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VIA EMAIL

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Dear Members of the Tribunal:

Re: ***Tennant Energy LLC v. Government of Canada***

Canada writes in response to the Tribunal's email of April 6, 2021 inviting Canada to reply to the Claimant's April 5, 2021 response to Canada's letter of March 26, 2021 and to submit a copy of Canada's proposed designations to Exhibit C-108. In this letter, Canada explains that:

(1) Its proposed designations to Exhibit C-108 are made in accordance with this arbitration's Confidentiality Order ("CO") and will in no way affect the Claimant's ability to rely on the exhibit in this arbitration;

(2) Pursuant to Procedural Order No. 7 ("PO 7"), information that was designated as confidential in the *Mesa Power* proceeding should be designated as confidential in this arbitration. Further, having the public versions of the *Mesa Power* hearing transcripts stand in place of the *Mesa Power* hearing videos will increase the efficiency of the confidentiality designation process and will ensure that information that would otherwise be available in a public version of the hearing videos will be made available to the public in an expeditious manner; and

(3) A resolution of this matter should not be delayed any further.

Canada's Proposed Designations to Exhibit C-108

Exhibit C-108, titled *Assessment of the Energy Production of the Proposed Arran Wind Energy Project*, was submitted with the Claimant's Memorial on August 7, 2020. It is identical to Exhibit C-374 in the *Mesa Power* proceeding. In that proceeding, the majority of Exhibit C-374 was redacted and designated confidential by Mesa Power Group, LLC ("Mesa Power"). Canada's proposed designations to Exhibit C-108 arise out of its ongoing obligations under the *Mesa Power* Confidentiality Order ("*Mesa Power* CO"), which requires the parties and their respective counsel to ensure that information from those proceedings remains confidential regardless of who owns it.[1] The Claimant's counsel has already made it clear that it is using documents it obtained as counsel in the *Mesa Power* proceeding.[2] Exhibit C-108 appears to be one of these documents. As such, Canada's proposed confidentiality designations to Exhibit C-108, attached as Annex A to this letter, were made to ensure consistency with how such information was designated in Exhibit C-374 by Mesa Power in that proceeding.

The Claimant's reply letter of April 5 is the first time it notes that it received Exhibit C-108 from Leader Resources Services Corp. ("Leader"), who allegedly asserted that there was no confidential information in the document.[3] After five months of exchanges on the confidentiality of Exhibit C-108, it is unclear why the Claimant is only mentioning this now. However, this new information does not absolve Canada of its obligations under the *Mesa Power* CO. The Claimant has not provided the necessary written consent that Mesa Power *itself* waived the confidentiality of the information contained in the document.[4] Only Mesa Power, not Leader, can do this. Oral assertions by the Claimant during the January 2020 procedural hearing that it received permission from the late Mr. Pickens that "non-confidential information" from the *Mesa Power* proceeding "could be passed along" are insufficient evidence that Mesa Power has given the Claimant permission to disclose confidential information that was submitted in the *Mesa Power* proceeding.[5] Unless the Claimant can

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[1] **RLA-093**, *Mesa Power v Canada*, Confidentiality Order, ¶ 20.

[2] *Tennant Energy, LLC v. Canada*, Second Procedural Hearing, Transcript of Proceedings, Day 1, 14 January 2020, pp. 82:19-83:6, 94:9-18.

[3] *See* Claimant's Letter, 5 April 2021, p. 3.

[4] Paragraph 8 of the *Mesa Power* CO provides that "[e]xcept with the prior written consent of the disputing party that claimed confidentiality with respect to the information and, in the case of materials from third parties, the owner of such confidential information, confidential information may be used only in these proceedings and may be disclosed only for such purposes to and among…(b) counsel to a disputing party…" (emphasis added). The Claimant has not provided any evidence that Mesa Power has waived the confidentiality designation by providing written consent to the Claimant's counsel (also Mesa Power's counsel) to use the confidential information in Exhibit C-374 and in turn, Exhibit C-108, in the *Tennant* proceedings.

[5] *See* Claimant's Letter, 5 April 2021, pp. 7 and 8.

provide concrete written evidence of such permission by Mesa Power, Canada cannot remove its proposed designations to Exhibit C-108 and remain in compliance with Canada's ongoing obligations under the *Mesa Power* CO.

Further, the Claimant's contention that Canada is attempting to exclude the admission of this exhibit from the record is misleading. Canada has never requested that Exhibit C-108 be excluded from the record. Documents designated as confidential pursuant to the CO remain as part of the record, and the Claimant is free to rely on them in their entirety. Redactions for confidential information only determine what information is made available to the public, not what is available to the parties to the arbitration. The Claimant is also incorrect in arguing that Exhibit C-108 is public by virtue of it being cited in the Deloitte Valuation Report. Canada's agreement to make public the Deloitte Valuation Report in its entirety, including the limited references to Exhibit C-108, was not a waiver of any confidentiality designations previously applied to Exhibit C-108.[6]

Finally, Canada's proposed confidentiality designations to Exhibit C-108 were timely. They were submitted to the Claimant in accordance with the Tribunal's instructions of October 16, 2020 that "[t]he Respondent […] provide the Claimant with its proposed designations by 30 October 2020 (for the Claimant's Memorial and Mr Pennie's witness statement)".[7] The deadline applicable to designations to a written submission such as the Claimant's Memorial equally applies to designations to the exhibits referred to in that submission.

***Mesa Power* Hearing Videos**

The language of PO 7 confirmed that, if so requested by Canada, "[t]he Tribunal would be prepared to order that any confidential information contained in the *Mesa Power* Videos be redacted from the publicly available versions of the Parties' pleadings and any decision or award."[8] As acknowledged by the Tribunal in PO 7, the disclosure of confidential information in the *Mesa Power* hearing videos was inadvertent and such disclosure did not result in Canada waiving confidentiality over the information contained therein.[9] Canada requests that all information in the hearing videos that was designated as confidential pursuant to the *Mesa Power* CO[10] be designated as confidential in this

[6] As Canada explains in the Disputed Designations Schedule at line three (Annex C to Canada's Letter of 26 March 2021), "[t]he information from C-108 that is found in the Deloitte Valuation Report is very limited, with the overwhelming majority of the information not found in the Valuation Report or anywhere else on record in the Tennant arbitration."

[7] Tribunal's Email of 16 October 2020, p. 2.

[8] P.O. 7, ¶ 50.

[9] *See* P.O. 7, ¶ 38.

[10] Namely C-107, C-201, C-204, C-205, C-206, C-208, and C-224 through C-243.

arbitration. The only remaining question would then be the manner in which this information is redacted and the remainder of the non-confidential information is made public.

