Singapore's Measurement, Reporting & Verification Framework under the Carbon Pricing Act

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Agenda

1. Overview of Singapore’s Carbon Pricing Act

2. Measurement, Reporting & Verification (MRV) framework

3. Online GHG Emissions Reporting Platform (EDMA system)

1 Overview of Singapore’s Carbon Pricing Act (CPA)

Singapore’s Institutional Arrangement for Climate Change

- Inter-Ministerial Committee on Climate Change (IMCCC) was established in 2007 to enhance Whole-of-Government coordination on climate change policies to ensure that Singapore is prepared for the impacts of climate change. IMCCC is chaired by Senior Minister and Coordinating Minister for National Security.

- National Climate Change Secretariat (NCCS) was established in 2010 under the Prime Minister’s Office (PMO) to develop and implement Singapore’s domestic and international policies and strategies to tackle climate change.

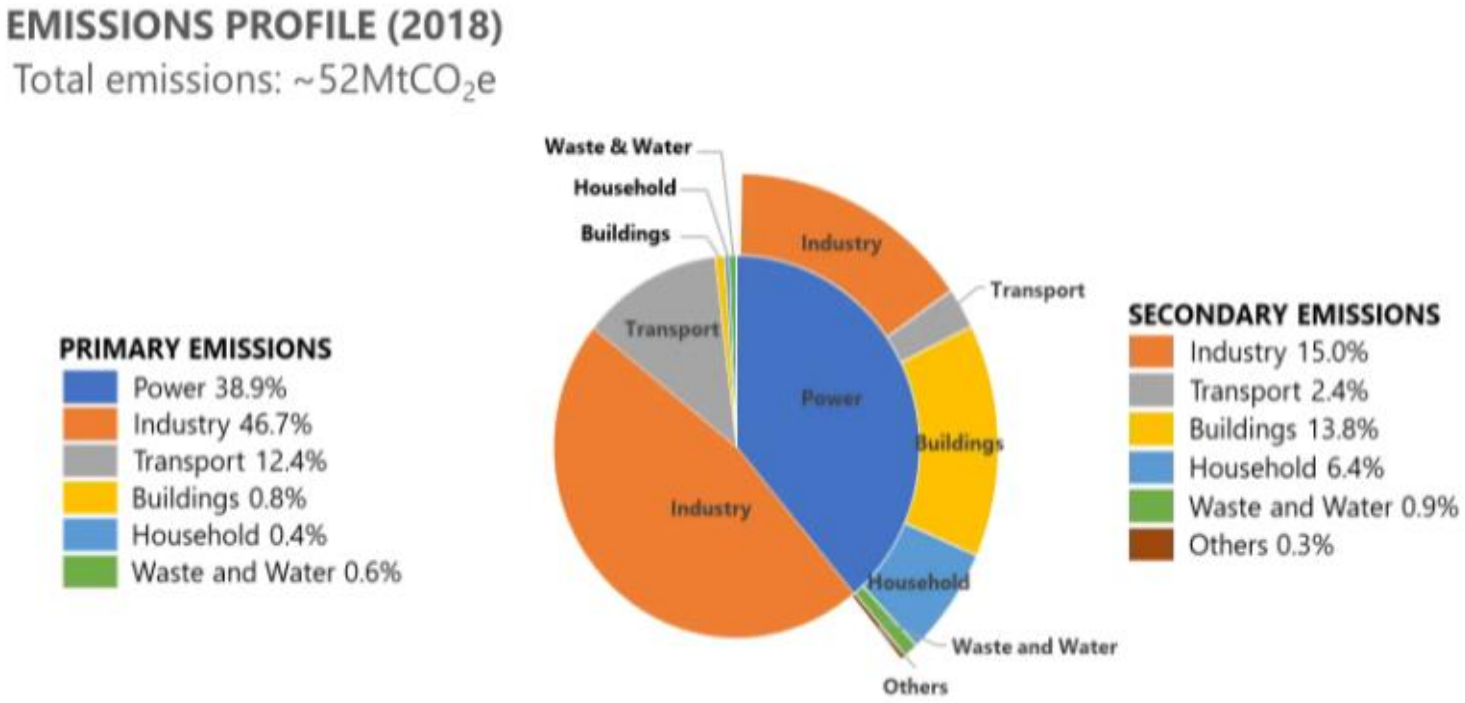
- Carbon Pricing falls under the purview of the Long Term Emissions and Mitigation Working Group (LWG), which examines mitigation options, and identifies the capabilities, infrastructure and polices needed for long-term emissions reduction.

