

Annex A. Description of emissions trading systems and results

Annex A.1 describes the seventeen emission trading systems and tradeable performance standards for which coverage and permit prices were estimated in 2015: The Alberta Specified Gas Emitters Regulation and the Quebec Cap-and-Trade System in Canada, the seven Chinese pilot systems (Beijing, Chongqing, Guangdong, Hubei, Shanghai, Shenzhen, Tianjin), the European Union Emissions Trading System, the systems in Saitama and Tokyo (Japan), Korea, New Zealand, Switzerland, and the California Cap-and-Trade Program as well as the Regional Greenhouse Gas Initiative in the United States. Annex A.2 shows results on ETS and tradeable performance standard coverage by sector and permit prices. Annex A.3 lists the system-specific adjustment and assumptions for the calculations.

A.1. Description of emissions trading systems used in the analysis

Table A.1 summarises the main features of the seventeen emissions trading systems and tradeable performance standards that were operational in 2015. These carbon pricing systems are included in the estimation of effective carbon rates as presented in Chapter 3 on carbon pricing developments. Regarding recent carbon pricing trends (Chapter 2) Table 2.1 lists all new carbon pricing systems, which have become operational since 2016 or are expected to become operational soon, and are included in the forward-looking estimates of Chapter 2.

Table A.1. Description of emissions trading systems used in the analysis

Country or region	Juris-dictions covered	Date trading started	Year used in the estimation	Greenhouse gas emissions covered	Sectors and activities covered	Threshold for inclusion of emitting facility (per year)	Number of facilities	Price Ceiling or Floor	Treatment of biomass
CAN	Alberta	July 2007	2015	CO ₂ , CH ₄ , N ₂ O, SF ₆ , HFCs, PFCs, NF ₃	- Main industrial facilities, including pipelines, - Electricity generation & imports	100,000 tCO ₂ -eq	121 (estimate)	Permit prices are set to CAD 15 in 2015, determined by ministerial order.	Not covered
	Quebec	January 2013	2015		- Main industrial facilities, including pipelines, - Electricity generation & imports, - Fuel suppliers	25,000 tCO ₂ -eq	76	- Price floor: CAD 10.75 (2013), increasing annually by 5% plus rate of inflation - Price ceiling: release of allowances from reserve account at CAD 40, 45 and 50 (2013); ceilings increase annually by 5% and are adjusted for inflation (Gouvernement du Québec, 2017 ^[11])	Not covered
CHN	Beijing	Nov 2013	2015 (partial)	CO ₂	- Electricity & heat generation, - Industries, - Services	10,000 tCO ₂	490		
	Chongqing	June 2014	2015 (partial)	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	- Electricity & heat generation, - Industries	20,000 tCO ₂ -eq	242		
	Guangdong	Dec 2013	2015 (partial)	CO ₂	- Electricity & heat generation, - Industries	20,000 tCO ₂	202		
	Hubei	April 2014	2015 (partial)	CO ₂	- Electricity & heat generation, - Industries	15,000 tCO ₂	138		
	Shanghai	Nov 2013	2015 (partial)	CO ₂	- Electricity & heat generation, - Industries, - Services	20,000 tCO ₂	191		
	Shenzhen	June 2013	2015 (partial)	CO ₂	- Electricity & heat generation, - Water supply, - Manufacturing,	5,000 tCO ₂	635 (+197 public buildings)		