The process to review the entirety of the *Mesa Power* hearing videos (consisting of six hearing days and approximately 50 hours of video recordings) and compare them to the public transcripts (which remain on the PCA's website)[11] in order to identify the sections of the videos that should be designated as confidential would be extremely labour intensive and costly. No accurately redacted version of the videos exists and Canada would be required to spend hundreds of hours and significant personnel and financial resources to prepare such version. A workable solution is readily available to the disputing parties which would require no additional resources from either party. Indeed, the most efficient way of proceeding is to have the publicly available redacted *Mesa Power* hearing transcripts stand as the public version of the *Mesa Power* hearing videos in this arbitration. This way, the same information that would be available in public versions of the hearing videos, if they existed, would be available to the public by virtue of the transcripts, which have already been properly redacted and are in the public domain.[12] The Claimant would be free to use that information as it sees fit.

Finally, Canada wishes to bring to the Tribunal's attention that the Claimant has not objected to Canada's proposed confidentiality designations to Exhibits C-179, C-214, C-215, C-216 and C-218, which are screenshots of the *Mesa Power* hearing videos. Canada provided its proposed confidentiality designations to these exhibits to the Claimant on October 30, 2020, which reflected confidentiality designations that had been made to this information pursuant to the *Mesa Power* CO. In an email sent to Canada on November 20, 2020, the Claimant objected to some of Canada's proposed designations (including those concerning Exhibit C-108) but it made no objections with respect to Exhibits C-179, C-214, C-215, C-216 and C-218. The October 30 and November 20 correspondence are attached to this letter as Annex B, and Canada now submits the final designations to these exhibits. Due to the file size of Exhibits C-179, C-214, C-215, C-216 and C-218, Canada will upload the final Confidential and Public versions of these exhibits to the PCA's private FTP site for this arbitration alongside the submission of this letter.[13]

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[11] *See* PCA Case Information on *Mesa Power Group LLC (USA) v. Government of Canada*, https://pca-cpa.org/en/cases/51/, Transcript Day 1 of 6, Transcript Day 2 of 6, Transcript Day 3 of 6, Transcript Day 4 of 6, Transcript Day 5 of 6, Transcript Day 6 of 6.

[12] If Canada's request is granted, Canada will provide the Tribunal with PDF documents of the public versions of the *Mesa Power* hearing transcripts that are available on the PCA's website.

[13] The final Confidential and Public versions of Exhibits C-179, C-214, C-215, C-216 and C-218 can be found on the PCA's FTP site in a folder titled "2021-04-13 - Final Confidential and Public Versions of Mesa Power Video Screenshot Exhibits".

Claimant's Counsel's Availability to Resolve these Issues

Canada acknowledges that Mr. Appleton is going through a difficult family situation. We wish his family member a speedy recovery and health going forward. However, as a result of Mr. Appleton's recent appearance before one of Canada's parliamentary committees, it has become clear that the resolution of these confidentiality-related issues should not be delayed any further. In this regard, Canada is compelled to note that on March 26, 2021, Mr. Appleton appeared as a witness before the Canadian House of Commons' Standing Committee on International Trade (CIIT),[14] and that in his remarks, he criticized "the government's decision to suppress the information" that has been at issue in this arbitration with respect to the *Mesa Power* hearing videos.[15] It is entirely inappropriate for the Claimant's counsel to continue delaying the resolution of these issues based on his personal circumstances, while at the same time making submissions to a parliamentary committee on matters relating to the very issues the Tribunal must decide. Further, even if Mr. Appleton remains unavailable to advance the arbitration, the rest of the Claimant's legal team – many of whom were involved in the *Mesa Power* arbitration – should be able to deal with this matter in Mr. Appleton's absence, just as they have been in a position to work on the Claimant's Reply Memorial on Jurisdiction.

Order Requested

Canada respectfully reiterates its requests set out in its letter of March 26, 2021. Further, Canada reserves its right to seek costs as a result of the Claimant's actions related to these matters.

Yours very truly,

Heather Squires
Deputy Director & Senior Counsel
Trade Law Bureau

[14] https://www.ourcommons.ca/DocumentViewer/en/43-2/CIIT/meeting-21/notice

[15] *See* Annex C, Transcript of the Standing Committee on International Trade, 26 March 2021, p. 7: "[i]n a current NAFTA case where I'm counsel, Tennant Energy v. Canada, there are admissions of internationally wrongful behaviour from public officials that come from a previous NAFTA case. Those admissions, astonishingly, talk about how Canadian public procedures were circumvented to assist governmental friends and supporters by a secret high-level group of officials. This is the evidence. Canada posted a link on the Internet to a video with all of this material. It was quite scandalous. It was public for five years, but then Canada took steps in the Tennant NAFTA arbitration case to prevent the public and Parliament from actually seeing this material after it was posted for five years on the Internet. Parliament and Canadians have no access because of the government's decision to suppress this information."

cc: Barry Appleton, TennantClaimant@appletonlaw.com (Appleton & Associates)
Ed Mullins, Ben Love (Reed Smith LLP)
Christel Tham, Diana Pyrikova (Permanent Court of Arbitration)
Annie Ouellet, Alexandra Dosman, Mark Klaver, Maria Cristina Harris (Trade Law Bureau)

GL Garrad Hassan

ASSESSMENT OF THE ENERGY PRODUCTION OF THE PROPOSED ARRAN WIND ENERGY PROJECT

Client	Leader Resources Services Corp.
Contact	Charles Edey
Document No	102620/OR/01
Issue	C
Status	Final
Classification	Commercial in Confidence
Date	25 June 2010

Author: J Ziegler

Checked by: A W Cameron, R A den Dunnen

Approved by: C Johnson

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GH has not conducted wind measurements itself and cannot, therefore, be responsible for the accuracy of the data supplied to it.

This document has been prepared pursuant to the "GH Proposal Reference 102620/OP/01 Issue A" dated 15 January 2010, and is subject to the terms and conditions contained therein.

KEY TO DOCUMENT CLASSIFICATION

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REVISION HISTORY

Issue	Issue date	Summary
A	25.03.10	Original issue (electronic version only)
B	26.04.10	Update with minor changes, typographical corrections and addition of monthly energy variation
C	25.06.10	Update following Client comments

Circulation	Copy No.
Leader	1
GH Canada	2

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EXECUTIVE SUMMARY

Leader Resources Services Corp. (Leader) is developing the Arran Wind Energy Project east of Port Elgin, Ontario. Leader has instructed Garrad Hassan Canada Inc. (GH) to carry out an independent analysis of the wind climate and energy production of the proposed wind farm. The results of the work are reported here in this document.

Leader has supplied data recorded at the Arran site since September 2006 to GH from two meteorological masts at a height of 60 m. The proposed layouts consisting of 70 GE 1.6xle 1.6 MW or 46 GE 2.5xl 2.5 MW machines with hub heights of 80 m, 85 m or 100 m have also been supplied by Leader.