Singapore's Emissions Profile

1. Singapore's GHG emissions in 2018 totaled ~52 $MtCO_2e$[1]. (~0.1 % of global emissions)

2. Majority of our primary emissions are from the Industry (47%) and Power (39%) sectors.

3. The scope of Carbon Pricing Act (CPA) covers the industry, power, waste and water sectors.



[1] 2018 GHG emissions and breakdown is published in SG's Long-Term Low-Emissions Development Strategy document by NCCS.

Singapore's International Commitments

Overview of Carbon Pricing Act (CPA)

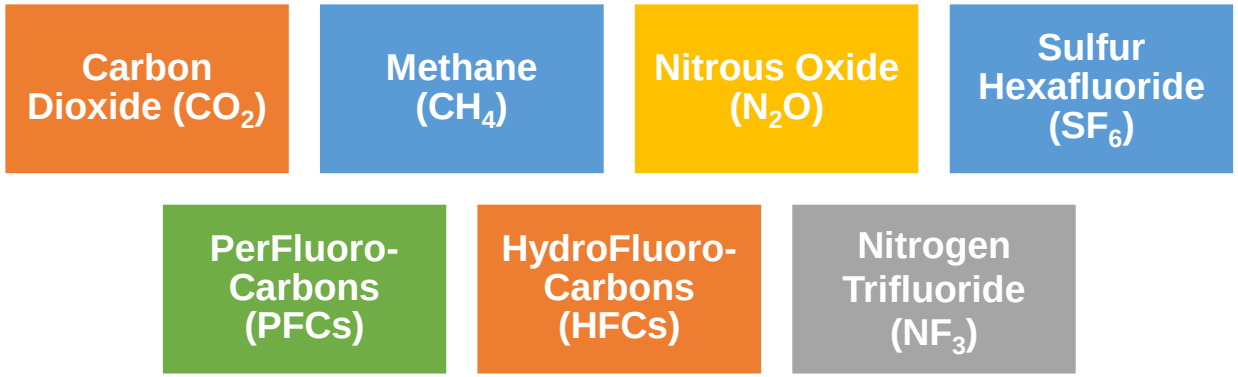
1. Carbon Pricing Act came into force on 1 January 2019.

2. Initial tax rate of S$5/t$CO_2$e from 2019 to 2023, for a transition period of 5 years
   - Applies to direct emissions from facilities emitting ≥ 25ktCO_2e in a year (~50 facilities which contributes ~80% of our total emissions)
   - Applied uniformly to all sectors without exemption (transparent, fair and consistent price signal across the economy)
   - Reviewing post-2023 carbon tax trajectory and level of the carbon tax and will announce the outcome of the review at Budget 2022, to provide time for businesses to adjust to any revision in the carbon tax trajectory

3. Government is prepared to spend more than the carbon tax revenues collected in the first 5 years to support worthwhile projects and help companies become more carbon / energy-efficient

Scope of Carbon Pricing Act (GHGs & Sectors)

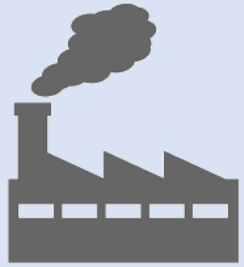
1. Covers **7 types of GHGs** emitted **directly** into the atmosphere (excludes indirect emissions from electricity and steam consumption)



2. Covers **industrial facilities** in the following sectors:-
   - Manufacturing and manufacturing-related services;
   - Supply of electricity, gas, steam, compressed air and chilled water for air-conditioning; and
   - Water supply and sewage and waste management

Scope of Carbon Pricing Act (Emission thresholds)

