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June 7, 2012

British Columbia Utilities Commission
600, 900 Howe Street, Box 250
Vancouver, B.C V6Z 2N3

Attention: Ms. Alanna Gillis, Acting Commission Secretary

Dear Madam:

RE: BRITISH COLUMBIA HYDRO AND POWER AUTHORITY DAWSON CREEK/CHETWYND AREA TRANSMISSION PROJECT, CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY APPLICATION PROJECT NO.3698640/ORDER G-132-11

INTERVENERS EVIDENCE TO BC HYDRO

Attached please find Interveners Evidence.

Sincerely,

Jamie Shand, President
Current Solutions Inc.

Attach.

Current Solutions Inc.

SUBMITTAL OF EVIDENCE

TO: BRITISH COLUMBIA HYDRO & POWER AUTHORITY

June 7, 2012

PROJECT NO: 3698640

CPCN – Dawson Creek/Chetwynd Area Transmission Project

Current Solutions Inc ("CSI") specializes in power interconnections for large industrial customers across North America, with most of its focus and experience in British Columbia and Alberta, specifically for pipeline and oil and gas customers. Over the past ten years, CSI has worked with BCTC, BC Hydro and several industrial customers on at least 10 major interconnections that impact BC Hydro's high voltage system. CSI has been involved with System Impact Studies throughout BC with several of these studies recently carried out in the Dawson Creek area. With our experience, CSI is knowledgeable about most aspects of System Impact Studies and can be considered a valuable resource in power interconnections to the grid.

Current Solutions Inc. completely supports the approval and immediate installation of the DCAT project (Project No: 3698640). This project should be simplified by approving it as "system reinforcement" required for the operation of the Bear Mountain Wind Farm IPP and the future load connection of a few industrial customers. CSI believes the need for DCAT was initiated by the Bear Mountain Wind Farm and supported by the future load growth from various new industrial customers in the area.

We suggest that Industrial customers do not need to be burdened with the commercial and regulatory conditions suggested by BC Hydro. While CSI believes the original need for the DCAT is driven by the Bear Mountain Wind Farm IPP, the absence of this DCAT system reinforcement is a major problem for the current and future system reliability in the area. The combined operation of the Bear Mountain Wind Farm, and the addition of new industrial load, has significantly reduced the ability for BC Hydro to provide the required standard of service to existing and future customers in the DCAT area.

The immediate installation of the transmission system reinforcement facilities for the DCAT project is essential for BC Hydro to provide a reliable standard of service to serve existing and future customers in Dawson Creek, especially under contingency (n-1) conditions. The proposed DCAT facilities are both beneficial to the grid and the local economy[1]. DCAT provides an overall net good to society and any further schedule delay would be detrimental to society.

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[1] Exhibit C18-1 & Exhibit C18-2 – City of Dawson Creek

1.0 NEED FOR 230 KV DCAT FACILITIES

CSI concurs with BC Hydro that the DCAT facilities are needed to accommodate new industrial load on the system. CSI also submits that the DCAT facilities are clearly required for the continued operation and potential expansion of the existing Bear Mountain Wind Farm IPP ("BMW").

The following items support the direction that BC Hydro's need for the 230 kV DCAT reinforcements were initially driven by the interconnection of the BMW IPP.

- Bear Mountain was the only wind farm IPP not connected initially at 230 kV. All other wind farms on BC Hydro's grid will be interconnected at 230 kV[2]. *Why would all other wind IPPs (some smaller than Bear Mountain) require 230 kV and not Bear Mountain?*
- CSI has reviewed the System Impact Study referenced by BC Hydro in its response to CSI's IR No. 4.1.a[3]. This study was undertaken by BCTC for the Bear Mountain Wind Farm IPP. The study when published was incomplete in many areas. Several sections of this SIS report required follow-up studies to determine the impact of the wind farm operation on the system. The SIS report results are discussed in more detail below.

1.1. System Impact Study (SIS)

A SIS report generally provides Power Flow Modeling, Impact on the Bulk Transmission System and Location of Connection or Tap point as described following.