These data, turbine types and layouts have been analysed here, to predict the long-term energy output of the proposed wind farm. The principal results are presented below:

- The long-term mean wind speed averaged over all turbine locations is estimated to be 6.4 m/s, 6.8 m/s and 6.5 m/s at the Arran site for Layout Options 1, 2 and 3, respectively.
- The projected energy capture of the Arran Wind Energy Project over the first 10 years of operation is presented in the table below. This includes calculation of the wake and air density effects and assumptions or estimates for availability, electrical efficiency, turbine performance, environmental and curtailment losses.

Layout Option	Turbine Type	Hub Height [m]	Rated Capacity [MW]	Net output [GWh/annum]
1	GE 1.6xle	80	112	273.4
2	GE 2.5xl	100	115	294.9
3	GE 2.5xl	85	115	264.5

- The confidence limits for the predictions have been calculated as:

Layout Option	1 year average net energy production [GWh/annum]			10 year average net energy production [GWh/annum]		
Probability of exceedance	90 %	75 %	50 %	90 %	75 %	50 %
1	213.9	242.1	273.4	233.7	252.5	273.4
2	228.3	259.8	294.9	247.6	270.0	294.9
3	205.4	233.4	264.5	225.0	243.7	264.5

1 INTRODUCTION

Leader Resources Services Corp. (Leader) is developing the Arran Wind Energy Project approximately 8 km east of Port Elgin, Ontario. Leader has instructed Garrad Hassan Canada Inc. (GH) to carry out an independent analysis of the wind climate and energy production of the proposed wind farm. The results of the work are reported here.

A description of the long-term wind climate at a potential wind farm is best determined using wind data recorded at the site. Leader has supplied data recorded at the Arran site since September 2006 to GH from two meteorological masts at a height of 60 m, and from Sodar measurements taken at four locations on the site in 2006 and 2007.

It is usual to combine the site measurements with long-term measurements from a local meteorological station to extend the period of data in order to estimate the long-term wind regime at the site. GH has obtained data from Goderich Meteorological Station as a source of reference data.

The proposed layouts and turbine models currently under consideration have been supplied by Leader. These have been analysed here, in conjunction with the results of the wind analysis, to predict the long-term energy output of the proposed wind farm.

2 DESCRIPTION OF THE SITE AND MONITORING EQUIPMENT

2.1 The site

The site is located approximately 8 km east of Port Elgin, as shown in Figure 2.1. The local terrain at the site is a mixture of agricultural land and scattered areas of trees. The topography is mostly flat, with elevations ranging between 210 m and 260 m. The site is adjacent to Lake Arran, which has a size of approximately 0.8 km east-west by 5 km north-south, and is located approximately 9 km east of the shore of Lake Huron.

A map showing the site is presented in Figures 2.2 and 2.3, including the locations of the meteorological masts. A panoramic view of the site from a representative location (coordinates 476387, 4922632) is shown in Figure 2.4.

The site is proposed within a region of high wind farm development activity and is approximately 15 km northeast of the existing Enbridge Ontario Wind Farm. The Enbridge Ontario Wind Farm consists of 110 Vestas V82 turbines.

GH considers the distance between the existing Enbridge Ontario Wind Farm and the proposed Arran Wind Energy Project sufficient such that the wind speed measurements and energy production of the proposed Arran Wind Energy Project will not be significantly influenced by the presence of the existing wind farm.

The surface roughness length of the site and surrounding area was assessed during a site visit made by GH staff in February 2010. Following the Davenport classification [1], the following general figures are considered appropriate:

Forested areas	0.5 m
Towns/Settlements	0.3 m
Site and surrounding areas	0.03 m
Water	0.0002 m

2.2 Monitoring equipment

2.2.1 Equipment

The wind measurement campaign at the Arran site commenced in August 2006 with the installation of the 60 m mast, Mast 2912, also known as Faust. In October 2006, a second 60 m mast, Mast 2913, also known as Crawford, was installed. Both are guyed tubular masts.

Leader has also employed remote sensing technology to collect wind measurements at the site, utilising the ART VT-1 Sodar device. The Sodar measurements are discussed in Section 4.2.

A summary of the measurements recorded at the site, including the grid co-ordinates of the masts, are presented below and in Table 2.1. The masts were observed by GH staff during a site visit in February 2010.

Mast	Eastings[1] [m]	Northings[1] [m]	Tower Type	Installation Date	Data from
Faust	477013	4920085	NRG tubular	19/08/2006	02/09/2006
Crawford	477519	4923943	NRG tubular	27/10/2006	28/10/2006

Notes: 1. Co-ordinate system is UTM Zone 17T, NAD83 datum

The wind data have been recorded using NRG Symphonie data loggers, NRG #40 anemometers and NRG 200 P wind vanes. The data loggers have been programmed to record, at ten-minute intervals, mean and standard deviation wind speed and direction, maximum and minimum wind speed.

All instruments at the Faust mast were replaced on 1 September 2009, and the instruments at the Crawford mast on 6 May 2009.

Maintenance records for the site measurements have been provided. The standard of documentation is good and certainly sufficient to ensure full traceability of the instrumentation. Visual checks on the masts indicate that the configurations are consistent with the commissioning reports. The details of the individual mast configurations are given below.

2.2.2 Mast mounting arrangements

Both the Faust and Crawford masts are NRG 60m STD tubular tilt up towers. The masts were installed in August and October 2006, respectively. A view of Faust mast and instrument mounting arrangements is shown in Figure 2.5 looking northeast.

The masts are equipped with the following instrumentation:

Faust mast Instrument	Height [m]	Serial Number		Boom orientation (true North)
		Up to 1/9/2009	After 1/9/2009	
NRG Maximum #40 anemometer	60.0	27908	104863	115°
NRG Maximum #40 anemometer	60.0	27910	106828	292°
NRG Maximum #40 anemometer	45.0	27909	106849	115°
NRG Maximum #40 anemometer	45.0	27911	106829	292°
NRG Maximum #40 anemometer	30.0	27932	104866	115°
NRG Maximum #40 anemometer	30.0	27912	106827	292°
W 200P wind vane	59.0	-	-	25°
W 200P wind vane	44.0	-	-	25°
W 200P wind vane	29.0	-	-	25°
Temperature sensor	5	-	-	-

Crawford mast Instrument	Height [m]	Serial Number Up to 6/5/2009	Serial Number After 6/5/2009	Boom orientation (true North)
NRG Maximum #40 anemometer	60.0	27914	104853	120°
NRG Maximum #40 anemometer	60.0	27913	104857	295°
NRG Maximum #40 anemometer	45.0	27916	104854	120°
NRG Maximum #40 anemometer	45.0	27915	104851	295°
NRG Maximum #40 anemometer	30.0	27928	104864	125°
NRG Maximum #40 anemometer	30.0	27917	104865	300°
W 200P wind vane	59.0	-	-	25°
W 200P wind vane	44.0	-	-	25°
W 200P wind vane	29.0	-	-	25°
Temperature sensor	5	-	-	-

Inspection of the masts conducted by GH during the site visit broadly corroborates values supplied by the client. The boom orientations quoted are corrected according to correlations performed with reference stations and investigation of the data.