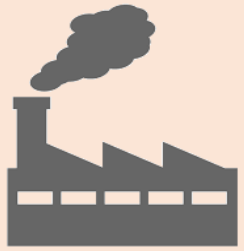
3. Regulates two types of facilities based on emissions thresholds:



Reportable Facilities

≥2,000 to <25,000 tCO_2e

- About 80 facilities
- Subject to Measurement & Reporting (M&R) requirements
  - Submit Emissions Report (ER) annually
  - Verified by NEA
- No carbon tax liability



Taxable Facilities

≥25,000 tCO_2e

- About 50 facilities
- Subject to Measurement, Reporting & Verification (MRV) requirements
  - Submit and maintain a Monitoring Plan (MP)
  - Submit an accredited external verified Emissions Report (ER) [2] annually
- Payment of carbon tax for the preceding year's emissions

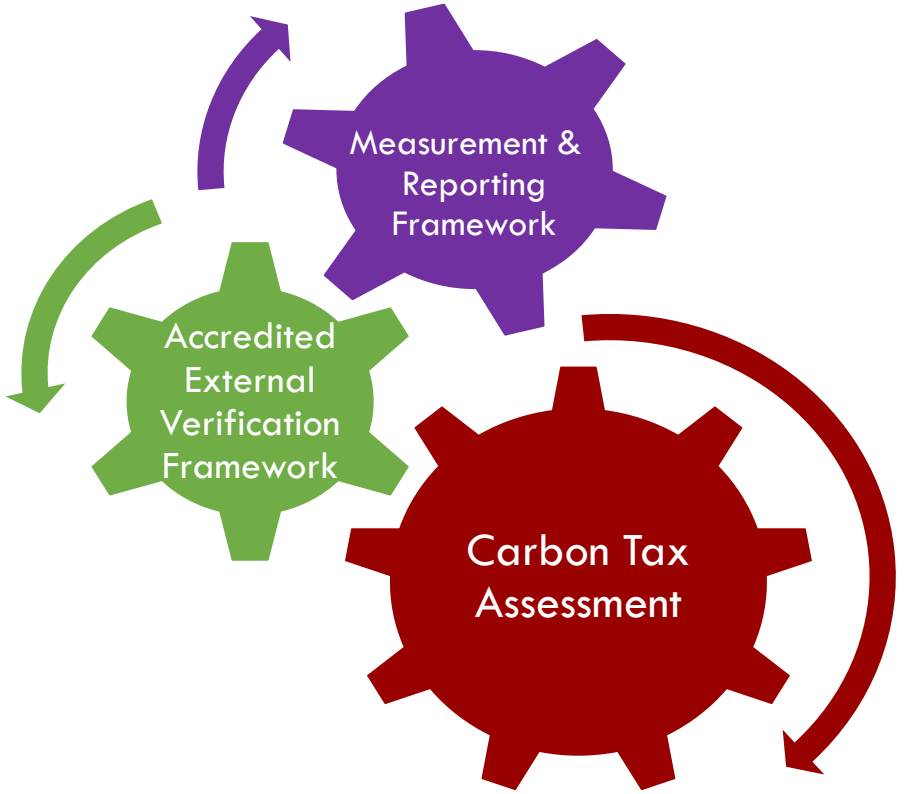
[2] If a taxable facility's verified reckonable emissions did not exceed 25,000 tCO_2e over a reporting period, the taxable facility will not need to pay carbon tax for that reporting period.