	Tianjin	Dec 2013	2015 (partial)	CO ₂	- Buildings - Power & heat generation, - Industries	20,000 tCO ₂	114		
EU	23 countries	Jan 2005	2015	CO ₂ , N ₂ O, PFCs	- Energy activities, - Ferrous metal, - Cement, glass and ceramics, - Pulp and paper - Aviation	Depends on activity, e.g. 20 MW thermal input for combustion activities, see European Commission (2003, Annex I) for details	> 11000		No need to surrender permits
JPN	Tokyo	April 2010	2015	CO ₂	Large commercial and industrial facilities	1,500 kl energy in crude oil equivalents	about 1300	None	No need to surrender permits
	Saitama	April 2011	2015	CO ₂			608	None	No need to surrender permits
KOR	National	Jan 2015	2015	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	- Electricity generation, - Manufacturing, - Water supply, - Waste & sewerage, - Construction, - Air transport (5 airlines)	125,000 tCO ₂ -eq (companies) 25,000 tCO ₂ -eq (installations)	525	President can enact market stabilisation measures (price ceiling and floor, additional release of permits)	No need to surrender permits
NZL	National	Jan 2008 (extended to more sectors in following years)	2015	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆	- Liquid fuel suppliers, - Stationary energy (gas and coal for electricity & heat generation), - Industrial processes (metal, mineral and chemical transformation), - Disposal facility operators, - Horticulture, - Primary industries (agriculture, forestry), - Synthetic GHG	Upstream coverage for each sector	109 ¹	- Mandatory participants can surrender one permit for every two tonnes of emissions. - Price ceiling: NZD 12.5 (half of NZD 25 due to the one-for-two transitional measure)	Not covered
CHE	National	Jan 2008	2015	CO ₂ , CH ₄ , N ₂ O, HFCs,	- Non-metallic minerals, metal & steel production	20 MW (installed total rated thermal)	54		No need to surrender

				PFCs, SF ₆ , NF ₃	- Chemicals & pharmaceuticals, - Paper production, - District heating - Refineries	input) or sector- specific criteria, see Swiss Federal Council, Annex 6 (2012 ^[2])			permits
USA	California	Jan 2013	2015	CO ₂ , CH ₄ , N ₂ O, SF ₆ , HFCs, PFCs, NF ₃	- Main industrial facilities, - Electricity generation & imports, - CO ₂ suppliers, - Fuel supplier	25,000 tCO ₂ -eq	416	- Price floor: USD 10 in 2012, increasing annually by 5% plus rate of inflation, - Price ceiling: release of allowances from reserve account at USD 40, 45 and 50	Not covered
	RGGI	Jan 2009	2015	CO ₂	Electricity generation	25 MW (installed capacity)	161		Not covered ²

Note: ¹This number refers to the number of participants with activities registered in the New Zealand Emissions Trading System up to end 2015 (New Zealand Emissions Trading Register, 2018^[3]); ²except if certain eligibility criteria apply (see RGGI (2008^[4]) for detail.

A.2. Permit prices and ETS coverage

Table A.2 shows the shares of emissions covered by ETS and tradeable performance standards across sectors for all countries and regions included in this report in which emitters could trade permits in 2015. For subnational trading systems, the emissions covered by the ETS and tradeable performance standards are given as shares of national emissions. The last column lists the price of tradeable emission permits in 2015 EUR per tonne of CO₂.