1.1.1. Power Flow Modeling

Power flow modeling determines the impact on the transmission system from the interconnection of the new load. This analysis is typically carried out through load flow modeling under steady state (N-0) and contingency (N-1) conditions[4].

The evidence in the published SIS[5] states that on page 3:

> *"The Bear Mountain WTG model, which is a user-defined model, is provided by the manufacturer, ENERCON. BCTC has tested this model extensively and the simulation results have revealed that it does not work properly for the subject study. The Manufacturer has revised the WTG model several times unfortunately without success. It has been observed that the root cause of the problem could be the voltage regulator. In the interest of time and for this study purpose, the voltage regulator is disabled as agreed by the IPP."*.

Also,

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[2] Exhibit B-30, CSI_4_002_0a, pdf page 145, BC Hydro response to CSI IR 4.2.a

[3] Exhibit B-30, CSI_4_001_0a, pdf page 143, BC Hydro response to CSI IR 4.1.a

[4] Exhibit B-30, CSI_4_003_0a, pdf page 152, BC Hydro response to CSI IR 4.3.a

[5] Exhibit B-30, CSI_4_001_0a, pdf page 143, BC Hydro response to CSI IR 4.1.a, Bear Mountain Wind Farm IPP Interconnection Impact Study, SPA 2007- 013M

> "Detailed system operation planning study with actual data will be performed in the later stage"
>
> *Source: Bear Mountain Wind Farm IPP Interconnection Impact Study, SPA 2007-013M, by British Columbia Transmission Corporation*

Therefore it is clear that the impact on the transmission system from the interconnection of the new load could not be carried out for this Bear Mountain Wind Farm SIS report because the model was not working properly. Normally BC Hydro (and previously BCTC) published the load flow study results as one of the major outputs or deliverables from the SIS report. With no model to be used for the flow analysis, it was clear that this load flow analysis was not carried out in the published 2007 SIS report. For this reason alone, the report is incomplete and required an "impact re-study" as stated on page 6 of the SIS report[5].

From the evidence submitted, CSI has not seen any studies or re-impact studies where the load flow analysis was carried out and results documented in an SIS report. Furthermore, per BC Hydro's IR response[6] , BC Hydro states that "Dynamic switching studies were not undertaken". CSI submits that wind generation results in voltage regulation issues as described by ABB below:

> *"To a certain degree, voltage control problems caused by deficit of reactive power in the grid can be, and is, remedied by installation of fixed or mechanically switched shunt capacitors. This will not help on voltage fluctuations, however, caused by varying output of wind generators. Regular voltage flicker is part of the picture, as well, caused by such phenomena as turbulent wind impact and so-called tower shadow effects. On top of this comes concerns for voltage collapses due to grid faults, as well as for fast appearing overvoltages associated with sudden islanding of wind power fed parts of distribution grids containing shunt capacitors for reactive power support."*

And

> *"As can be expected, the severity of impact on power quality from wind power operation is dependent on the strength, i.e. the fault level of the grid to which a wind mill or indeed a whole wind farm is connected.*
>
> *Source:* ABB Power Systems AB, AC Power Division, "*Voltage and power quality control in wind power applications by means of dynamic compensation*", by Rolf Grünbaum, www.abb.com

ABB is stating that one way of increasing system fault levels at wind installations is to increase the transmission voltage very close to the point of interconnection and to provide a high voltage transmission path to large generators. To mitigate voltage control problems caused by the normal operation of Bear Mountain Wind Generation, BC Hydro is interconnecting Bear Mountain with the GMS generators via a 230 kV transmission system.

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[6] Exhibit B-30, CSI_4_002_0c, pdf page 148, BC Hydro response to CSI IR 4.2.c

CSI questions why dynamic switching studies were not undertaken to evaluate the voltage flicker impacts of the Bear Mountain Wind farm and similarly, why the load flow studies were not carried out as part of the original SIS Report.

1.1.2. **Impacts on the Bulk Transmission System**

Impacts on the bulk transmission system determine what, if any, equipment is required for the system to accommodate this new load. This recommendation is then taken as the input for the Facility Study which in turn determines the design, cost and schedule to build the new reinforcement facilities identified in the SIS.