2 Measurement, Reporting and Verification (MRV) Framework under CPA

MRV Framework

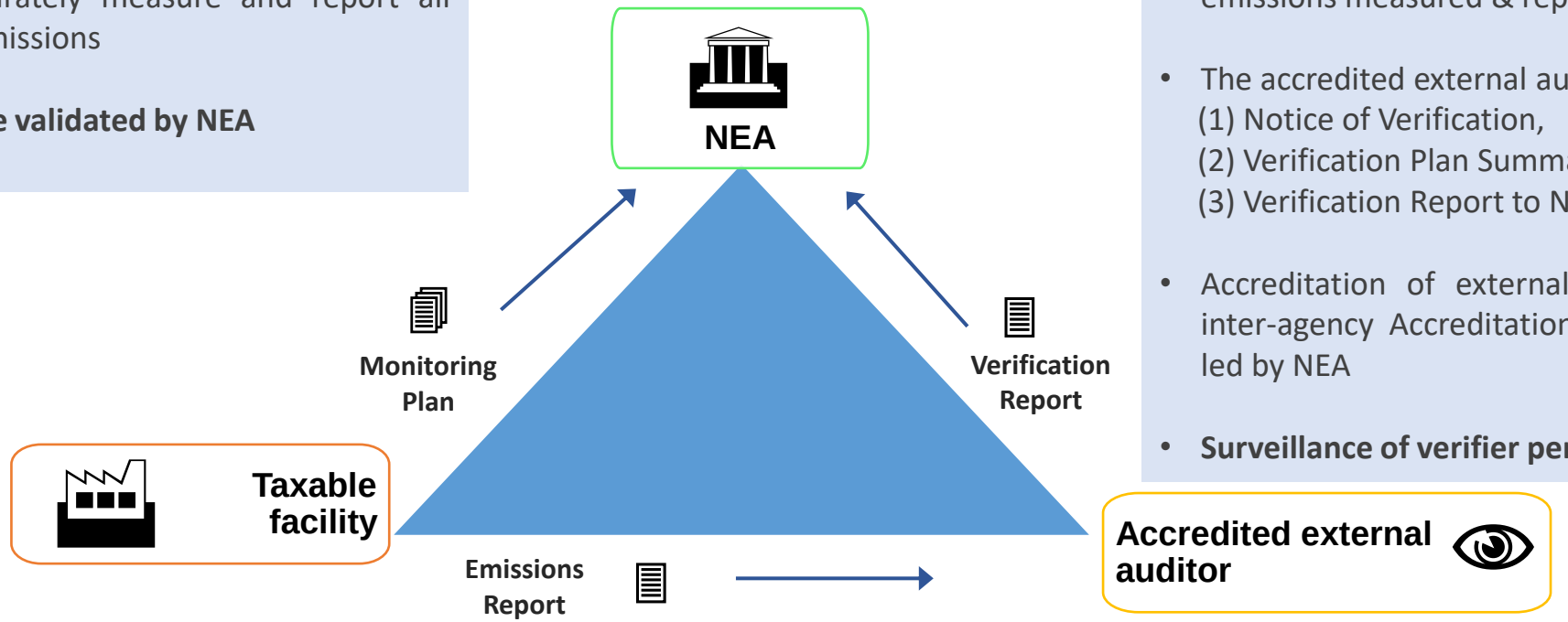
The Measurement, Reporting & Verification (MRV) framework is the cornerstone of a robust carbon pricing scheme

- Accredited external verification is required as an independent assurance that the GHG emissions measured & reported are accurate
- The verified emissions forms the basis for the assessment of a facility's carbon tax liability
- Aligned with international standards / guidelines (e.g. IPCC Guidelines, GHG Protocol, ISO 14064) & regulatory practices in other carbon pricing jurisdictions (e.g. EU, California/Quebec) or countries (e.g. Australia)



MRV Framework – Three-party relationship

- Monitoring Plan (MP) documents the facility's methods, steps and procedures to accurately measure and report all GHG emissions
- **MPs are validated by NEA**



- Accredited external verification of Emissions Report (ER) ensures independent assurance that the GHG emissions measured & reported are accurate
- The accredited external auditor submit:
  (1) Notice of Verification,
  (2) Verification Plan Summary and
  (3) Verification Report to NEA
- Accreditation of external auditors conducted by an inter-agency Accreditation Working Committee (AWC) led by NEA
- **Surveillance of verifier performance done by NEA**

- The accredited external auditor verifies the Emissions Report (ER) to a reasonable level of assurance.
- Taxable facilities submit a verified Emissions Report annually.
- The verified emissions form the basis for the assessment of the taxable facility's carbon tax liability.