Table A.2. Permit prices and ETS coverage

		ETS coverage						ETS Permit Price (in EUR per tonne of CO ₂)	
		Road	Off-road	Industrial production	Agriculture & fishing	Residential & Commercial	Electricity		
AUT		Emissions covered by ETS (%)	0%	11%	30%	0%	0%	66%	7.60
BEL		Emissions covered by ETS (%)	0%	1%	53%	0%	0%	69%	7.60
CAN	Alberta	Emissions covered by ETS (%)	0%	9%	33%	0%	0%	54%	10.57
	Quebec	Emissions covered by ETS (%)	15%	6%	6%	7%	9%	0%	11.19
CHE		Emissions covered by ETS (%)	0%	15%	24%	0%	0%	0%	10.95
CHN	Beijing	Emissions covered by ETS (%)	0.0%	0.0%	0.5%	0.0%	0.7%	0.6%	6.05
	Chongqing	Emissions covered by ETS (%)	0.0%	0.0%	1.5%	0.0%	0.0%	0.9%	3.58
	Guangdong	Emissions covered by ETS (%)	0.0%	0.0%	2.7%	0.0%	0.0%	5.6%	2.37
	Hubei	Emissions covered by ETS (%)	0.0%	0.0%	2.0%	0.0%	0.0%	1.9%	3.60
	Shanghai	Emissions covered by ETS (%)	0.0%	0.0%	1.4%	0.0%	3.7%	2.4%	3.42
	Shenzhen	Emissions covered by ETS (%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	5.44
	Tianjin	Emissions covered by ETS (%)	0.0%	0.0%	2.1%	0.0%	0.0%	1.2%	3.19
CZE		Emissions covered by ETS (%)	0%	24%	40%	0%	0%	96%	7.60
DNK		Emissions covered by ETS (%)	0%	10%	51%	2%	0%	73%	7.60
EST		Emissions covered by ETS (%)	0%	0%	33%	0%	0%	88%	7.60
FIN		Emissions covered by ETS (%)	0%	26%	29%	0%	0%	70%	7.60
FRA		Emissions covered by ETS (%)	0%	60%	64%	0%	1%	91%	7.60
DEU		Emissions covered by ETS (%)	0%	41%	64%	0%	0%	90%	7.60
GRC		Emissions covered by ETS (%)	0%	21%	100%	6%	0%	99%	7.60
HUN		Emissions covered by ETS (%)	0%	21%	51%	0%	0%	78%	7.60
ISL		Emissions covered by ETS (%)	0%	45%	4%	0%	0%	0%	7.60
IRL		Emissions covered by ETS (%)	0%	9%	65%	0%	0%	97%	7.60
ITA		Emissions covered by ETS (%)	0%	45%	68%	0%	0%	88%	7.60
JAP	Tokyo	Emissions covered by ETS (%)	0%	0%	0.3%	0%	1.7%	1.9%	9.83
	Saitama	Emissions covered by ETS (%)	0%	0%	3.3%	1.6%	0%	2.2%	9.83
KOR		Emissions covered by ETS (%)	0%	37%	96%	0%	25%	98%	8.95
LUX		Emissions covered by ETS (%)	0%	0%	73%	0%	0%	64%	7.60
NLD		Emissions covered by ETS (%)	0%	3%	63%	8%	1%	97%	7.60
NOR		Emissions covered by ETS (%)	0%	35%	100%	0%	1%	66%	7.60
NZL		Emissions covered by ETS (%)	79%	79%	49%	76%	61%	82%	2.12
POL		Emissions covered by ETS (%)	0%	74%	74%	0%	0%	94%	7.60
PRT		Emissions covered by ETS (%)	0%	51%	42%	0%	0%	93%	7.60
SVK		Emissions covered by ETS (%)	0%	59%	41%	0%	0%	85%	7.60
SVN		Emissions covered by ETS (%)	0%	7%	53%	0%	0%	98%	7.60
ESP		Emissions covered by ETS (%)	0%	73%	62%	0%	1%	95%	7.60
SWE		Emissions covered by ETS (%)	0%	63%	28%	0%	0%	30%	7.60
GBR		Emissions covered by ETS (%)	0%	38%	53%	3%	1%	87%	7.60
USA	California	Emissions covered by ETS (%)	9%	3%	7%	6%	5%	4%	12.44
	RGGI	Emissions covered by ETS (%)	0%	0%	0.1%	0%	0%	4%	6.11

A.3. ETS-specific adjustments and assumptions

Results presented in Table A.2 are based on the general estimation methodology described in OECD (2016_[5]). In addition, the following specific adjustments and assumptions apply for the different emissions trading systems.

A.3.1. Canada

Canada prices carbon emissions through tradeable permits at the Provincial level. In 2015, the Quebec Cap-and-Trade System and the Alberta Specified Gas Emitters Regulation, put a price on carbon emissions through tradeable permits.