On page 4 of the Bear Mountain Wind Farm IPP, SIS report 5, BC Hydro states: *"Impacts to the bulk electric transmission system are not included."* CSI wonders why this was not analyzed, especially when the main purpose of the SIS is to actually determine the impact on the system. On page 6 of that same report, it states *"Impact to the bulk transmission system is not included in the assessment and will be covered in a separate study".* There is no evidence submitted from BC Hydro that a separate or additional study was carried out.

Based on the technical issues discussed, CSI submits that as part of BC Hydro's technical due diligence, a 230 kV solution should have been modeled during the SIS report but due to the previously mentioned issues, it was not. BC Hydro in the SIS report recommended restudying this impact at a later date.

CSI believes that BC Hydro would not ignore the findings of its incomplete, preliminary SIS report. It can therefore only be concluded (probably for the sake of time and efficiency) that the results from the DCAT study or analysis was used in lieu of a transmission system reimpact study for BMW to provide the above technical analysis not performed in the aforementioned early SIS report. Therefore, in the absence of a complete SIS for the BMW Power IPP, and as proper due diligence by BC Hydro, the DCAT analysis for new 230 kV facilities provided the appropriate recommendation in lieu of an updated SIS for BMW. With the technical recommendations presented earlier concerning wind power and its impact on the system, CSI believes BC Hydro did the correct technical recommendation to upgrade the infrastructure serving the Bear Mountain Wind Farm IPP to 230 kV.

1.1.3. **Location of Connection or Tap Point**

This section will recommend the location for the suggested local tap or interconnection point. The actual tap point is not material to DCAT and will not be discussed further. On another note however, due to the constant referral to the need for future other studies referred to in items 3-10 of the SIS report, the entire credibility and applicability of the 2007 SIS Report results is questionable.

1.2. Original System Impact Study Report was Incomplete

The initial SIS work done by BC Hydro as discussed in section 1.1 was preliminary and incomplete. The initial SIS report carried out in 2007 required detailed follow up, which in CSI's respectful submission is what the DCAT study became; the detailed updated version of the Bear Mountain SIS interconnection work.

BC Hydro submitted no other evidence to show that the requirements for an updated SIS for the BMW Wind Farm IPP had been completed. BC Hydro provided evidence that the initial SIS was carried out in the report SPA 2007-013M[5] with no other supplementary evidence of additional SIS follow up. Therefore, it is clear that the true impact of the operation of the 120 MW BMW Farm IPP on the system was never determined.

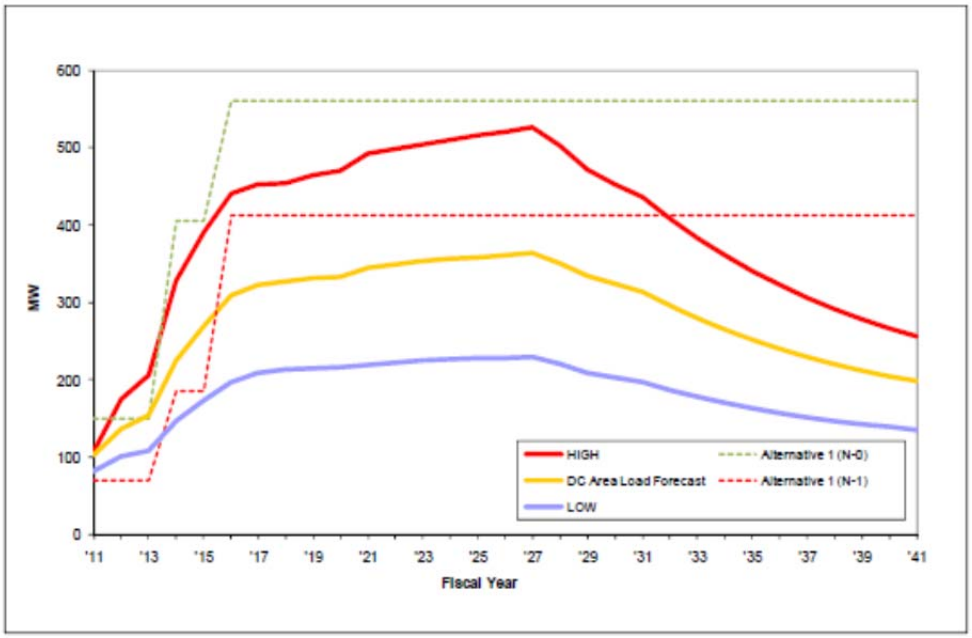
As such, CSI respectfully submits that this study was incomplete and required further detailed modeling and analysis. CSI believes that the DCAT system studies that followed were in fact a follow up to the SIS Report. The DCAT study provided the detailed analysis and impact restudy that was referred to in the initial April 2007 study conducted by BCTC.