3 Online GHG Emissions Reporting Platform (EDMA system)

Online Emissions Reporting Platform (EDMA system)

1. Annual emissions reporting is carried out via the Emissions Data Monitoring and Analysis (EDMA) system.

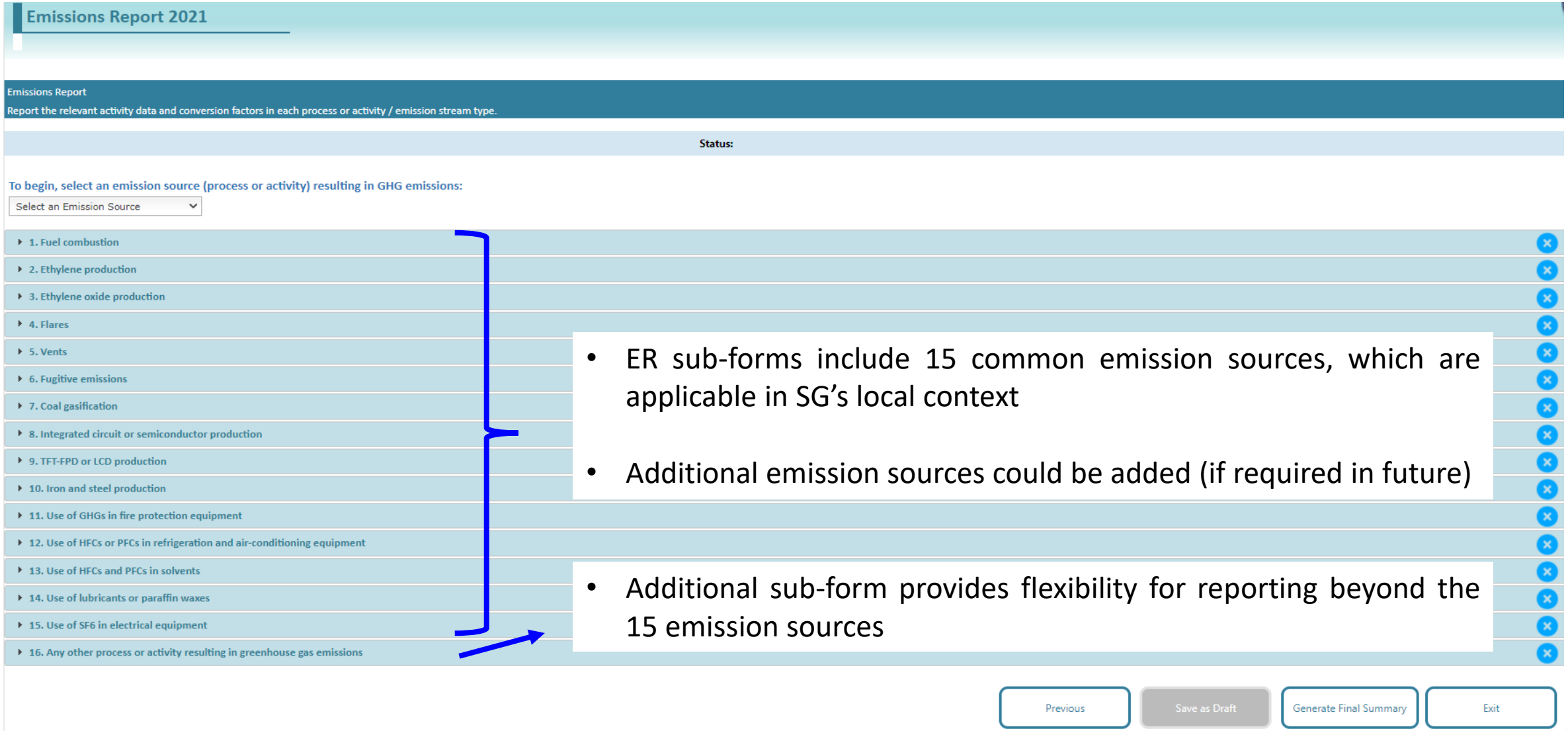
Emissions Report (ER) – Design Principles

