Proposed Approach for Methane Regulatory Design

Sept. 14, 2018

BC Oil & Gas COMMISSION

20TH ANNIVERSARY

Housekeeping

- Welcome
- Fire alarm / muster point
- Washrooms
- Plan for the day
- Ground rules

Agenda

- Introductions
- General regulatory approaches
- Timeline
- Emission reductions
- Proposed B.C. regulatory actions by source
- Model

General Regulatory Approaches

Federal Regulations

- Canada committed to 40-45% below 2012 levels by 2025
- Limits to methane emissions are being proposed in **five** key areas:
    1. **Fugitive equipment leaks**
    2. **Venting**
    3. **Pneumatic devices**
    4. **Compressors**
    5. **Well completions (exemptions)**
- Citizen reporting
- Would require corrective actions (equipment repairs, gas combustion and gas conservation)
- Would utilize existing provincial reporting structures when possible, such as production accounting systems
- Final federal regulations published in April 2018

Options to Meet Federal Requirements

- **Equivalency agreement:**
  - Federal regulations do not apply and B.C. implements a legally enforceable regime that is equivalent to the federal regulations and which also must allow for citizens to request the investigation of alleged offences.
- **Administrative agreement:**
  - Federal regulations apply but are administered and enforced by the Province (e.g. BC Oil and Gas Commission) through an administrative agreement.
- **ECCC regulates:**
  - Federal regulations apply in B.C. and are administered and enforced by the federal government.

Provincial Approaches

- Alberta Energy Regulator (AER) has published draft requirements in D60 (May 2018)
  - Currently considering comments received on draft
- Government of B.C. will seek equivalency agreement with the federal government
  - Commission Board regulations under development
  - Equivalency will be determined using a technical assessment (e.g. emissions reduction modelling) and an assessment of the legislative framework (citizen reporting)

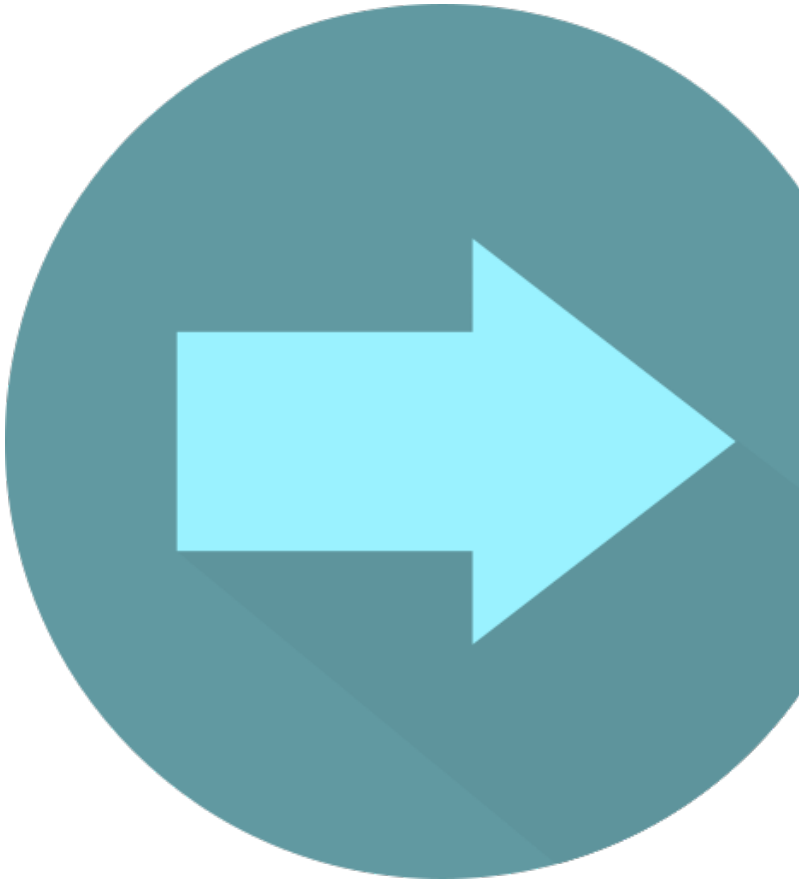
Guiding Principles for B.C. Regulation

- **Specific**, **simple** and **transparent**– Regulate at the source level, all reporting is public
- **Measureable** and **credible** – Emission reductions must be quantified and verifiable
- **Package** achieves **equivalent emissions reductions** as federal regulations would achieve as well as provincial targets
- Meets target: **45 per cent reduction by 2025**
- Works within **existing regulatory framework**
- Considers regulatory actions in **other jurisdictions**
- References **standards** such as CSA, where appropriate