All anemometers are mounted on booms approximately 10 to 15 mast diameters long and the cups of the anemometers are approximately 13 boom diameters above the booms. The wind vanes have been mounted in a similar manner.

These mounting arrangements are consistent with the recommendations of the IEC [2].

2.2.3 Mast Calibrations

All anemometers used on the masts have been individually calibrated by OTECH Engineering within their wind tunnel at Davis, California.

GH has retrospectively applied the individual calibrations to these wind speed data. A summary of the adjustments made to wind speed data recorded at the masts during the measurement campaign is given in Table 2.2 and Table 2.3.

2.3 Remote Sensing monitoring equipment – Sodar

Wind data have also been recorded at the Arran site using the Atmospheric Research & Technology VT-1 Phased-Array Doppler Sodar System. Data were recorded near the Crawford Mast from May 2007 to July 2007, and near the Faust mast from October 2006 to January 2007. Sodar data were also recorded at two more locations further from the anemometry masts. During these periods ten-minute mean wind speed and wind direction were recorded at range gate heights between 30 m and 140 m in 5 m increments.

As mentioned above, Leader has informed GH that the VT-1 Sodar device was deployed in four locations at the Arran Wind Energy Project site as follows:

- Faust – 7 May 2007 to 12 July 2007, approximately 110 m southeast of the Faust mast;
- Crawford – 10 October 2006 to 11 January 2007, approximately 140 m northeast of the Crawford mast;
- Faust 2 – 17 August 2007 to 26 September 2007, approximately 2.4 km east of the Faust mast;

- Ransome – 5 July 2006 to 1 October 2006, approximately 1.7 km northwest of the Faust mast and 3.1 km southwest of the Crawford mast.

Details of the measurements recorded on site and the grid co-ordinates of the Faust and Crawford Sodar deployments are presented in Table 2.1.

3 SELECTION OF REFERENCE DATA

In the assessment of the wind regime at a potential wind farm site, it is desirable to correlate data recorded at the site with data recorded at a nearby long-term reference meteorological station. This allows the estimate of the long-term wind regime at the site to be representative of a longer historical period. When selecting an appropriate meteorological station for this purpose it is important that it should have good exposure and that data are consistent over the measurement period being considered.

GH has investigated potential sources of consistent, long-term reference data in the surrounding area. The Goderich, Wiarton Airport and Mount Forest meteorological stations have been identified by GH as potential reference stations.

Time series data comprising mean wind speed and direction from each station were procured directly from the Environment Canada (EC) National Climate Data Archive [3]. Checks were performed comparing the data from these stations with each other and with the site data to confirm the consistency of the measurements. Based on available information about the consistency and exposure of the stations and the quality of the correlations with the site data, the Goderich Environment Canada (EC) station was selected as the most suitable long-term reference. General information for the Goderich station is presented in Table 2.1 and its location is illustrated in Figure 2.1

3.1 Goderich Meteorological Station

For the Goderich Meteorological Station, GH procured time series data from EC for the period of February 1994 to December 2009. The Goderich station is an automatic station situated approximately 85 km south-southwest of the proposed Arran Wind Energy Project site, as shown in Figure 2.1.

The Goderich meteorological station was visited by GH staff in August 2009. GH had correspondence with the EC staff concerning its consistency. The station is currently comprised of two 10 m towers equipped with RM Young and U2A anemometers. The RM Young is the primary instrument for monitoring wind speed and direction at the station. The station appears to be well maintained with good data coverage. The instruments are well exposed with no apparent structure or forest cover which could significantly affect the measurement masts. There are two hangars up to 9 m in height generally to the south at a distance of 280 m from the mast.

Data have been collected at Goderich Airport station since October 1980. EC staff has indicated that the RM Young propvane was installed in February 1994 and that no significant change has occurred since this installation [3]. It is considered that the installation of the RM Young has affected the consistency of measurements at the station. Consequently, the analysis of the long-term wind regime relies on data recorded at the Goderich Airport station since February 1994.

Correlations on a daily and monthly basis have been undertaken with the site data resulting in R^2 values as follows:

Mast	Daily R^2	Monthly R^2
Faust	0.72	0.91
Crawford	0.73	0.94

Given this result, GH considers this station to be suitable as a representative source of long-term reference data.

3.2 Conclusions

GH considers that the Goderich meteorological station is the most appropriate source of long-term reference data for the Arran Wind Energy Project due to its representative location and the similarity of its exposure to the site, the reliability and consistency of measurements, and the strength of correlations to on-site measurements.

Therefore the analysis of the long-term wind regime at the site relies on data recorded at the Goderich meteorological station since February 1994. The uncertainty associated with assuming this period to be representative of the long-term is considered in Appendix 1.

4 WIND DATA

The data sets that have been used in the analysis described in the following sections are summarised in Table 2.1.

4.1 Wind data recorded at the site

The wind data have been subject to a quality checking procedure by GH to identify records that were affected by equipment malfunction and other anomalies. These records were excluded from the analysis. The main periods for which valid wind data were not available are summarised below, together with details of the errors identified:

Faust mast:

- 22 Feb 2008 to 6 May 2009: sensor failure, 59 m wind vane;
- 23 May 2009 to 28 Jun 2009: missing data, all instruments;
- At each 60 m instrument, up to 1618 10-minute records were removed due to possible icing events.

Crawford mast:

- At each 60 m instrument, up to 2166 10-minute records were removed due to possible icing events.

In a technical note issued in Spring 2008 [5], NRG described a problem which had arisen with #40 anemometers, manifesting itself as intermittent underspeeding or dragging. After investigation, NRG concluded that the degrading and underspeeding was due to a phenomenon known as "dry friction whip", and all anemometers manufactured after 1 January 2009 featured modifications aimed at reducing or eliminating the occurrence of this behavior. The conclusions of NRG's investigation and the subsequent design changes are discussed in more detail in [6], presented by NRG at the AWEA annual conference in early May 2009.

GH has performed a thorough examination of the wind data recorded at this site and has identified periods of data affected by this issue. The impacts of this problem on the wind data are twofold:

- When it is clear that a particular #40 has degraded in a particular period of time, it is common practice to exclude data recorded by that instrument for this period. In practice, this has resulted in extended periods of wind data being excluded from analyses, resulting in lower data coverage rates.

- As a consequence of the nature this phenomenon, it is not always possible to identify and exclude all degraded data. Depending on the specifics of the analysis, the remaining degraded data may result in additional uncertainty in the long-term mean speed prediction.

