# LNG/Upstream Gas Electrification and GHG Reduction – Executive Summary


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The new Provincial government has stated that their proposed approach to LNG development would consider the following:

*"To prevent carbon leakage, the government is to create a new incentive program for these large industrial emitters. A performance benchmark will be established based on the lowest emitting facility in that sector operating anywhere in the world. An industrial incentive worth up to 100 percent of the carbon tax they pay beyond $30 per tonne will be paid out, depending on how well their greenhouse gas intensity compares to the benchmark."*

*"A second approach under the clean growth incentive program will encourage such emitters to apply for investment support to transition to clean technology alternatives. The budget for this, along with a new industrial emissions reporting and auditing framework, will be announced in 2019."*

Under the BC Governments Natural Gas Development Framework the goals expected from government for LNG development are:

- *Provide fair return for access to BC resources.*
- *Include express guarantees of jobs and training opportunities in BC*
- *Fit BC's commitment to reconciliation with Indigenous Peoples and make partners of BC First Nations*
- *Protect our air, land, water, including support for climate solutions and a low-carbon industrial strategy*

Under the Paris Accord (which has been ratified by vast majority of global nations including Canada) and the Pan Canadian Framework on Climate Change (PCFCC), nations will be responsible for accurate reporting of their emissions and this will filter down to all emitters in the economy including large emitters. There will be no free rides and any break afforded to large emitters results in a cost to taxpayer or business here in BC or elsewhere in Canada. Every effort should be made to mitigate this risk to the taxpayers and other businesses/sectors. And emitters should be responsible for all their emissions which under the previous governments LNG strategy was not the case.

Further, to achieve the Paris goal of limiting global temperatures to 2$^{o}$C will require profound changes to global energy supplies in the near to future term. The level of change has been outlined by Shell as follows:

> *"Shell recognizes that a simple extension of current efforts, whether efficiency mandates, modest carbon taxes, or renewable energy supports, is insufficient for the scale of change required. The relevant transformations in the energy and natural systems require concurrent climate policy action and the deployment of disruptive new technologies at mass scale within government policy environments that strongly incentivise investment and innovation. No single factor will suffice to*

*achieve the transition. Instead, Shell relies on a complex combination of mutually reinforcing drivers being rapidly accelerated by society, markets, and governments."*

*Governments around the world implement legislative frameworks to drive efficiency and rapidly reduce CO2 emissions, both through forcing out older energy technologies and through promoting competition to deploy new technologies as they reach cost effectiveness. For example, at the national and sub-national level, governments speed up the energy transition by adapting power markets to new renewable technologies and putting a meaningful price or constraint on carbon emissions from conventional thermal generation. Legislation in many jurisdictions forces grids towards 100% renewable energy by the 2040s.*

*But the most significant emissions-targeted action which could be taken by governments around the world is the adoption of effective implicit or explicit carbon- pricing mechanisms. Since Paris, government-led carbon-pricing approaches have been gaining traction. At the 2017 OnePlanet Summit, several countries and states within the Americas committed to expand their use of these mechanisms. During the same year, China announced the launch of its nationwide emissions trading system, starting with the power sector. And by the beginning of 2018, California, Quebec, and Ontario were operating under linked emissions trading systems.*

While not fully in line with what is required under the Paris Agreement, Shell's general statement is that significant change is required. An incremental approach to GHG reduction is not consistent with Paris, and that where the opportunity exists, significant electrification pathways should be followed for any new carbon investments which are being considered. BC Hydro (2012) identified that to meet climate change targets electrification of up to 68,000 GWh may be required by 2050.

In terms of LNG and the associated upstream gas development there is significant GHG risk which the Clean Energy Association believes can be mitigated in a manner which would greatly assist the province and possibly Canada in developing the LNG and upstream gas sector while meeting it's climate change goals under the proposed new Energy Roadmap and the PCFCC. The development would follow a extensive electrification approach consistent with Shell's statements, the PCFCC, and hopefully part of the new BC Energy Roadmap. The current standard for the lowest emitter in the world are, or will be, Freeport LNG, Woodfibre, and Tilbury. All these plants will have an intensity of approximately 0.06 to 0.08 because they use E-Drive technology to liquefy the gas and for utility power.

Based on a plant LNG size of 13MPTA (1.73 Bcfd) which is similar in size to Shell's LNG Canada Phase 1 with utility power from BC Grid and gas compression drives, the GHG quantification and reduction is provided in **Table 1**:

**Table 1: Phase 1 of Large LNG Plant - 13MPTA (1.734 Bcfd)**

| Segment | Conventional Approach | Significant Electrification | %Reduction | Power Requirements (MW) | Power Requirements (GWhr) |
|---|---|---|---|---|---|
| LNG Facility | 2,925,000 (3) | 975,000 | 67% | 750 | 6,390 |
| Transmission (2) | 350,000 | 15,000 | 99% | 100 | 852 |

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|---|---|---|---|---|---|
| Upstream (1) | 3,865,000 | 1,141,000 | 70% | 310 | 2,180 |
| **Total** | **7,140,000** | **2,131,000** | **70%** | **1160** | **9,422** |

(1) Assumes conventional shallow cut processing
(2) Stage 1 Coastal Gaslink
(3) Assumes gas drives for compression and BC Grid for utility power. Intensity is 0.225 which compares to 0.15 Shell has stated for their LNG Canada project. It is not clear how this is achieved based on GHG quantification. An intensity 0.15 is achievable based on several pathways, but it is not clear which pathway LNG Canada is taking.



