gas	IEA - WEO -2019	CPS	Advanced Economies, Africa, Asia Pacific, Central and South America, Developing Economies, European Union, Eurasia, Europe, Global, Middle East, Non OECD, North America, OECD, OPEC
Oil and Gas	IEA - ETP - 2017	B2DS	Global

Coal	IEA - WEO -2019	SDS	Advanced Economies, Africa, Asia Pacific, Central and South America, Developing Economies, Eurasia, Europe, Global, Middle East, Non OECD, North America, OECD
Coal	IEA - WEO -2019	STEPS	Advanced Economies, Africa, Asia Pacific, Central and South America, Developing Economies, Eurasia, Europe, Global, Middle East, Non OECD, North America, OECD
Coal	IEA - WEO -2019	CPS	Advanced Economies, Africa, Asia Pacific, Central and South America, Developing Economies, Eurasia, Europe, Global, Middle East, Non OECD, North America, OECD
Coal	IEA - ETP - 2017	B2DS	Global
Automotive	IEA - ETP - 2017	B2DS	Global
Automotive	IEA - ETP - 2017	2DS	Global
Automotive	IEA - ETP - 2017	RTS	Global