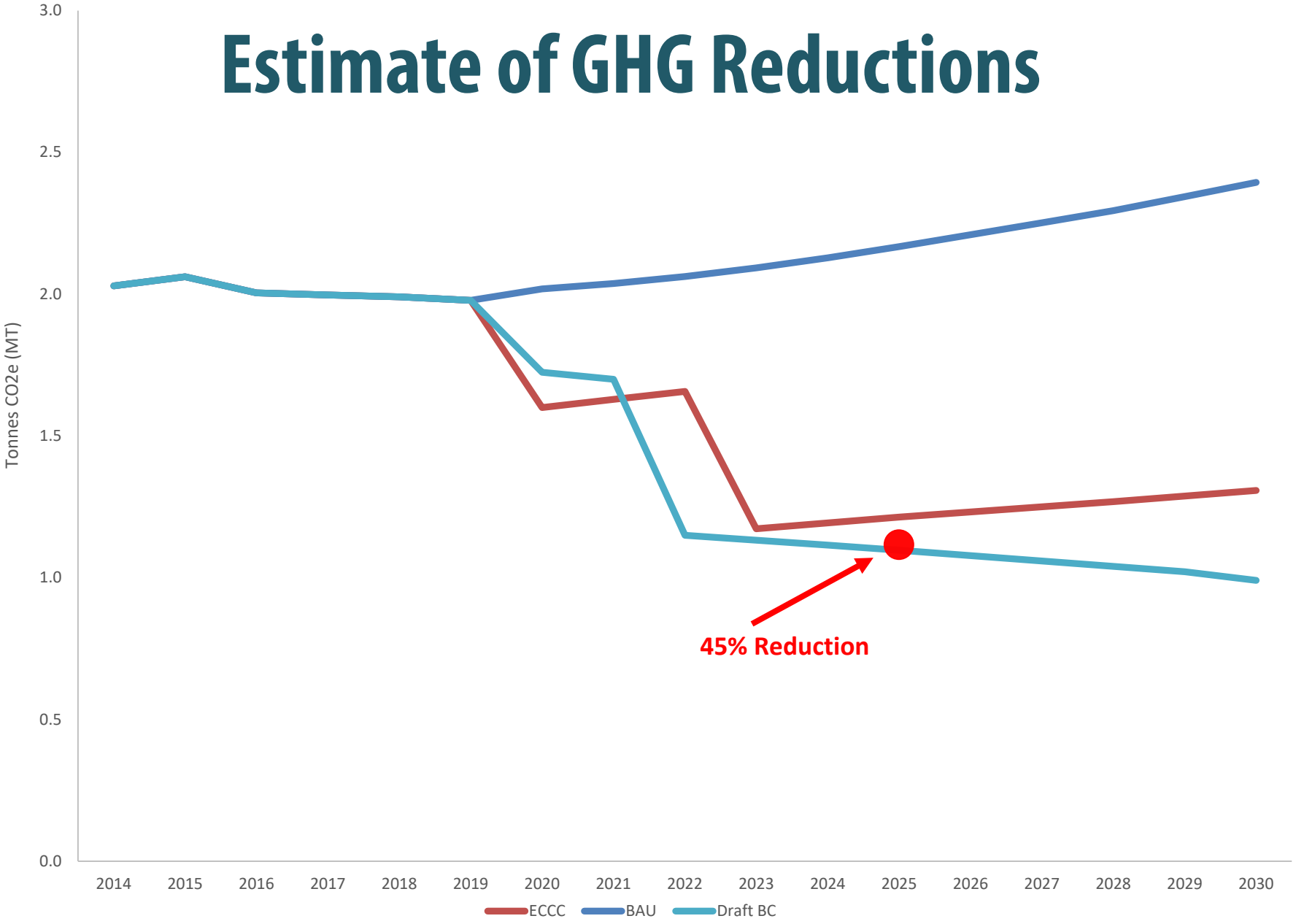
B.C. Regulatory Timelines

- Sept. 14, 2018 – Consultation Kickoff
- Oct. 15, 2018 – Written Feedback to Commission
- Nov. 2018 – draft regulation will be presented to the Commission Board
- Target to have final regulation approved by June 2019
- Equivalency discussions with federal government have recently been initiated