2.0 NEED FOR GDAT AND NEW SYSTEM FACILITIES

The updated load forecast submitted by BC Hydro in their March 23rd letter shows significant load growth, increasing beyond 350 MW, starting in F2014[7]. The proposed DCAT Alternative 1 submitted by BC Hydro indicates DCAT Alternative 1 will increase the N-1 capacity in the region to 185 MW[8].

Figure 1: Load forecast of aggregated customer load in the DCAT study area for a 30 year period from fiscal year 2011 to 2041

(Source: Exhibit B-6, IR Response No. 1.6.1 Dated: September 22, 2011)



[7] Exhibit B-22, Supplemental Evidence, Section 3 - Load Forecast for the DCAT region

[8] Exhibit B-6, pdf page 21, BC Hydro responses to BCOAPO IR 1.6.1

Therefore, the evidence submitted shows the proposed DCAT system Alternative 1 capacity increase to 185 MW will not provide capacity to serve the predicted load of future customers with an estimated load of over 350 MW in F2014. Clearly, this shows a need for an expanded, more robust, transmission system than what the DCAT project proposes as shown as the "F2016 stage" or GDAT.

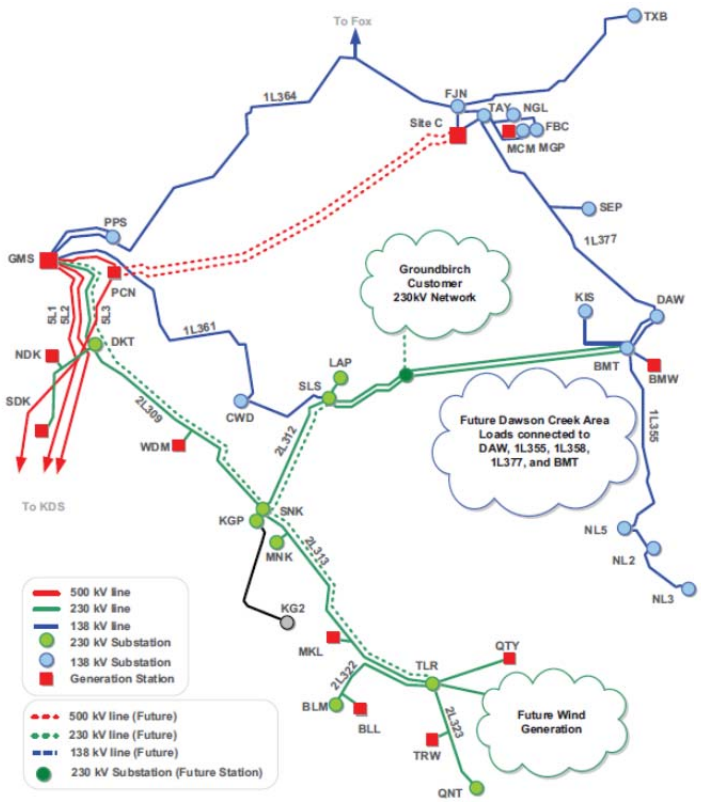
2.1. Duplication of Facilities

The submitted possible future transmission system configuration diagram[9] by BC Hydro shows the current 230 kV transmission system that provides support to accommodate the addition of several new wind farm IPPs also included on the possible future transmission system configuration.