In the analysis of the Arran site, GH has identified suspected degradation in the following #40 anemometers installed at the site:

Faust mast:

- 60m Anemometer, oriented south east: Jan 2007, Dec 2007, Jun 2008 and Jan 2009;
- 60m Anemometer, oriented north west: Feb 2007;
- 45m Anemometer, oriented south east: Feb-Mar 2007;
- 30m Anemometer, oriented south east: Oct 2007, Jan-Feb 2007, Aug 2008 and Dec 2008;
- 30m Anemometer, oriented north west: Feb 2007.

Crawford mast:

- 60m Anemometer, oriented south east: Dec 2007 and Mar 2008;
- 60m Anemometer, oriented north west: Jan 2007, Apr 2008 and Apr 2009;
- 45m Anemometer, oriented south east: Jul 2009;
- 45m Anemometer, oriented north west: Feb 2007, Aug 2009, Oct 2009- Feb 2010;
- 30m Anemometer, oriented south east: Dec 2006, Apr-May 2007, Aug 2007, Oct 2007, May-Jun 2008, Aug 2008-May 2009;
- 30m Anemometer, oriented north west: Jan-Feb 2008, Mar 2009.

GH has excluded wind speed data recorded by these anemometers for the periods listed only.

Offsets between the direction data have been observed in correlations that were conducted between the masts and the reference station. Any offsets from the direction data that were observed at these two masts were corrected for accordingly and are summarised below:

Faust mast:

- Wind vane at 59 m: 25 degrees for the whole measurement period;
- Wind vane at 44 m: 35 degrees up to 1 Sep 2009, 21 degrees thereafter;
- Wind vane at 29 m: 25 degrees for the whole measurement period.

Crawford mast:

Wind vane at 59 m: 25 degrees for the whole measurement period;

- Wind vane at 44 m: 25 degrees for the whole measurement period;
- Wind vane at 29 m: 30 degrees up to 19 Feb 2009, -19 degrees from 19 Feb 2009 to 6 May 2009, 33 degrees thereafter.

It is likely that the mountings and/or booms of the 44 m wind vane at the Faust mast and the 29 m wind vane at the Crawford mast have moved throughout the measurement period and the data recorded by these vanes are not considered reliable. There is a significant amount of data missing for the 59 m wind vane at the Faust mast, and the 59 m wind vane at the Faust mast shows excessive scatter in correlations, therefore only the 44 m wind vane at the Crawford mast and the 29 m wind vane at the Faust mast to provide direction data.

The duration, basic statistics and data coverage for the data recorded at the Faust and Crawford masts are summarised in Table 4.1 and 4.2.

In an attempt to minimise mast effects in the measured wind speed data, selective averaging of the data recorded at each site mast was undertaken, using the calibrated anemometers at the upper measurement heights, as follows:

- For both masts, wind speeds recorded by the anemometer oriented to the southeast were taken for the southeast direction sector, and wind speeds recorded by the northwest oriented anemometer were taken for the northwest degree direction sector.

- For the remaining direction sectors, wind speeds from both anemometers were averaged.

4.2 Wind data recorded at the site – Sodar

The Sodar data provided to GH is the raw data output from the Sodar system, which is subject to an automatic filter by the Sodar system. The system operates by monitoring lower level acoustical signals echoed by discontinuities in the atmosphere and it is understood that an automatic filter attempts to removes records that are affected by ambient noise and fixed echoes. The system also assigns a "reliability" value to each measurement, which is based on a number of criteria set by the Sodar program and has a value of 9 for "reliable" data and 0 for "unreliable" data.

Despite this automatic filter, detailed inspection of the data by GH indicated that the data set still contained many erroneous records, which were most likely caused by adverse atmospheric conditions including, but not limited to, periods of precipitation. To improve the signal at each of the specified range gates, valid data were filtered based on the following criteria:

- Signal to noise ratio greater than 10;
- Accepted measurements with a vertical speed less than 1.5 m/s;
- Removed measurements with a "reliability" value lower than 7.

Some manual cleaning of the data was also performed, based on comparisons to the measurements from the masts on a time series basis. Where erroneous data or large deviations were observed, these data were removed from the analysis.

Based on these criteria, correlations between each of the range gates and the data coverage at each of the range gates, the reliable range was identified to be 30 m to 140 m.

Details of the Sodar measurements at Arran are summarised in Table 2.1 for the range 30 m to 100 m.

4.3 Wind data recorded at the reference station

The data set from the Goderich Meteorological Station that has been used in the analysis described in the following sections is summarised in Table 2.1.

These hourly wind data have been subject to a quality checking procedure by GH. An insignificant number of records were identified to be affected by equipment malfunction and other anomalies.

The duration and basic statistics for the Goderich Meteorological Station data are summarised in Table 4.3.

5 DESCRIPTION OF THE PROPOSED WIND FARM

5.1 The wind turbine

The following wind turbine models are under consideration for the proposed Arran Wind Energy Project. The characteristics and performance data of these turbines are presented in Table 5.1.

- GE 1.6xle, 1.6 MW, hub height 80 m;
- GE 2.5xl, 2.5 MW, hub height 100 m;
- GE 2.5xl, 2.5 MW, hub height 85 m.

The power curves used in this analysis have been supplied by Leader [7] and are for the air density and turbulence intensity as given in Table 5.1. GH has evaluated the turbulence levels at the Arran site and assessed the potential impact to turbine power performance, as discussed further in Section 6. The power curves are based on calculations and exhibit peak power coefficients, Cp, of 0.47 and 0.43 for the 1.6xle and 2.5xl, respectively. The Cp for the GE 1.6xle is considered to be high but attainable for modern wind turbines, while the Cp for the GE 2.5xl is considered to be reasonable.

A measured power curve from an independent test of the performance of the turbines has not been supplied, therefore GH has been unable to verify that the power performance levels provided by the turbine manufacturer are attainable. It is recommended that formal warranted and independently measured power curves for the specific turbine models proposed for the site are obtained to confirm the performance levels supplied.

Using historical pressure and temperature records from nearby meteorological stations and standard lapse rate assumptions, GH has estimated the long-term mean air density at the site to be 1.215 kg/m^3 at an elevation of 314 m above sea level.

The supplied power curves used in this analysis have been adjusted to the predicted site air density, in accordance with the recommendations of the IEC [2]. This has been undertaken on an individual turbine basis.

5.2 Wind farm layout

Leader has supplied the two different turbine layouts for the wind farm [8], featuring 70 and 46 turbines respectively. The 46 turbine layout is to be considered with 85 m and 100 m hub heights, giving the following three options:

- Option 1: 70 turbines at 80 m hub height (GE 1.6xle)
- Option 2: 46 turbines at 100 m hub height (GE 2.5xl)
- Option 3: 46 turbines at 85 m hub height (GE 2.5xl)

The proposed turbine locations are presented in Figure 2.2 and Figure 2.3 with the grid co-ordinates of the turbines given in Table 5.2 to 5.4.