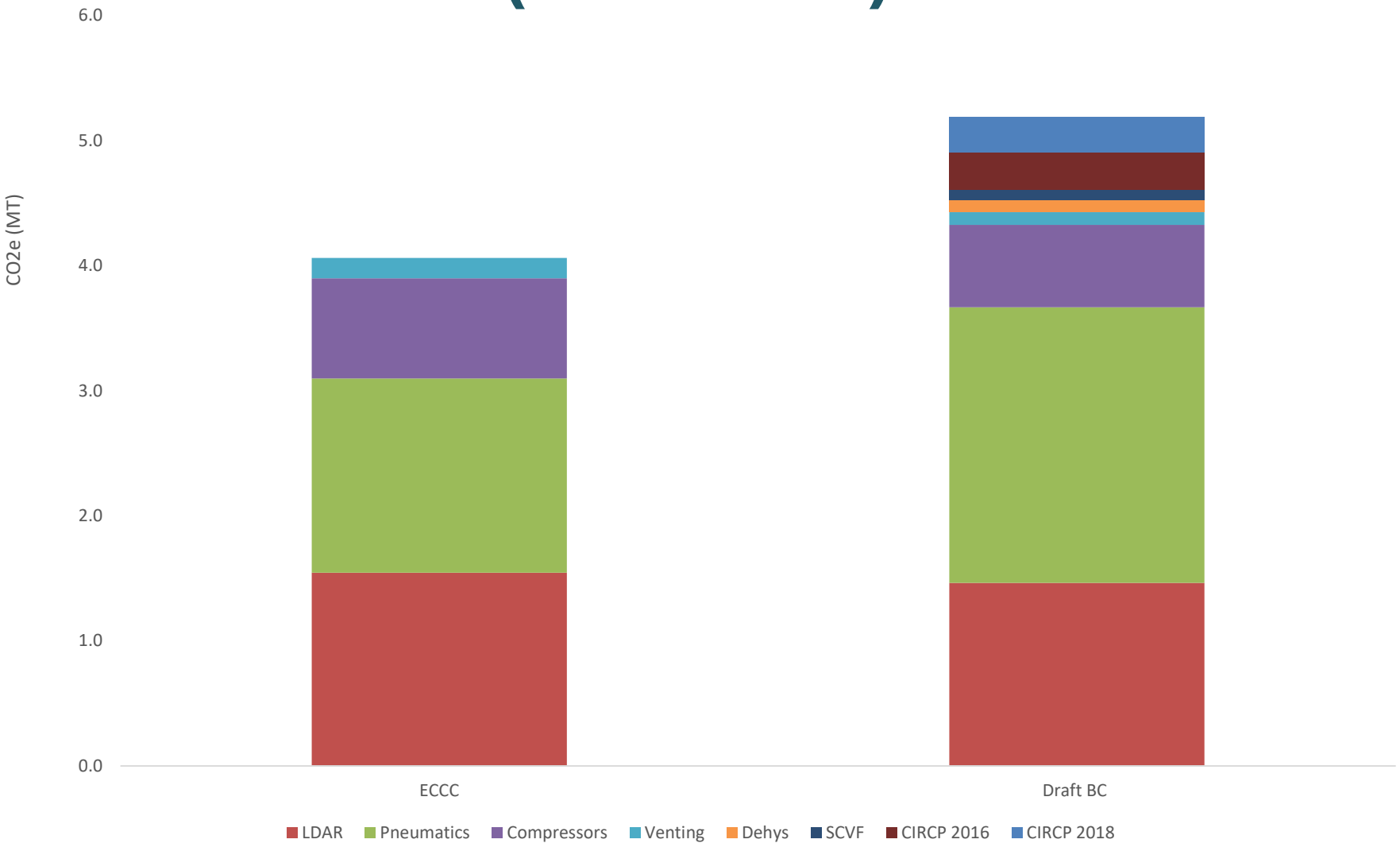
Emission Reductions



Estimate of GHG Reductions



Estimate of Cumulative Reductions (2020-2025)