The possible future transmission system configuration shown in Figure 2 also provides generic bubbles for new load in the region as BC Hydro stated *"The POI of other load interconnections in the area are not confirmed at this time"*[10]*.* This opens the possibility of multiple connection points to the existing transmission and substation network.

Figure 2: BC Hydro submitted future transmission system configuration diagram.

(Source: Exhibit B-5, IR Response No. 1.18.3 Dated: September 15, 2011)



[9] Exhibit B-30, BCUC_4_004_08_01, pdf page 32, BC Hydro response to BCUC IR 4.4.8.1

[10] Exhibit B-30, BCUC_4_004_08_01, pdf page 31, BC Hydro response to BCUC IR 4.4.8.1

To date, CSI is unaware of any evidence submitted by BC Hydro that shows any plans for transmission lines and any system substations to serve the other numerous industrial oil and gas customer's that have submitted applications in the area. It seems contradictory and short sighted for BC Hydro to claim that the need for DCAT is driven entirely by industrial customer load but not have any system substation to serve the generic industrial customer geographical loads noted in the "bubbles" on the submitted drawings. Of note, the only substation in the DCAT proposal is right next to the Bear Mountain Wind Farm, many kilometers from the load centre of the majority of the proposed industrial load customers.

CSI submits that for DCAT (and in the future GDAT) to be properly planned and designed to serve industrial load customers (not just wind farm IPPs) system substations should be planned for efficient and effective interconnection and service. This is further discussed below.

CSI believes the process and practices previously in place at BC Hydro and formerly BCTC need to be changed to accommodate the services required for the Oil and Gas customers. The existing model in BC has worked for services such as mines and other single, isolated industrial customers.

CSI will quickly outline the interconnection process concerning design and ownership.

The current process in BC involves the industrial customer designing, building and owning and operating its own transmission line and customer owned substation as defined as part of the electric tariff. This was the case following the interconnection of Louisiana Pacific (LP). LP was required to construct their own private substation designated LAP as shown in the previous figure provided by BC Hydro[11]. As a result, the proposed DCAT project was unable to utilize the now private LAP substation and is instead proposing to construct a new Sundance substation (SLS)[12]. Reviewing the provided map shows that this new SLS substation is very close to the existing private LAP. This, in CSI's respectful submission, is a duplication of assets and not an efficient transmission planning design for the net good of society.

One overall result of this current process is that multiple customers are tapping into the same transmission line in different (albeit close) locations with their own private facilities rather than utilizing a preplanned and well-designed system substation. The existing process has allowed customers to be served via their own capital cost and risk but it has resulted in the duplication of facilities as seen with LAP. The result of this process over the years has not built up a public transmission infrastructure in BC for usage by any other users aside from the initial customer.

The customer owned facility model creates what may be deemed as a random and chaotic version of transmission system planning because the customer is in control of the timing, design, routing and size of the facilities. The unknown timing and location of the tap points and customer owned substations as shown in the "bubble" on the *possible future transmission system configuration* provided in Figure 2 supports this statement.

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[11] Exhibit B-1, pdf page 15, Chapter 1 - Introduction

It is difficult for BC Hydro to perform a coordinated overall transmission system planning model since the customer controls the process and each customer will control their own schedule with no central or overall planning concern for the benefit of the province or rate payers. This point is shown as part of the DCAT study because after considerable amount of work and planning by BC Hydro, the only reference to the customer owned substations submitted in the planning interconnection drawing is a "bubble".

In Alberta, the transmission system planning model is more appropriate for the Oil and Gas Customers, where many customers (even competitors) require service in the same area. The system builds a transmission line and substation to serve many customers. Each project requires regulatory scope, need, cost and facility approval. The substation can be either a system substation to serve many customers or a customer owned substation to service a single customer. Once a substation or transmission line is built, it is a public line and therefore allows access by any future user.

The Alberta process for transmission supply is somewhat similar to the BC Hydro Distribution process where the Utility designs, owns and operates the line. It is built to serve the initial customer but any future customers can have access. Similar to the BC Hydro 25 kV projects, the initiating customer pays a capital contribution and the system contributes capital funds based on the size of the contracted load.