2. NEA has designed the Emissions Report ("ER") template to incorporate the following M&R elements:
   - 16 types of emission sources with various emission stream types (covering Fuel Combustion & IPPU)
   - Reporting at emission stream level and emissions quantification methods (i.e. Calculation Approach, Material Balance and Direct Measurement)
   - Default conversion factors[3] and fixed Global Warming Potentials (GWPs)

3. To reduce the administrative burden of annual reporting, NEA has also included time-saving features:
   - Minimal data entry required annually (activity data & site-specific conversion factor)
   - Automatic computation of emissions using in-built formulae, in CO_2e at emission stream, emission source and facility level
   - Auto-population of fuel data from ER to energy use report under the Energy Conservation Act
   - Pre-population of emission sources/streams into the ER for next reporting period

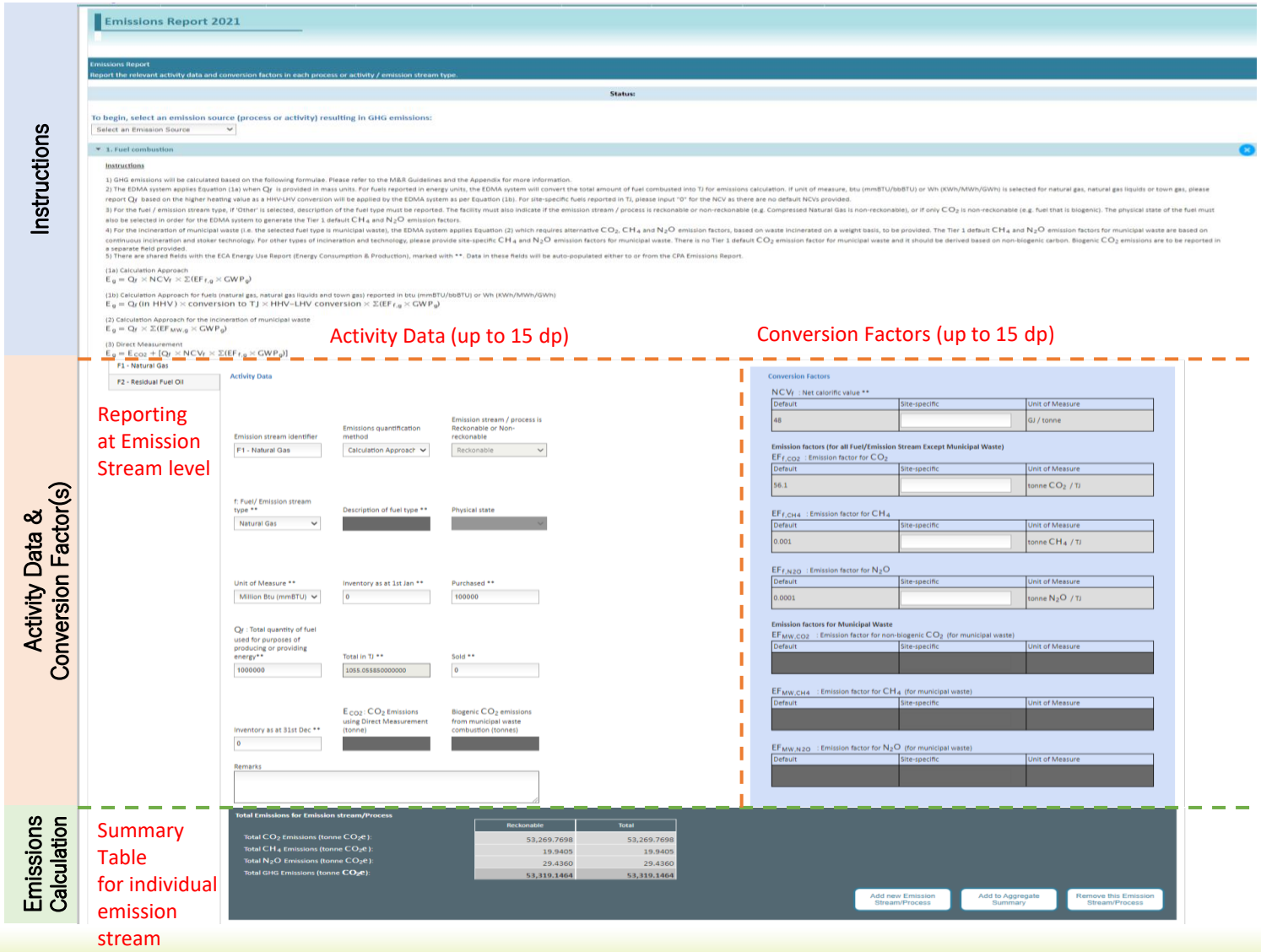
[3] Default factors are provided based on 2006 IPCC Guidelines, which can be overridden using site-specific factors (if available).