A.3.1.1. Alberta

Verified emissions for the Alberta Specified Gas Emitters Regulation, a tradeable performance standard, were not available for 2015 at the time of writing. Hence, emission coverage is estimated using 2015 facility-level data on greenhouse gas emissions, differentiated by gas, as published by the Government of Canada (2017_[6]). Based on this data, the following system-specific adjustments and assumptions are made:

- The *matching* of facilities to the six Effective Carbon Rate (ECR) sectors is based on the North American Industry Classification System (NAICS) as reported in the dataset (Government of Canada, 2017_[6]).
- *Process emissions* are excluded using data from the Canadian Greenhouse Gas Emissions Inventory (Environment Canada, 2017_[7]).
- The *price* associated with the Specified Gas Emitters Regulation (SGER) for 2015 is assumed to be CAD 15 per tonne CO₂, which corresponds to the permit price emitters had to pay to Alberta's Climate Change and Emissions Management Fund for compliance obligations they could not meet in a more cost-effective way (make improvements at their facility to reduce emissions; use emission performance credits generated at facilities that achieve more than the required reductions; purchase Alberta-based carbon offset credits).

A.3.1.4. Quebec

Data on emissions subject to the Quebec Cap-and-Trade System in 2015 is from Quebec's Ministry of Sustainable Development, Environment and the Fight against Climate Change (Gouvernement du Québec, 2017_[8]). The dataset reports the verified greenhouse gas emissions in 2015 of all facilities and fuel suppliers subject to the system. In addition, the following ETS-specific adjustments and assumptions are made:

- *Matching* of facilities to the six sectors discussed in the main body of the report is based on the North American Industry Classification System (NAICS) as in the previous edition of Effective Carbon Rates (OECD, 2016_[5]).
- *Non-CO₂ emissions* are removed based on facility-reported emissions data, which is differentiated by gas (Government of Canada, 2017_[6]).
- *Process emissions* are excluded and *fuel suppliers* included combining the verified emissions dataset with provincial-level data contained in the Canadian Greenhouse Gas Emissions Inventory (Environment Canada, 2017_[7]).
- The average auction price in 2015 was CAD 15.88 per tonne of CO₂ (average of four auctions, weighted by the number of allowances sold).

A.3.2. People's Republic of China

The estimation of emissions covered by the Chinese Pilot ETSs follows Li et al. (2015_[9]) as outlined in Annex B in OECD (2016_[5]). The estimation by Li et al. (2015_[9]) follows largely the general estimation methodology as detailed in Annex A in OECD (2016_[5]), but deviations occur due to different structures and availability of data. In particular, the following specific adjustments to the general estimation methodology and assumptions are made:

- *Industrial process emissions* from lime and cement production are excluded from the estimation of the emissions trading systems in Beijing, Chongqing, Guangdong, Shanghai and Shenzhen using a uniform process emission factor (0.57 tonnes CO₂ per tonne of cement) from the literature. Cement and lime production account for 87% of China's total industrial process emissions in 2005 (UNFCCC, 2015_[10]).
- *Auto-generation of electricity* in China mainly occurs in the aluminium sector (Li, 2015_[11]). Because the vast majority of Chinese aluminium is produced outside the area of the seven pilot systems, no adjustment for auto-electricity is made.
- To calculate *indirect CO₂ emissions from electricity*, an average value for the national carbon intensity of electricity production is used. This implicitly assumes that electricity consumed in different sectors and regions is produced based on the same energy mix.
- In *Shanghai*, emissions from air transport subject to the ETS are currently allocated to the commercial and residential sector.
- In *Shenzhen*, 197 public buildings are covered by the Shenzhen ETS, but no information is available to estimate the total sector coverage.
- Prices:
 - Beijing's average price in 2015 amounts to CNY 41.70 (EUR 6.05) per tonne CO₂
 - Chongqing's average price in 2015 amounts to CNY 24.75 (EUR 3.58) per tonne CO₂
 - Guangdong's average price in 2015 amounts to CNY 16.38 (EUR 2.37) per tonne CO₂
 - Hubei's average price in 2015 amounts to CNY 24.84 (EUR 3.60) per tonne CO₂
 - Shanghai's average price in 2015 amounts to CNY 23.65 (EUR 3.42) per tonne CO₂
 - Shenzhen's average price in 2015 amounts to CNY 37.55 (EUR 5.44) per tonne CO₂
 - Tianjin's average price in 2015 amounts to CNY 22.02 (EUR 3.19) per tonne CO₂
- To determine the price signal sent by ETS in China, an average price from all pilot systems was calculated for each sector, weighted by the proportion of covered emissions from each system in that sector. Price information is based on