3.0 BC GOVERNMENT POLICY AND ENERGY PLAN

The BC Government realizes the importance of growth in the energy sector in BC. In the BC Energy Plan[12], the BC government has encouraged the development of the energy reserves as a high priority.

The BC Energy Plan[8], number 12, states the following:

> "*Since its inception, BCTC has planned system upgrades and new transmission projects in response to a customer's request. Transmission projects, however, require longer lead and construction times than generation or load build. The experience of other jurisdictions with this type of planning approach is that transmission capacity is often not in place when it is needed.*
>
> *To prevent this situation from occurring in British Columbia, BCTC* (now only BC Hydro) *will move beyond this contract driven approach to an approach that* ***builds infrastructure in advance of need****. The BC Transmission Corporation will study and propose, where appropriate, system upgrades or expansions based, in part, on its own assessment of future market needs*".

Source: The BC Energy Plan, "Electricity Policies", http://www.energyplan.gov.bc.ca

The need for service still drives the approval of each power supply project but BC Hydro is encouraged, via the Energy Plan, to properly plan and build the facilities for future

[12] "The BC Energy Plan" Electricity Policies - http://www.energyplan.gov.bc.ca/PDF/BC_Energy_Plan_Electricity.pdf

growth without a contract for every MW of service to justify the expansion of its infrastructure.

It is difficult to size a facility perfectly for the demand. However, if the facility is too small, it cannot serve, therefore by definition, all facilities should be oversized or have some surplus. In the case of the DCAT facilities, it is clear that the proposed 230 kV facilities do not provide adequate future surplus (Post 2016) without the addition of GDAT. Since the 230 kV facilities are fairly robust, there is some surplus space available on the line to accommodate near term future load. This is just good system planning. The surplus capacity is available for future loads and per the Energy Plan should not have to be contracted for.

Based on the BC governments Energy Plan, CSI recommends that no additional commercial or regulatory commitments or terms be placed on any industrial customer's connection to the grid in the Dawson Creek area or any other area in the province. The customers will be committed to the terms and conditions signed off on their Electric Service Agreement as approved by the existing tariffs.

CSI recommends that BC Hydro and BCUC approve the DCAT facilities without the additional commercial and regulatory terms and conditions that BC Hydro has suggested for this application. CSI respectfully submits that these terms and conditions are discriminatory against a specific type of customer (oil and gas) and location (Dawson Creek Area). It is the opinion of CSI that the new recommendations by BC Hydro are against the Electric ACT but are, however, policy issues which the commission has deemed outside the scope of this hearing and will not be further discussed in this submittal.

4.0 ALTERNATIVES FOR TRANSMISSION SERVICE

BC Hydro needs to expand its transmission facilities throughout BC and specifically in NE BC. The sooner this infrastructure gets built, the sooner the oil and gas companies will grow the economy by creating jobs and delivering products to the markets.

To solve some of the infrastructure challenges facing BC Hydro and the industrial customers in the area, some different methods of service could be looked at through GDAT process. Discussed following are three alternative methods of service that could be looked at to serve the future load.

4.1. Status Quo

4.1.1. Existing BC Hydro process where each industrial customer designs, builds, owns and operates its own transmission lines and substations. The capital funds for this work will be provided by the customer.

4.1.2. High voltage system planning is difficult because the customers control the scope and timing of when the transmission lines are built. Duplication of facilities results as does surplus unused capacity in customer owned facilities.

4.1.3. The customer owns, operates and controls the transmission infrastructure, mitigating rate increases for the transmission infrastructure.

4.2. New System Owned Facilities

4.2.1. A new process where BC Hydro designs a central transmission system to provide service for existing, proposed and future load in the area. The process would be similar to the existing BC Hydro 25 kV process where BC Hydro designs, owns and operates the facilities with capital contributions paid by the customer, depending on contracted load.

4.2.2. Due to the complexity and magnitude of the need for new facilities, as well as the tight timing required, it is probable that the BC government would need to give BC Hydro direction for the scope and timing of this service. It would likely involve an expanded version of the GDAT proposal with a 230 kV loop and substations to serve the customer load.