Sample screenshot of ER template (16 emission sources or sub-forms)



- ER sub-forms include 15 common emission sources, which are applicable in SG's local context
- Additional emission sources could be added (if required in future)
- Additional sub-form provides flexibility for reporting beyond the 15 emission sources

Sample screenshot of ER template (Individual emission sub-form)



- Each sub-form has 3 sections:
  - Instructions & formulas (top)
  - Activity data (middle-left) and Conversion factors (middle-right)
  - Emissions calculation (bottom)

- Multiple emission streams can be created within each sub-form (e.g. different fuel types under Fuel Combustion)
- Pre-filled with dropdowns for common stream types (from IPCC) and common UOMs
- Pre-filled with default conversion factors (from IPCC)

- Automatic emission calculations in tCO_2e

Sample screenshot of ER template (Emission Source / Stream & Facility-Level Summary)

- Summary of emissions for each emission source (e.g. for fuel combustion)

Summary of Emissions for Fuel combustion

Emission stream identifier	Fuel/ Emission stream type	Total Reckonable Emissions (tonne CO_2e)				Total Emissions (tonne CO_2e)			
		CO_2 Emissions	CH_4 Emissions	N_2O Emissions	Total GHG Emissions	CO_2 Emissions	CH_4 Emissions	N_2O Emissions	Total GHG Emissions
F1	Natural Gas	5.3269	0.0019	0.0029	5.3319	5.3269	0.0019	0.0029	5.3319
F2	Gas / Diesel Oil	0.0000	0.0000	0.0000	0.0000	318.6300	0.2709	0.7998	319.7007
	Total	5.3269	0.0019	0.0029	5.3319	323.9569	0.2728	0.8027	325.0326

- Final Summary by types of GHG (e.g. CO_2, CH_4, N_2O) and emission streams

Summary of Emissions (Emission Stream / Process or Activity Level)

Total Emissions

Please refer to the below table to view the total reckonable and non-reckonable emissions per emission stream/ process or activity level:

* Click here to toggle the unit of measurement between tonne (t) and kilogramme (kg) t

Emission Source (process or activity)	Emission Stream Identifier	Total GHG Emissions (CO_2e)	CO_2 (CO_2e)	CH_4 (CO_2e)	N_2O (CO_2e)	HFCs (CO_2e)	PFCs (CO_2e)	SF_6 (CO_2e)	NF_3 (CO_2e)
1. Fuel combustion	F1 - Natural Gas	5,331.9146	5,326.9769	1.9940	2.9436				
1. Fuel combustion	F2 - Residual Fuel Oil	3,137.0196	3,126.9600	2.5452	7.5144				
2. Ethylene production	P1 - Naphtha	2,313.0000	2,250.0000	63.0000					
2. Ethylene production	P2 - Ethane	1,366.0000	1,240.0000	126.0000					
3. Ethylene oxide production	P3 - Air thermal	8,795.9000	8,630.0000	165.9000					
4. Flares	P4 - Flare	2,779.8000	2,686.5000	84.0000	9.3000				
5. Vents	P5 - Vents	3,100.0000	1,000.0000	2,100.0000					
6. Fugitive emissions	P6 - Leakages	521.0000	1.0000	210.0000	310.0000				
7. Coal gasification	P7 - Coking Coal	2,000.0000	2,000.0000						
8. Integrated circuit or semiconductor production	P8 - CVD NF3	3,622.5000					526.5000		3,096.0000
9. TFT-FPD or LCD production	P9 - HFC-23	11,700.0000				11,700.0000			
10. Iron and steel production	P10 - EAF	8,000.0000	8,000.0000	0.0000					
11. Use of GHGs in fire protection equipment	P11 - CO2 fire extinguisher	10.0000	10.0000						
12. Use of HFCs or PFCs in refrigeration and air-conditioning equipment	P12 - R-410A	1,725.0000				1,725.0000			
13. Use of HFCs and PFCs in solvents	P13 - PFC-14	6,500.0000					6,500.0000		
14. Use of lubricants or paraffin waxes	P14 - Lubricant	613.0666	613.0666						
15. Use of SF6 in electrical equipment	P15 - SF6	23,900.0000						23,900.0000	
16. Any other process or activity resulting in greenhouse gas emissions	P16 - Any Other Process	1.0000	1.0000						
	Total	85,416.2009	34,885.5036	2,753.4392	329.7580	13,425.0000	7,026.5000	23,900.0000	3,096.0000