Based on a LNG plant with 26 MPTA (3.47 Bcfd) capacity the GHG's with gas drive compression and utility power will have approximately 6,760,000 tonnes/yr of GHG emissions. The pipeline to transport the gas will have approximately 1,800,000 tonnes/yr of which virtually all emissions are related to gas compression drives for "pumping" the gas. The associated upstream gas collection and processing have an estimated 9,945,000 tonnes/yr of GHG's. **Table 2** outlines the estimated GHG reductions should electrification be significantly pursued in line with BC Climate Policy primarily through a conversion of gas compression drives to electric motor with BC Grid supply.

### Table 2: Large LNG Plant - 26MPTA (3.468 Bcfd)

| Segment | Conventional Approach | Significant Electrification | % reduction | Power Requirements (MW) | Power Requirements (GWhr) |
|---|---|---|---|---|---|
| LNG Facility | 6,760,000 | 1,950,000 | 71% | 1,480 | 12,610 |
| Transmission (2) | 1,800,000 | 30,000 | 98% | 360 | 3,155 |
| Upstream (1) | 9,945,000 | 4,498,000 | 55% | 620 | 4,370 |
| **Total** | **18,505,000** | **6,478,000** | **65%** | **2,460** | **20,135** |

(1) Assumes conventional shallow cut processing
(2) Stage 2 Coastal Gaslink plus 4 compressor Stations 3 compressors each (12 total)

Based on an aggregate LNG industry of 60 MPTA (7.23 Bcf/d), which is the equivalent of two large plants, one medium plant, and two small plants the GHG quantification and reduction is provided in **Table 3** estimated.

### Table 3: LNG Industry Capacity - 60MPTA (8.000 Bcfd)

| Segment | Conventional Approach | Significant Electrification | % reduction | Power Requirements (MW) | Power Requirements (GWhr) |
|---|---|---|---|---|---|
| LNG Facilities | 15,600,000 | 4,500,000 | 71% | 3,420 | 29,140 |
| Transmission (2) | 5,315,000 | 50,000 | 99% | 1,000 | 8,760 |
| Upstream (1) | 24,133,000 | 11,547,000 | 52% | 1,420 | 9,980 |
| **Total** | **45,048,000** | **16,097,000** | **64%** | **5,840** | **47,880** |

(1) Assumes conventional shallow cut processing
(2) Assumes Stage 3 Coastal Gaslink + Stage 2 Prince Rupert Gas Transmission Project

Based on potential GHG reductions which could be achieved with significant electrification there are costs and benefits with this significant electrification approach to LNG and upstream gas. These costs and benefits are generally as follows:

- The avoided cost of carbon: By electrifying an entity would avoid the current and future cost of carbon.
- In terms of an LNG facility, electrifying the compression and utility power would result in the avoidance of burning gas which could be sold as additional LNG export capacity.
- In terms of the transmission line, electrifying the compression stations would allow that burned gas to be sold as LNG.
- In terms of upstream gas collection and processing, the avoided gas for combustion would be avoided gas which would be purchased at the processing facility.
- To counter the previous benefits would be the requirement to purchase electricity from BCH or other mechanisms with associated costs of power procurement and transmission to deliver the capacity and energy.

Based on the above, and taking into consideration the three development scenarios previously noted, the associated costs and benefits range from a positive NPV of $9 billion to $44 billion. Some of the benefits would have to be applied to the LNG plant capital cost as it is more capital intensive to build E-Drive LNG however this can be offset because E-Drive is more operationally efficient than gas drive. Electrification of the gas transmission pipeline would require a parallel transmission line but this transmission line would additionally support LNG plant electrical load and electrifying upstream gas would require transmission expansion such as Peace Region Electricity Supply (PRES), North Montney Power Supply (NMPS) and perhaps some smaller distribution lines. It appears to make economic sense to consider extensive electrification of LNG and upstream gas and would provide BC and Canada a better opportunity to meet climate targets and better position the BC/Alberta LNG/Upstream Gas industry for a carbon constrained future in line with the Paris Accord. The lower carbon footprint would put BC LNG on a better competitive footing against Australia and US East Coast LNG facilities which primarily use gas drives for compression and utility power or connect to grids which have a much higher carbon footprint than BC's clean grid provided the electrification can be achieved based on the market price of LNG in Asia, unless buyers are prepared to accept a slightly higher price for the much lower carbon LNG. LNG and upstream gas with the lowest carbon footprint is expected to have greater long term viability in a Paris Accord world once it is implemented in 2020.