Total Estimated Reductions/Costs

		Reductions 5 yr MT CO_2e (%)	Reductions 10 year MT CO_2e (%)	Cost (Million) (10 year)	$/tonne (10 year)
ECCC	**Total**	**4.1 (100)**	**9.2 (100)**	**$487**	**$53**
	LDAR	1.5 (37)	3.0 (33)	$352	$118
	Pneumatics	1.6 (39)	4.4 (48)	$52	$12
	Compressors	0.8 (20)	1.5 (16)	$78	$51
	Venting	0.2 (5)	0.3 (3)	$7	$24
	Dehys	-	-	-	-
	SCVF	-	-	-	-
Draft B.C.	**Total**	**4.6 (100)**	**10.9 (100)**	**$332**	**$30**
	LDAR	1.5 (32)	2.8 (26)	$118	$42
	Pneumatics	2.2 (47)	6.0 (55)	$138	$23
	Compressors	0.7 (15)	1.5 (14)	$68	$46
	Venting	0.1 (2)	0.2 (2)	$4	$24
	Dehys	0.1 (2)	0.2 (2)	$1	$5
	SCVF	0.1 (2)	0.2 (2)	$3	$18

Draft B.C. Regulatory Actions By Source

Venting

ECCC	Jan 2023	Limit to 1,250 m^3 of hydrocarbon gas per month (not source specific but lists exempted sources)
Draft B.C.	Jan 2022	**New Facilities:** Limit to 3,000 m^3 of vented per month from all tankage combined at new facilities
	Jan 2023	**Existing Facilities:** Limit to 9,000 m^3 vented per month from all tankage combined at existing facilities

Rationale

- Venting from tankage very small (<1%)
- Site venting limits are difficult to administer and enforce

Pneumatic Devices

ECCC	Jan 2023	Retrofit to low-bleed
Draft B.C.	Jan 2021	**New Facilities:** Controllers at new facilities must not vent natural gas
	Jan 2022	**Existing Facilities:** Retrofit to low-bleed Compressor stations at 3 MW or greater of compression and gas processing plants (as defined in DPR) must not vent natural gas

Rationale

- Recognizes venting from pneumatic devices is a large source of methane emissions in B.C.
- Limits on venting at new facilities are more cost effective than at existing facilities
- Limits on venting at larger facilities are more cost effective than at smaller facilities and larger facilities are more likely to have access to electricity and instrument air

Pneumatic Pumps

ECCC	Jan 2023	Control for methanol pumps (>20 L pumped per day on average over a month)
Draft B.C.	Jan 2021	**New Facilities:** Pneumatic pumps at new facilities must not vent (operate > 750 hrs per year) **Existing Facilities:** No change

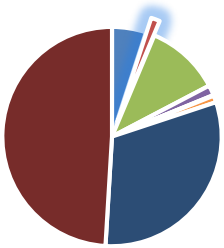
Rationale

- Limits on venting at new facilities are more cost effective than at existing facilities
- Pneumatic pump operation is usually seasonal and there is high uncertainty in the emissions values
- Emissions from existing pumps will be addressed through other government programs

More on Pneumatics

- LB: Designed to and operated so that venting of natural gas is $\leq 0.17\ m^3/hr$ or less when averaged over a one day (24 hour) period
- Exceptions for safety – must then be minimized and technical assessment needed on file
- Intermittent pneumatic devices must not vent natural gas when idle
- Quantification based on best available data–measurement studies in line with GHG reporting

Centrifugal Compressors



ECCC	Jan 2023	**New Installations:** Limit to < 8.4 m^3/hr
	Jan 2023	**Existing Installations:** Limit to < 20.4 m^3/hr Limit to < 40.8 m^3/hr (> 5 MW)
Draft B.C.	Jan 2021	**New Installations:** Limit to < 3.4 m^3/hr
	Jan 2022	**Existing Installations:** Limit to < 10.2 m^3/hr

Rationale

- Limits on venting for new facilities are more cost effective than at existing facilities
- Similar to draft D60