market prices from the emission exchanges in 2015, see PMR (2015_[12]), PMR (2015_[13]), and PMR (2015_[14]).

- The weighted effective average *price* in China amounts to CNY 22.82 (EUR 3.30) in the industry sector, CNY 26.71 (i.e. EUR 3.87) in the commercial and residential sector, CNY 22.08 (i.e. EUR 3.20) in the electricity sector.¹

A.3.3. EU

Data on verified emissions from more than 11 000 installations, and their corresponding economic activity classification, is from the European Commission (2017_[15]). In addition, the following specific assumptions are made:

- The Statistical Classification of Economic Activities in the European Community (NACE) classifies economic activities into 615 economic classes. Where available, NACE codes are used to *match* emissions from installations to Effective Carbon Rate (ECR) sectors.² If no NACE code is available installations are matched to ECR sectors codes using a compulsory activity code, that derives from the list of activities included in the EU ETS shown above. For electricity generation and heat generation installations, there is only one common activity code. To distinguish between emissions from electricity and heat generation from installations with no NACE code but a common activity code two steps are undertaken. First, a ratio of emissions from electricity generation installations to heat generation installations is built based on information from installations for which a NACE code is available. Second emissions from electricity and heat generation from installations with no NACE code but a common activity code, are attributed to electricity and heat generation according to the ratio calculated in the first step.
- The *electricity sector* is covered at close to 100% in most countries, given that even small fossil fuel power plants (≥ 20 MW capacity) have to take part in the ETS. For some countries coverage was initially estimated to exceed 100% in the electricity sector. This is a consequence of initially allocating all emissions from electricity generation under the ETS to the electricity sector, even though some of these emissions result from auto-electricity generation in the industry sector. NACE and activity codes only specify the main activity of an installation. A power plant owned by an industrial company that produces electricity for its own production, but at the same time also for the grid maybe coded simply as a power plant. All its emissions would then be coded as emissions from the electricity sector, even though some are from auto-electricity generation in the industry sector. Knowing that the coverage of the electricity sector cannot be above 100% and that the rules on inclusion of power plants onto the ETS imply close to 100% coverage of the electricity sector any emissions in excess of 100% coverage of the electricity sector are called overflow emissions and separated from the electricity sector. These overflow emissions are then allocated to the industry sector, given that they result from auto-generation of electricity in the industry sector.
- With respect to *aviation*, commercial flights within the EEA area are covered by the EU ETS as described above. The Taxing Energy Use database only takes emission from domestic flights into account. For that reasons it is assumed that all regularly scheduled domestic flights are covered by the EU ETS, which are 97%

of all flights within the EEA according to a study for the European Aviation Safety Agency (EASA, 2009_[16]).

- The average allowance *price* of all auctions in 2015 was EUR 7.60 per tonne of CO₂ (European Energy Exchange, 2015_[17]).