4.2.3. Funding could be provided as a special directive or infrastructure initiative by the BC Government so as to not increase rates to other customers. The funds have been prepaid by the Oil and Gas companies already as part of the $6 billion in land lease funds. Additional funds could be requested by the government or BC Hydro, mitigating the rate increases for the T infrastructure. The key is to preplan and build in an organized manner with BC Hydro owned system lines and substations to serve a multitude of customers.

4.2.4. BC Hydro owns, operates and controls the transmission infrastructure. All existing and future customers would have access to the facilities.

4.3. Approval of an Industrial System Designation (ISD) for the Dawson Creek Industrial customers

4.3.1. An independent entity could build and own a 230 kV transmission loop and several gas fired efficient generators (combined cycle or cogeneration) so that both transmission service and generation would be provided. The BC Hydro grid would serve only as a backup service for reliability and system stability.

4.3.2. All generation and transmission costs of service would be accumulated privately and paid via a long term tariff to the ISD owner, independent of the BC Hydro rate schedules.

4.3.3. The ISD owner owns, operates and controls the transmission infrastructure, mitigating rate increases for both generation and transmission.

4.3.4. The BC government may have to change its policy and environmental emission charges to allow “clean” gas generation in BC, rather than just “green” power.

4.3.5. Onsite generation would provide voltage support to the BC Hydro grid and also back up power or surplus power to be supplied to the BC Hydro grid.

5.0 SUMMARY

CSI strongly supports the need for immediate installation of the proposed DCAT facilities.

CSI believes that DCAT is required immediately to provide system support to the Bear Mountain Wind Farm IPP that has already been built.

Currently there are existing customers in the Dawson Creek who are served via an interruptible service. This interruptible service is in contrast to other customers in BC who are paying the same rate or tariff that enjoy a firm standard of electric service. Furthermore, due to the current system constraints, BC Hydro is unable to serve new customers in the Dawson Creek area, despite its obligation to serve.

The regulatory proceedings for DCAT can be considered precedent setting for the much larger scope of work in the upcoming GDAT facilities.

BC Hydro is indeed governed by the electric tariff[13] but it is directed by policy. The BC Energy Plan developed provincial goals to attract oil and gas development[14]. Directionally, the BC Government has recommended development of infrastructure to serve future development of energy reserves. CSI respectfully submits that BC Hydro should follow this direction and not impose new commercial terms and conditions on the Oil and Gas Customers.

Careful and robust planning is required now for GDAT. This planning should include transmission lines and substations to service all customers and not just IPPs.

BC Hydro and the BCUC need to ensure consistent treatment with a fair process and policy for all customers in BC, not discriminated by type of industry, location, load or ownership.

In fairness to BC Hydro and the BCUC, there has been a significant change in the power needs in BC over the past few years with the development of the shale gas reserves. The oil and gas customers require many power supply services in a short time frame in concentrated areas. The quantity of facilities and timing required for these services resulted in a significant challenge to BC Hydro. As such, the existing BC Hydro interconnection and regulatory processes were not equipped or appropriate for this new wave of services.

BC Hydro, BCUC and the BC Government should reexamine the processes and procedures to accommodate this new load and develop the energy resources for the province of BC. BC Hydro has an obligation to serve its customers, however if the process is too slow, the service becomes not a viable alternative for today's oil and gas customers.

It is important for the good of the province (government, power rate payers, and industrial customers, other stakeholders) to design and build a robust, efficient and effective transmission power infrastructure. These facilities would allow access for all customers. It would provide future expansion, minimize line losses, minimize duplication of facilities and

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[13] Exhibit B-30, CSI_4_005_0c, pdf page 163, BC Hydro response to CSI IR 4.5.c

[14] BC Energy plan – Oil and Gas Background, 2007EMPR0008-000178, http://www.energyplan.gov.bc.ca/PDF/2007EMPR0008_000178_Attachment3.pdf

also optimize the usage of the surplus or stranded assets such as customer owned transmission lines and substations.

CSI believes that the first step in this process is the immediate installation of DCAT, followed in parallel with proper planning for the future GDAT facilities with regulatory support and direction for BC Hydro from the BCUC and the BC government.