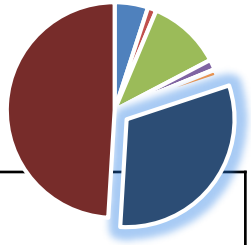
Reciprocating Compressors

ECCC	Jan 2023	**New Installations:** Limit to < 0.06 m^3/hr/throw
	Jan 2023	**Existing Installations:** Limit to < 1.38 m^3/hr/throw
Draft B.C.	Jan 2021	**New Installations:** Control units with more than 4 throws
	Jan 2022	**All Installations:** Fleet average < 0.83 m^3/hr/throw No compressor venting over 5 m^3/hr/throw

Rationale

- Limits on venting for new facilities are more cost effective than at existing facilities
- Similar to draft D60

LDAR



ECCC	2020	**OGI/Method 21** 3 x per year at batteries, compressor stations, gas plants 3 x per year at non single well sites **Alternative approach** Possible
Draft B.C.	2020	**OGI/Method 21** 3 x per year for gas plants, compressor stations and multi-well batteries 1 x per year for single-well batteries, custom treating facilities and injection/disposal facilities (other facilities except for wellsite facilities) 1 x per year for tight/shale wells **Alternative approach** Allowed for in proposed regulation Other facilities: screening 1 x per year

Rationale

- Recognizes fugitive leaks are a large source of methane emissions
- Fixed and personal monitors are designed to detect high volume leaks only
- Risk-based approach
- Coverage provided for all types of facilities
- Good housekeeping – focus should not only be on very large leaks

LDAR at Wellsites

Shale/Tight Wells - Comprehensive Survey

- Generally have good access
- Number of wells per pad makes surveys more economically feasible
- Number of wells per pad increasing over time therefore leak opportunities per pad location are increasing

Conventional Wells – Screening Survey

- Access issues more likely than at multi-well pads
- Can be large distances apart making economics challenging
- The number of conventional wells is declining

LDAR at Sour Facilities

- Sour service design and permitting does not always mean sour gas is within the systems (sour compressor station can be compressing sweet gas)
- Sour facilities often have sweet systems within them that can leak (units after the sweetening block, fuel gas)
- No B.C.-based public data available that demonstrates that sour facilities leak less than sweet facilities
- Potential off lease odour issues are a public concern

Expectations on Surveys

- Include all equipment that may be a source of fugitive emissions, including pneumatic devices
- Minimum 60 days apart for comprehensive surveys that must be done 3 x per year
- Minimum 9 months apart for comprehensive surveys that must be done 1 x per year
- New construction survey within 30 days
- Post turnaround survey within 14 days
- Conducted by trained and experienced surveyors

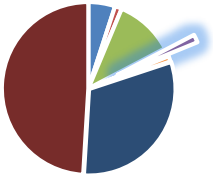
Expectations on Repairs

- Immediate if safety hazard
- Immediate if off-lease odour
- Without delay if result of failed pilot or flare stack ignitor
- At next planned shutdown if a major shutdown is needed to complete the repair
- All others, within 30 days
- Verification of repair

Questions for Discussion - LDAR

- Adoption of CSA Z620 or part of it
- Alternative survey approaches / technologies
  - Apply to regulator for approval of alternative approach
  - Conduct alternative programs and keep records to demonstrate equivalent reductions
  - Alternative technology testing protocol

Glycol Dehydrators

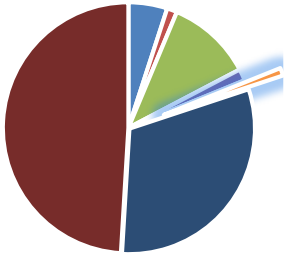


Draft B.C.	2022	**New Installations:** Methane emissions not to exceed 68 kg/day/dehydrator
	2023	**Existing Installations:** Methane emissions not to exceed 136 kg/day/dehydrator

Rationale

- Co-benefit of benzene reductions
- Similar to draft D60

SCVF



Draft B.C.	2020	Limit to 100 m^3/day

Rationale

- Safety and environmental hazard prevention
- Number of wells affected is expected to be small (approximately 15)
- SCVF repair is a cost-effective emissions reduction option for wells with the highest SCVF flow rates

Other Considerations

We would like to know your thoughts on:

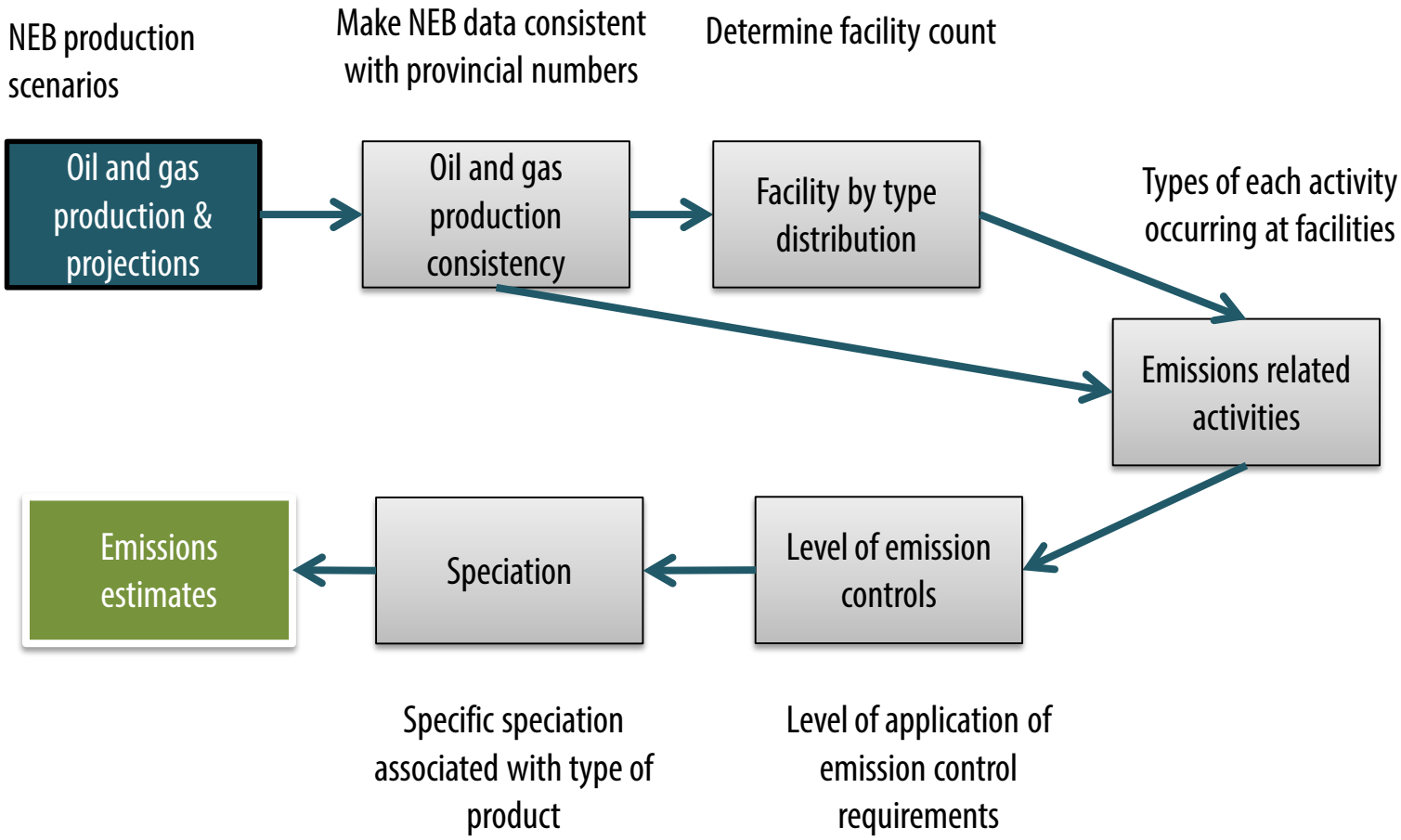
- Reporting/record keeping
- Verification
- Check-in period
- Other

The Model

Modelling Approach

- Provincial modelling approach aims to be consistent with ECCC Emissions Analysis Model (EAM)
- The EAM methodology was used as basis for determining outcomes of federal regulations
- Methodology includes emission sources of interest, based on multiple data sources
- Gives the ability to develop emissions estimates of GHGs for historic and future years