It is noted that a minimum inter-turbine spacing of 3.6 rotor diameters is proposed between Turbines 05-06 and 05-07 in Option 1 in the direction of the significant winds from the southwest, and spacings of 3.9 rotor diameters between turbines 07-01 and 07-02 and 08-01 in Option 2 in the direction of the significant winds from the south and southwest. There are many more instances over the site where the separations are less than 5.0 rotor diameters in the direction of significant winds. The resulting increase in

turbulence levels has the potential to increase fatigue loads and it is recommended that the turbine supplier be approached at an early stage to gain approval for the proposed layout.

No wind sector management strategy has been supplied, and GH has not included any losses that may be associated with this. However, GH considers it unlikely that any such strategy will be required for the proposed layout.

It is noted that Turbines 05-03, 06-05 and B-12 in Option 1 and Turbines 05-02, 05-03, 08-03 and A-11 in Options 2 and 3 are close to wooded areas. The height of these trees is significantly less than the hub height of the proposed turbine models, and the potential for significantly elevated turbulence levels is small. Nevertheless, GH considers it would be prudent to approach the turbine supplier at an early stage to gain approval for the position of these turbines in relation to the wooded areas.

6 RESULTS OF THE ANALYSIS

The analysis of the potential wind farm involved several steps, which are summarised below:

- The long-term mean wind speed at the Goderich Meteorological Station at 10 m was derived for the period from February 1994 to December 2009.
- Data recorded at the Goderich Meteorological Station at 10 m were correlated on a monthly basis to the measured data recorded at the Faust and Crawford masts. These correlations were used to derive the long-term wind speed and direction frequency distributions at the Faust and Crawford masts at 60 m.
- The shear profiles measured at the Faust and Crawford masts were used to extrapolate the long-term wind speed and direction frequency distributions up to the proposed hub heights.
- Wind flow modelling was carried out to determine the hub height wind speed variations over the site relative to the Faust and Crawford masts.
- The net energy production of the wind farm was calculated taking account of wake effects, availability, electrical efficiency, turbine performance, environmental and curtailment losses.
- An assessment of the uncertainty in the predicted wind farm energy production was undertaken.

A more complete description of the methods employed is included in Appendix 1.

6.1 Long-term wind regime at Goderich Meteorological Station at 10 m

As detailed in Section 3, wind measurements from Goderich Meteorological Station over a period of approximately 15 years and 11 months were available for the analysis. From the 15.9 years of measurements a total of approximately 15.6 years of valid wind data were available. In order to avoid the introduction of bias into the annual mean wind speed estimate from seasonally uneven data coverage, the following procedure was followed:

- The mean wind speed for each month was determined from the average of all valid data recorded in that month over the period. This was taken as the monthly mean thereby assuming that the valid data are representative of any missing data.
- The mean of the monthly means was taken to determine the annual mean ("mean of means") to eliminate the effect of seasonal bias in the data.

By this method, the predicted long-term mean wind speed at the Goderich Meteorological Station was found to be 4.7 m/s.

6.2 Long-term wind regime at the Faust and Crawford masts

As detailed in Section 2.2, data have been recorded at the Faust and Crawford masts from September and October 2006, respectively, comprising approximately 3.4 and 3.2 years of data. Using the method described above to eliminate seasonal bias, the annual wind speed was derived at each mast at 60 m, and found to be 5.9 m/s and 6.0 m/s for the Faust and Crawford masts, respectively.

Monthly mean wind speeds at the Goderich station were correlated to the concurrent monthly wind speeds measured at the site masts at 60 m. The results of these correlations are shown in Figures 6.1 and 6.2 and exhibit R^2 values of 0.91 and 0.94. The slope and offset found from each correlation was applied to the monthly wind speeds measured at Goderich and combined with the wind speeds measured at the site masts to synthesise two time series of monthly wind speeds dating back to February 1994.

Long-term mean wind speeds were calculated from this synthesised data using the same method as described above, resulting in long-term mean wind speed predictions of 5.8 m/s at 60 m at the Faust mast and 6.0 m/s at 60 m at the Crawford mast, which represent a decrease of 0.8 % and 1.1 %, respectively, compared to the mean wind speed over the measurement period.

6.3 Use of Sodar data

The Sodar data recorded on site have been analyzed and compared to the wind measurements at the two site masts, to determine how best the Sodar data can be utilised in this analysis. Comparison of the mean wind speeds measured during the periods of concurrent anemometry and Sodar measurements at the Faust and Crawford masts show that there is significant disagreement at 60 m:

Location	Anemometry mast (60 m)	Sodar (60 m)
Faust	6.4 m/s	5.8 m/s
Crawford	5.1 m/s	4.6 m/s

GH has therefore used the available Sodar data to support the vertical extrapolation of wind speeds from the two site masts, as discussed in Section 6.5.

6.4 Forestry effects

As described in Section 2.1, there are several areas of forestry on the site. The wind flow modelling and the vertical extrapolation of the measured wind speeds to hub height therefore need careful consideration. Where there are obstacles to the flow such as trees in proximity to a mast or turbine, it is necessary to consider the effect of these obstacles on the wind flow model [9]. The following methodology has therefore been adopted:

- From aerial photography, topographic maps and observations during the site visit, areas of forestry and land cover have been analyzed. The trees were measured to be 13 m in height on average.
- For each mast and turbine location, an effective reduction in the measurement or hub height has been estimated to account for the influence of trees as an obstacle to the wind flow. The selection of these heights is based on the effective flow displacement height of the trees, the proximity of the mast or turbine to the trees and the frequency of occurrence of the relevant wind directions. The following relationship is used to find the effective flow displacement height per direction sector at each mast and turbine location:

$$d = d_{tree} - D/50 \qquad [6.1]$$

where: d is the effective flow displacement height;
d_{tree} is the flow displacement height of the surrounding trees; and
D is horizontal distance from surrounding trees.

- By weighting each sector's effective flow displacement heights by the frequency of winds in each sector, a weighted displacement height is calculated for each individual site mast and turbine. The resulting displacement heights range up to 4 m.
- The reductions in measurement height for the masts are presented in the table below.

Mast	Height reduction [m]
Faust	1
Crawford	2

- The effective hub heights for the proposed turbines are presented in Table 5.2 to Table 5.4.

The impact of future tree growth and felling are not discussed further in this assessment.

It is noted that a detailed forestry felling strategy has not been supplied. For the purpose of this assessment, it has been assumed that current forest cover found on site with a 50 m turbine site clearing will be representative of project life of the proposed wind farm.

6.5 Vertical extrapolation of wind speed

The boundary layer power-law shear exponents at the site masts were derived from the available measurements. The power-law relates the ratio of measured wind speeds, U_1/U_2, to the ratio of the measurement heights, z_1/z_2, using the wind shear exponent, α, as follows:

$$\frac{\overline{U}(z_1)}{\overline{U}(z_2)} = \left(\frac{z_1 - d}{z_2 - d}\right)^{\alpha} \qquad [6.2]$$

where: α is power-law wind shear exponent;
$\overline{U}$ is the mean wind speed;
z is the height above ground level; and
d is the effective flow displacement height.