Summary of facility's total emissions (reckonable and non-reckonable) **by GHG types and emission streams**

Reckonable Emissions

Please refer to the below table to view the total reckonable emissions per emission stream/ process or activity level:

* Click here to toggle the unit of measurement between tonne (t) and kilogramme (kg) t

Emission Source (process or activity)	Emission Stream Identifier	Total Reckonable GHG Emissions (CO_2e)	CO_2 (CO_2e)	CH_4 (CO_2e)	N_2O (CO_2e)	HFCs (CO_2e)	PFCs (CO_2e)
1. Fuel combustion	F1 - Natural Gas	5,331.9146	5,326.9769	1.9940	2.9436		
1. Fuel combustion	F2 - Residual Fuel Oil	3,137.0196	3,126.9600	2.5452	7.5144		
2. Ethylene production	P1 - Naphtha	2,313.0000	2,250.0000	63.0000			
2. Ethylene production	P2 - Ethane	1,366.0000	1,240.0000	126.0000			
3. Ethylene oxide production	P3 - Air thermal	8,795.9000	8,630.0000	165.9000			
4. Flares	P4 - Flare	2,779.8000	2,686.5000	84.0000	9.3000		
5. Vents	P5 - Vents	3,100.0000	1,000.0000	2,100.0000			
7. Coal gasification	P7 - Coking Coal	2,000.0000	2,000.0000				
8. Integrated circuit or semiconductor production	P8 - CVD NF3	526.5000					526.5000
9. TFT-FPD or LCD production	P9 - HFC-23	11,700.0000				11,700.0000	
10. Iron and steel production	P10 - EAF	8,000.0000	8,000.0000	0.0000			
12. Use of HFCs or PFCs in refrigeration and air-conditioning equipment	P12 - R-410A	1,725.0000				1,725.0000	
13. Use of HFCs and PFCs in solvents	P13 - PFC-14	6,500.0000					6,500.0000
16. Any other process or activity resulting in greenhouse gas emissions	P16 - Any Other Process	1.0000	1.0000				
	Total	57,276.1342	34,261.4369	2,543.4392	19.7580	13,425.0000	7,026.5000

Summary of facility's total reckonable emissions **by GHG types and emission streams** (used to determine carbon tax liability for taxable facilities)

Lessons learnt in administering CPA and operationalising the ER

Energy Conservation Act

- Good foundation for building enhanced MRV requirements and IT modules

Competent team

- Learning by-doing
- Understanding of reporting pain points from past experience

Competent and helpful IT system vendor

- Design reporting modules to reduce reporting burden

Multiple facilities' consultations & briefings

- Incorporate end-users' feedbacks to improve UX/UI
- Facilitated readiness for emissions reporting

Publishing of MRV Guidelines

- Useful reference materials to guide facilities & improve their understanding

Continuous Improvements

- Yearly updates for ER based on facilities' and NEA's experience

References

- For detailed information on Singapore's carbon tax framework, please visit NEA's website:
  - GHG Measurement and Reporting requirements

  - GHG Verification and Accreditation requirements

- Alternatively, you may send in your queries via the contact details available on NEA's website.

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