Path to Translating Production Data to Emissions Estimates



B.C. Modelling

- B.C. has conducted modelling to determine:
  - The types of policy actions that may achieve equivalent emission reductions to the federal and provincial policies
  - The average cost to industry of implementing these policy actions
  - The potential impact of the policy actions on production

B.C. Modelling Parameters

Three main parameters (facility level):

- Activity Factors: translate production forecast to facility level data to develop estimates.
  - These are intermediate products such as facility counts and equipment counts
- Emission Factors: translate activity data to release rate/emissions (volume of gas)
- Control Factor: provide the level of mitigation technology implementation and potential for application

B.C. Emissions Modelling

$Emissions_{Facility}$ = (# emitting high bleed devices x EF_{HB}) + (# emitting low bleed devices x EF_{LB}) + (# of emitting pumps x EF_{pump})

Where:

# of Emitting – total equipment x % of non- controlled pieces of equipment

HB – total controllers x % of high bleed equipment per facility type

LB – total controllers x % of low bleed equipment per facility type

EF – emission factor per equipment type

B.C. Modelling Inputs

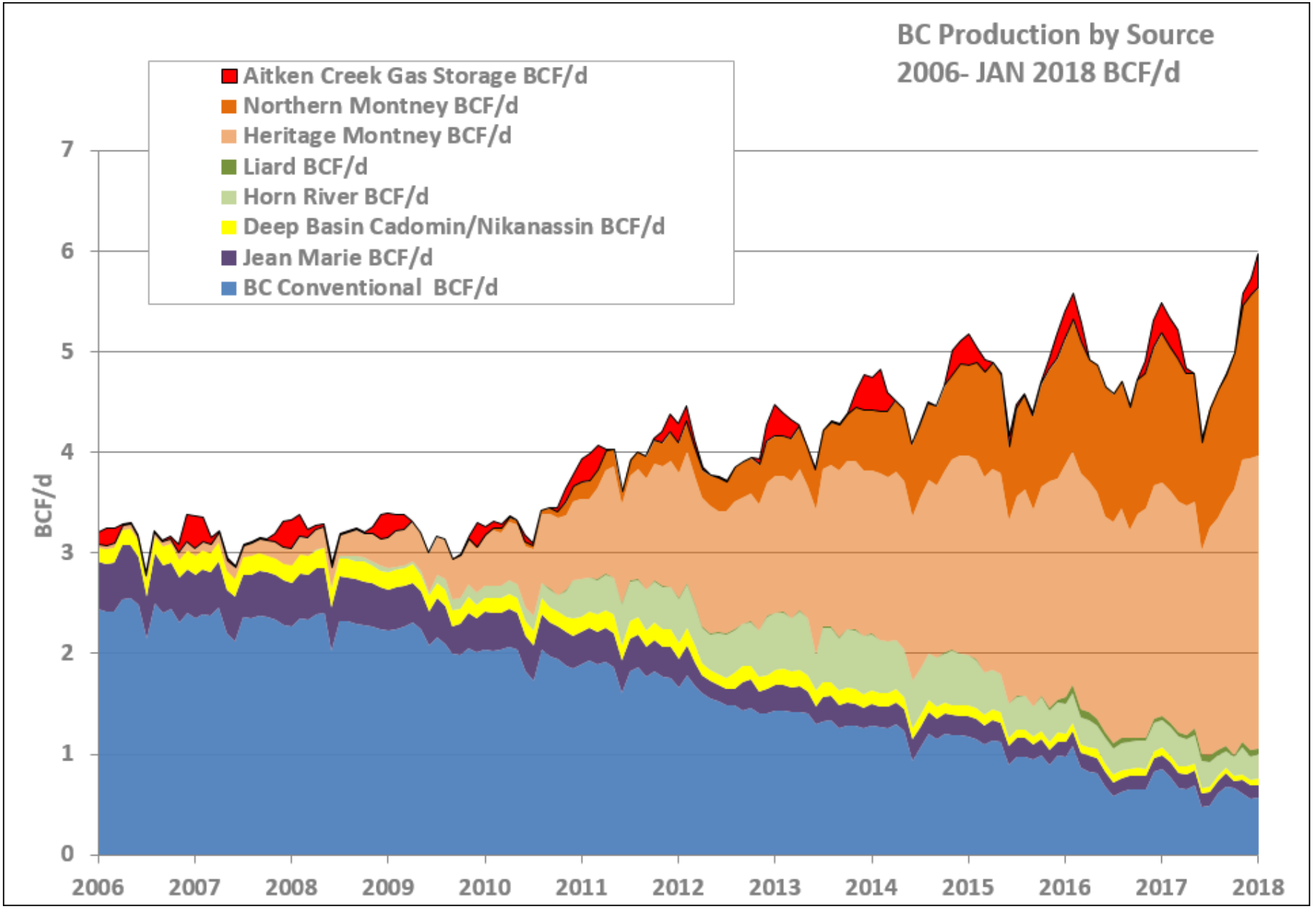
Input	Pneumatics	Compressors	LDAR	Venting	Dehys	SCVF
Control Factor	N/A	ECCC	ECCC	ECCC	AER	N/A
Activity Factor	ECCC and AER	ECCC	ECCC	ECCC (based on AB data)	OGC	OGC
Emission Factor	ECCC	AER	ECCC	ECCC	AER	OGC
Count	ECCC	ECCC and GHGRR	Modified NEB Forecast	ECCC	GHGRR & OGC	OGC