The boundary-layer power-law shear exponents were derived on an individual basis for each mast. The ratios of concurrent wind speed data recorded at multiple measurement heights at each mast were used to derive the expected long-term mean power-law shear exponent at the mast locations. These values were applied to extrapolate the long-term mean wind speed and direction frequency distribution at each mast to hub height.

The calculated wind shear exponents for the site masts are 0.27 and 0.37 for the Faust and Crawford masts, respectively. These values are considered to be reasonable given the site terrain and ground cover in the vicinity of the respective masts.

Comparisons were made with the Sodar data measured on the site. Using concurrent data periods, the shear exponent values are calculated from mast data and from the speeds measured by Sodar at heights of 30m, 45m, 60m, 80m, 85m and 100m. The resulting concurrent shear exponent values are shown in the table. Note that because the values presented in this table are based only on at most a few months of data, they are not considered to be representative of an annual period. However, they are useful for comparative purposes between the Sodar and the site masts.

Location of Vertical Shear Exponent [α]	Mast	Sodar
Faust	0.24	0.27
Crawford	0.49	0.48

Comparison of the exponent shows reasonable agreement, giving additional confidence in the shear exponents estimated for the entire period. This has been accounted for in the uncertainty analysis.

Applying the annual shear exponents measured at each mast (0.27 and 0.37 at the Faust and Crawford masts, respectively) to predicted long-term mean wind speeds at 60 m resulted in the following long-term mean wind speeds predictions at the proposed hub height at the location of each mast:

Mast	Long-term mean wind speed at hub height [m/s]		
	80 m	85 m	100 m
Faust	6.3	6.4	6.7
Crawford	6.7	6.8	7.2

The hub height wind speed frequency distributions have been derived by extrapolating the measured wind speed data on a time series basis. Specifically, power-law wind shear exponents were calculated on a ten-minute basis from the measured data and used to extrapolate the data recorded at 60 m to hub height. These data were combined with direction data recorded at 59 m to create a hub height wind speed and direction frequency distribution at hub height. The frequency distributions derived from this time series was then scaled to the relevant long-term hub height mean wind speed shown in the table above. The corresponding long-term joint wind speed and direction frequency distributions at 80 m hub height for the two site masts are represented in Tables 6.1 and 6.2 and in the form of wind roses in Figures 6.4 and 6.5.

The uncertainty associated with the extrapolation of the wind regime to hub height is considered in Section 6.6 and detailed in Appendix 1.

GH generally recommends that on-site masts are at least three-quarters of the proposed hub height. Both masts are less than three-quarters of two of the proposed hub heights and consequently, the uncertainty associated with the extrapolation of the wind regime is considerable, particularly for the 100 m hub height. However, as the Sodar measurements corroborate the results found from the mast measurements, the uncertainty is slightly mitigated.

6.6 Site wind speed variations

The large extent of the wind farm and the significant distances separating masts and wind turbine locations require careful consideration in the wind flow modelling.

The variation in wind speed over the wind farm site has been predicted using the WAsP computational flow model as described in Appendix 1. The wind flow model, initiated from the Faust and Crawford masts, has been used to predict the long-term wind regimes at the turbine locations.

The digital terrain map, which is a crucial input to the wind flow modelling, has been obtained by GH on behalf of the client. Roughness contours were digitised by hand using available satellite photography and map data as well as information gathered during the site visit.

The distance between the wind flow model initiation masts and several of the proposed turbine locations in these layouts is large. For example, the maximum mast-to-turbine spacing for Option 1 is 9 km and the average is 3.5 km. In this type of terrain, GH generally recommends that all proposed turbine locations are within 2 to 3 km of a measurement mast. Since this condition is not met, there is considerable uncertainty in predicting the variation in wind flow across the site. This has been accounted for in the uncertainty

analysis, as discussed in Appendix 1. Additional measurements conducted at the site in closer proximity to the proposed turbine locations would serve to further reduce these uncertainties.

A check was performed, predicting the wind speed at each measurement mast by initiating the WAsP model from the other mast.

Mast	Measurement height [m]	Long-term mean wind speed MCP [m/s]	Long-term mean wind speed WAsP [m/s]
Faust	60	5.8	5.8
Crawford	60	6.0	6.0

This shows good agreement between measured and predicted speeds at 60 m and gives some additional confidence in the performance of the WAsP model across the Arran site. However, due to higher wind shear predicted at Crawford, the hub height wind speeds modelled across the site using only the Crawford mast are approximately 3.5 % greater, on average, than using only the Faust mast.

To take advantage of the measurements made at each site mast, the wind flow model was initiated from the Faust and Crawford masts, based on nearest proximity of distance to each turbine location. The resulting mean wind speeds at each turbine have then been weighted-averaged based on their proximity to each mast.

Tables 5.2 to 5.4 show the predicted long-term mean wind speeds at each turbine at the proposed hub height for each layout option. The average long-term wind speed for the wind farm as a whole was found to be 6.4 m/s for Option 1, 6.8 m/s for Option 2 and 6.5 m/s for Option 3.

6.7 Long-term energy production prediction

The projected energy production of the wind farm is summarised in the table below; this represents an estimate of the annual production expected over the first 10 years of operation. Wind farms typically experience a “ramp up” in availability before mature operation is reached. A more detailed description of loss factors and the assumptions made within this analysis are included within Appendix 2 and the energy capture of individual turbines is presented in Tables 5.2 to 5.4. The expected variation of wind farm production with time is discussed in Appendix 3.

Layout Option	1	2	3	
Wind Farm Rated Power	**112**	**115**	**115**	**MW**
Gross Energy Output	319.3	340.9	306.6	GWh/annum
Wake effect	93.8	94.7	94.5	%
Availability	95.7	95.7	95.7	%
Electrical efficiency	97.0	97.0	97.0	%
Turbine performance	99.6	99.6	99.6	%
Environmental	98.8	98.8	98.8	%
Curtailment	100.0	100.0	100.0	%
Net Energy Output	**273.4**	**294.9**	**264.5**	**GWh/annum**
Net Capacity Factor	**27.9**	**29.2**	**26.2**	**%**

The table above includes potential sources of energy loss that have been estimated, assumed or not considered. The methods used to calculate losses, the losses for which assumptions have been necessary and those losses that have not been considered are discussed in detail in Appendix 2. It is recommended that the various loss factors included within Appendix 2 are reviewed and considered carefully. However, in particular it is noted that for this analysis the following general approach has been adopted:

Wake effects – A detailed calculation has been undertaken. No consideration has been given to the possibility of additional nearby projects being built;