A.3.4. Japan

A.3.4.1. Tokyo

Emissions by sector from are from the Tokyo Metropolitan Government (TMG, 2017_[18]). In addition, the following country-specific assumptions are made:

- The share of *indirect emissions from electricity use*, i.e. emission from electricity bought from an electricity provider, in total emissions is calculated for each sector using Tokyo's greenhouse gas inventory (TMG, 2017_[19]). Thereby it is assumed that the share of indirect emissions from electricity use in total emissions is the same for covered and non-covered facilities in a given sector.
- 2015 emissions under the cap are currently not available by economic subsector. For this reason subsector data from the latest year available, i.e. 2010, are *scaled* to 2015 by the difference of aggregate emissions under the cap from 2010 to 2015.
- The detailed subsector data for 2010 has only been published as preliminary data. Meanwhile official data show higher aggregate emissions for 2010 than the preliminary data does. The preliminary by subsector data is therefore *scaled* to match the official aggregate data for 2010.
- According to Jin (2017_[20]) one excess reduction credit traded between JPY 1080 and JPY 1550. One excess reduction credit allows emitting one tonne CO₂ (TMG, 2012_[21]). For the calculation of effective carbon rates a central estimate of JPY 1320 per tonne CO₂ for 2015 is assumed.

A.3.4.2 Saitama

Emissions by sector from are from the Saitama Prefectural Government (SPG, 2017_[22]). In addition, the following country-specific assumptions are made:

- The share of *indirect emissions from electricity use*, i.e. emission from electricity bought from an electricity provider, in total emissions is calculated for each sector using Saitama's greenhouse gas inventory (SPG, 2017_[23]). Thereby it is assumed that the share of indirect emissions from electricity use in total emissions is the same for covered and non-covered facilities for a given sector.
- The Saitama ETS is linked with the Tokyo ETS via SME credits. Therefore it is assumed that the credit price from Tokyo also applies to Saitama. According to Jin (2017_[20]) one excess reduction credit traded between JPY 1080 and JPY 1550. One excess reduction credit allows emitting one tonne CO₂ (TMG, 2012_[21]). For the calculation of effective carbon rates a central estimate of JPY 1320 per tonne CO₂ for 2015 is assumed.

A.3.5. Korea

The Korean Ministry of Environment provided aggregated sector data on verified carbon dioxide emissions covered by the Korean emissions trading system in 2015. In addition, the following ETS-specific assumptions and adjustments are made:

- *Industrial process emissions* are retrieved from the UNFCCC as submitted by the Korean authorities.
- *Non-GHG emissions* had been excluded from the aggregated data provided by the Ministry of Environment. Hence no adjustment for non-GHG emissions was necessary.
- It is assumed that *biomass* is covered by the system, but that its emissions factor is equal to zero.
- The average permit *price* was KRW 11230 per tonne of CO₂ in 2015 according to data provided by the Korean Ministry of Environment.

A.3.6. New Zealand

The coverage of the New Zealand ETS is estimated differently than for the other ETS. Given that the New Zealand ETS is an upstream ETS, applying to fuels (whether imported or produced) rather than to users, coverage is estimated by calculating which proportion of each fuel type is subject to the ETS. The proportion of ETS coverage for emissions from each fuel is assumed to apply uniformly to all users of that fuel. To calculate coverage at the user level, total covered emissions from fuels used by each user are then divided by the total emissions for that user. Data on total covered emissions by user by calendar year are published by the New Zealand Environmental Protection Agency. In addition, the following assumptions are made:

- CO₂ emissions occur from energy use occur *primarily through liquid fossil fuel combustion and in the stationary energy sector*. Consequently, non-energy related emissions (e.g. industrial processes or agriculture) have been excluded from the estimation.
- The data retrieved from the New Zealand Environmental Protection Agency lists *emissions from industrial processes* separately from emissions from energy use, allowing exclusion of industrial process emissions from the estimation.
- It is assumed that ETS participants fully pass ETS costs on to end users.
- The average *price* of New Zealand Units (NZUs) is used, to reflect the fact that 97% of surrendered permits in 2015 were NZUs (49% Forestry NZUs; 48% Other NZUs) (New Zealand Environmental Protection Agency, 2015^[24]). From 1 June 2015, only NZUs and New Zealand-based assigned amount units (NZAAUs) are eligible to meet the NZ ETS obligations (New Zealand Ministry for the Environment, 2016^[25]).
- The rate of permits is halved because one permit is surrendered for every two tonnes of CO₂ emissions. The average permit price has been calculated as half the average NZU price for 2015: EUR 2.12 per tonne CO₂, or NZD 3.38 per tonne CO₂ (Carbonnews, 2018^[26]). This one-for-two transition measure is gradually phased out over three years starting January 1, 2017 (New Zealand Ministry for the Environment, 2016^[27]).

A.3.7. Switzerland

A list of ETS installations, as well as surrendered emissions by facility and year, are taken from the website of the Swiss Emissions Trading Registry (2018_[28]). Covered facilities are matched to sectors based on information provided by Swiss Federal Office for the Environment for the previous edition of this report (OECD, 2016_[5]). In addition, the following country-specific adjustments and assumptions are made:

- Installation-level data on non-CO₂ emission are retrieved from the Swiss Pollutant Registry (Swiss Federal Office for the Environment, 2017_[29]) and deducted from verified ETS emissions.
- *Process emissions* as declared by Switzerland to the UNFCCC (Swiss Federal Office for the Environment, 2017_[30]) are deducted from the industry sectors with process emissions.
- The weighted average of the three allowance auctions of 2015 is applied as the permit *price*.
- The 2015 emission permit *price* amounts to CHF 11.68 per tonne of CO₂.

A.3.8. USA

To determine the price signal sent by emissions trading systems in the USA an average auction price from RGGI and the California system was calculated for all sectors, weighted by the proportion of emissions subject to each system in that sector.

The weighted average auction price in the USA in 2015 amounts to USD 12.33 in the industry sector, USD 9.07 in electricity and USD 12.44 in all other sectors.

A.3.8.1. RGGI

Data on verified emissions of facilities covered by system is obtained from RGGI reports on annual emissions (RGGI, 2017_[31]). In addition, the following system-specific adjustments and assumptions are made:

- All emissions are *attributed to the main industrial sector* of the facility as specified by the North American Industry Classification System (NAICS). The NAICS codes of all facilities is obtained from the Energy Information Agency (EIA, 2017_[32]).
- The average auction clearing *price* in 2015 was USD 6.11 per tonne CO₂ (RGGI, 2017_[33]).

A.3.8.2. California

Data on greenhouse gas emissions subject to a compliance obligation in the Cap-and-Trade Program are published at the facility level by the Californian Air Resource Board (ARB) in the “Annual Summary of GHG Mandatory Reporting” (California ARB, 2017_[34]). Based on this data the following system-specific adjustments and assumptions are made:

- The *matching* of facilities to the six Effective Carbon Rate (ECR) sectors is based on the North American Industry Classification System (NAICS). NAICS codes are reported for all facilities in California ARB (2017_[34]). In specific cases, activity codes, as reported in California ARB, (2017_[34]), have been used to refine the match.

- Emissions from *fuel suppliers* have been attributed to the six sectors based on the following main assumptions: first, the transport sector is fully covered from transportation fuel suppliers, and second, the remaining fuel supplier emissions are allocated to all other sectors at a constant share.
- *Non-CO₂ and industrial process emissions* are excluded based on information from the California Greenhouse Gas Emission Inventory (California ARB, 2017^[35]).
- The average auction *price* in 2015 was USD 12.44 per tonne CO₂ (California ARB, 2017^[36]).

Notes

- ¹ Exchange rates are from the OECD.Stat database (OECD, 2017^[94]).
- ² Sector definitions used in this report and outlined in Section A.1.3 of OECD (2016^[3]) do not always match sector categories applied by individual countries.

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