Production Model

- B.C. looked at the potential effect of the methane reduction policy on production levels
- Production decreases could result from:
  - Wells being shut in when policy costs > well revenue
  - Potential wells determined to be uneconomic due to policy
- Loss of production anticipated to less than 0.05%
- Number of potential well shut ins expected to be less than 500 (already considered to be marginal wells)
- No new wells deemed uneconomic

Facility Counts

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Change (2030-2014)
	Historical Data				**Forecast**													
Single Well Production	8,778	9,037	8,572	8,671	8,314	8,042	7,851	7,709	7,631	7,599	7,607	7,658	7,743	7,858	7,982	8,152	8,337	-441
Conventional	6,709	6,539	5,876	5,573	4,940	4,394	3,921	3,493	3,124	2,793	2,495	2,235	2,009	1,807	1,614	1,459	1,317	-5,392
Tight	1,811	2,451	2,657	3,055	3,336	3,612	3,898	4,186	4,479	4,780	5,087	5,399	5,711	6,028	6,345	6,671	6,999	5,188
Shale	258	47	39	43	39	36	33	30	28	27	25	24	23	23	22	22	22	-236
Single Well Battery	50	47	29	41	39	38	37	36	36	36	36	36	37	37	38	39	39	-11
Conventional	38	34	20	26	23	21	19	17	15	13	12	11	9	9	8	7	6	-32
Tight	10	13	9	14	16	17	18	20	21	23	24	26	27	29	30	32	33	23
Shale	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
Multi Well Group Battery	105	104	101	96	92	89	87	85	84	84	84	85	86	87	88	90	92	-13
Conventional	80	75	69	62	55	49	43	39	35	31	28	25	22	20	18	16	15	-65
Tight	22	28	31	34	37	40	43	46	50	53	56	60	63	67	70	74	77	55
Shale	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3
Oil well	1,136	1,162	1,023	1,015	994	983	997	1,039	1,096	1,174	1,256	1,333	1,397	1,426	1,438	1,460	1,471	335
Oil SWB	75	70	55	60	59	58	59	61	65	69	74	79	83	84	85	86	87	12
Oil MWB	66	64	57	52	51	50	51	53	56	60	64	68	72	73	74	75	75	9
Oil Sat B	166	165	156	151	148	146	148	155	163	175	187	198	208	212	214	217	219	53
Natural Gas Processing Plant	57	62	64	66	66	66	66	66	66	66	66	66	66	66	66	66	66	9
Compressor Station	488	475	400	373	381	389	398	409	420	431	443	456	469	482	495	510	526	38


BC Production by Source
2006- JAN 2018 BCF/d
Aitken Creek Gas Storage BCF/d
Northern Montney BCF/d
Heritage Montney BCF/d
Liard BCF/d
Horn River BCF/d
Deep Basin Cadomin/Nikanassin BCF/d
Jean Marie BCF/d
BC Conventional BCF/d
BCF/d
0
1
2
3
4
5
6
7
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018