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Refrigeration Systems Protocol Stakeholder Team Meeting

Ontario & Quebec Adaptation
February 12th, 2018

Agenda

1. Changes to draft protocol & questions for stakeholders
2. Next steps

Work since last Stakeholder meeting

- Incorporated stakeholder comments to protocol text
- Default Baseline Emission Factors
 - Charge size ratios (kg/kW)
 - Blended GWP for baseline refrigerants
 - Narrative of work on Appendix A
- Added references throughout text

Default Baseline Emission Factors

- Refrigeration system categories
 - Stand-alone commercial refrigeration
 - Centralized commercial refrigeration
 - Centralized industrial refrigeration (food processing)
 - Centralized industrial refrigeration (other)
 - Commercial or industrial chillers



Q1. Baseline for Secondary loop systems

- Two types of centralized refrigeration systems (Table 4.3)
 - Direct Expansion
 - Secondary Loop System (Indirect)
- What type of system should we assume would have been the baseline scenario for a secondary loop system?
 - Option 1: Secondary loop system
 - Option 2: Direct Expansion system

Comparison of table 4.3 options

Option 1: Assume that a secondary loop system would have been the baseline scenario.

- Implications

- The difference in the project scenario would be the type and charge of refrigerant used.
- With this option the project would potentially generate less emission reduction credits.

Category		ODSHAR deadline	Annual Emission Factor (kgCO ₂ e/kW/yr)	
			Pre-deadline	Post-deadline
Centralized commercial-Direct expansion	Medium temperature	1/1/2020	801	616
	Low temperature	1/1/2020	1574	1210
Centralized commercial - Indirect (Secondary loop)	Medium temperature	1/1/2020	229	176
	Low temperature	1/1/2020	343	264

Comparison of table 4.3 options

Option 2: Assume that a Direct Expansion System would have been the baseline scenario.

- Implications:
 - New secondary loop systems would generate significantly more GHG emissions than in Option 1.
 - Potentially not conservative, unless DX systems really are BAU

Category		ODSHAR deadline	Annual Emission Factor (kgCO ₂ e/kW/yr)	
			Pre-deadline	Post-deadline
Centralized commercial	Medium temperature	1/1/2020	801	616
	Low temperature	1/1/2020	1574	1210

Development of Default Baseline EF

- The default baseline emission factors were derived using the following equation:

$$EF = (Charge\ ratio) \times (Leak\ rate) \times (Blended\ GWP)$$

- Calculation example: Stand alone systems

Category		Charge Ratio (kg/kW)	Leak Rate	GWP		ODSHAR Deadline	Annual Emission Factor (kgCO ₂ e/kW/yr)	
				Pre-Deadline	Post-Deadline		Pre-Deadline	Post-Deadline
Stand alone	Medium temperature	0.23	10%	2861	1400	2020	66	32
	Low Temperature	1.5	10%	2861	1500	2020	429	225

- **Charge ratio**
 - ARB 2009 inventory of refrigeration and A/C emissions
- **Leak rate**
 - Canadian National Inventory Report
- **Blended GWP**
 - *Pre-deadline*: ODSHAR Amendments (2017) BAU assumptions
 - *Post-deadline*: Regulatory limits from ODSHAR Amendments

Q2. Baseline leak rate

- Protocol leak rate (NIR): **10%**

Category		Charge Ratio (kg/kW)	Leak Rate	GWP		ODSHAR Deadline	Annual Emission Factor (kgCO ₂ e/kW/yr)	
				Pre-Deadline	Post-Deadline		Pre-Deadline	Post-Deadline
Stand alone systems	Medium temperature	0.23	10%	2861	1400	2020	66	32
	Low Temperature	1.5	10%	2861	1500	2020	429	225

- US EPA Green Chill program leak rates: 20-25%
- IPCC ranges (Canada would be at the low end):
 - Stand-alone commercial refrigeration equipment: 1-15%
 - Medium and large commercial refrigeration equipment: 10-35%
 - Industrial refrigeration, including food processing and cold storage: 7-25%
 - Chillers: 2-15%
- Which should be the most appropriate leak rate considering conservativeness and appropriateness to Canada?

Blended Global Warming Potential

- Blended GWP values for project start dates prior to ODSHAR deadlines were derived using the following equation:

$$\text{Blended GWP} = \sum_i [(\text{Refrigerant market share})_i \times \text{GWP}_i]$$

Calculation example: Stand alone systems

Refrigeration system category	BAU refrigerant	Market share	100-Year GWP	Blended GWP
Stand-alone refrigeration	R-404A	25%	3922	2861
	R-507A	25%	3985	
	R-407A	25%	2107	
	HFC-134a	25%	1430	

Q3. Market shares of baseline (BAU) refrigerants

Refrigeration system category	BAU refrigerant	Market share	100-Year GWP	Blended GWP
Stand-alone refrigeration	R-404A	25%	3922	2861
	R-507A	25%	3985	
	R-407A	25%	2107	
	HFC-134a	25%	1430	
Centralized refrigeration	R-404A	25%	3922	2861
	R-507A	25%	3985	
	R-407A	25%	2107	
	HFC-134a	25%	1430	
Chillers	R-404A	20%	3922	2428
	R-507A	20%	3985	
	R-407C	20%	1774	
	HFC-134a	20%	1430	
	HFC-245fa	20%	1030	

BAU refrigerant market share

- No information available from ECACC about BAU market share assumptions
- Using NIR market share for installed commercial refrigerant results in very high blended GWP
- No other data source identified on BAU market share
- **Options:**
 1. **Apply the ODSHAR regulatory limits across all projects**
 2. Use simple average of BAU refrigerants
 3. Choose lowest GWP value
 4. Identify a suitable data source for market share



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Item 4

NEXT STEPS

Next steps

- Stakeholders to review draft protocol and submit comments to the Reserve no later than:
 - **Friday, February 23rd** (end of day)
 - bzavariz@climateactionreserve.org
- Final draft protocol targeted to be submitted to Ministries March 9

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