Availability – A generic assumption has been made for availability ramp up and the availability that is expected in mature operation. The availability number presented is the average availability over the first 10 years of operation. The details of the track record of the specific turbine model, balance of plant infrastructure, local grid system and Operation and Maintenance arrangements have not been assessed. The above assumption is subject to change were such an assessment to be undertaken;

Electrical efficiency – A generic assumption has been made. The details of the specific balance of plant infrastructure and grid connection point have not been considered. The above assumption is subject to change if a detailed assessment of the electrical infrastructure were undertaken;

Turbine performance – An assumption for the ramp up in turbine performance has been taken into account. In addition, the impact of the site specific wind flow conditions on the turbine power curve has been evaluated. A calculation of high wind speed hysteresis losses has also been undertaken. The power curve assumptions made here are subject to change where a thorough review of the Turbine Supply Agreement and supporting contract documentation is undertaken;

Environmental – An estimate of losses due to blade degradation, icing and other environmental losses has been made; and

Curtailment – It has been assumed that no curtailment of the project is required. This assumption should be confirmed through suitable review of the building consent, grid connection and turbine supply agreements

6.8 Seasonal energy variation

The expected average seasonal variation in energy production has been approximately estimated from the available site measurements at the Faust and Crawford masts as well as the Goderich station.

Based on the predicted long-term hub height wind speed and direction frequency distributions at the Faust and Crawford masts, a power performance matrix was developed for the Arran Wind Energy Project. A time series of air density was developed from the combination of temperature and pressure records from the Faust and Crawford masts. By applying the approximately 3.4 years of concurrent density, wind speed and direction data recorded at the site to the performance matrix a simulated time series of power production data was produced.

Based on the above methodology, the expected seasonal variation in energy production is presented in Table 6.3. It is noted that the uncertainty associated with the prediction of any given month is significantly greater than that associated with the prediction of the annual energy production. It is also noted that the results presented are inclusive of topographical and array losses only.

6.9 Uncertainty analysis

The main sources of deviation from the central estimate have been quantified and are shown in Tables 6.4 to 6.9 for the three different layout options. The figures in each table are added as independent errors and the total errors in each table are added as dependent errors giving the following uncertainties in net energy production for the wind farm. These represent the standard deviation of what is assumed to be a Gaussian process:

Option	Turbine	Hub height [m]	1 year average [GWh/annum]	10 year average [GWh/annum]
1	GE1.6xle	80	46.4	31.0
2	GE2.5xl	100	51.9	36.8
3	GE2.5xl	85	46.1	30.9

The uncertainties that have been considered in the analysis of the wind farm include the following:

- The accuracy of the wind speed measurements;
- The accuracy of the wind speed correlations;
- The assumption that the period of historical data available is representative of the long-term wind regime;
- Wind shear extrapolation;
- The accuracy of the wind flow modelling;
- The accuracy of the wake modelling;
- The accuracy of the fiscal sub-station meter;
- The accuracy of the availability, electrical, turbine performance, environmental, and curtailment loss assumptions;
- The variability of the future annual wind speeds at the site.

There are several uncertainties for which only pragmatic assumptions have been made at this stage, including those listed below. It is recommended that the client consider each of these uncertainties carefully. They can often be mitigated to some extent, especially in early years of the project, through appropriate warranty provisions. Therefore, these uncertainties should be considered in detail in combination with these provisions, for instance as part of a full technical due diligence exercise. These uncertainties include:

- Availability;
- Electrical losses;
- Turbine performance;
- Environmental losses;
- Curtailment.

7 CONCLUSIONS AND RECOMMENDATIONS

Valid wind data have been recorded at the Arran site for 3.4 years. Based on the results from the analysis of these data the following conclusions are made concerning the site wind regime.

1. The long-term mean wind speed at the locations of the site masts are predicted to be:

Mast	Measurement height [m]	Mean wind speed at measurement height [m/s]	Mean wind speed at 80 m [m/s]	Mean wind speed at 85 m [m/s]	Mean wind speed at 100 m [m/s]
Faust	60	5.8	6.3	6.4	6.7
Crawford	60	6.0	6.7	6.8	7.2

2. The standard errors associated with the predictions of the long-term mean wind speeds at the proposed hub heights are shown in the table below. If a normal distribution is assumed, the confidence limits for the predictions are as follows:

Mast	Hub Height	Standard error [m/s]	Mean wind speed [m/s] Probability of exceedance		
			90 %	75 %	50 %
Faust	80	0.21	6.0	6.1	6.3
	85	0.22	6.1	6.2	6.4
	100	0.28	6.3	6.5	6.7
Crawford	80	0.23	6.4	6.5	6.7
	85	0.24	6.5	6.7	6.8
	100	0.32	6.8	7.0	7.2

Site wind flow and array loss calculations have been carried out and from these the following conclusions are drawn:

3. The long-term mean wind speed averaged over all turbine locations at hub height is predicted to be 6.4 m/s at 80 m, 6.5 m/s at 85 m and 6.8 m/s at 100 m.

4. The projected energy capture of the proposed wind farm over the first 10 years of operation is as follows, for the turbine models and hub heights under consideration. This includes calculation of wake and air density effects and assumptions or estimates for availability, electrical efficiency, turbine performance, environmental and curtailment losses.

Layout Option	Turbine Type	Hub Height [m]	Rated Capacity [MW]	Net output [GWh/annum]
1	GE 1.6xle	80	112	273.4
2	GE 2.5xl	100	115	294.9
3	GE 2.5xl	85	115	264.5

There are a number of other losses that could affect the net energy output of the wind farm, as detailed in Appendix 2, but these have not been considered here. It is recommended that the client considers each of these losses and the possible effects they may have on the net energy production.

The net energy predictions presented above represent the long-term mean, 50 % exceedance level, for the annual energy production of the wind farm. These values are the best estimate of the long-term mean values to be expected from the project. There is therefore a 50 % chance that, even when taken over very long periods, the mean energy production will be less than the value given.

5. The standard error associated with the prediction of energy capture has been calculated and the confidence limits for the prediction are given in the table below :

Layout Option	1 year average net energy production [GWh/annum]			10 year average net energy production [GWh/annum]		
Probability of exceedance	90 %	75 %	50 %	90 %	75 %	50 %
1	213.9	242.1	273.4	233.7	252.5	273.4
2	228.3	259.8	294.9	247.6	270.0	294.9
3	205.4	233.4	264.5	225.0	243.7	264.5

There are a number of uncertainties that have been considered only as a combined overall uncertainty at this stage, as detailed in Section 6. It is recommended that the client consider each of these uncertainties carefully. They can often be mitigated to some extent, especially in early years of the project, through appropriate warranty provisions. Therefore these uncertainties should be considered in combination with these provisions, for instance as part of a full technical due diligence exercise.

6. The energy production of the wind farm is expected to be characterised by a “ramp up” in availability and, potentially, other time dependent loss factors. The results presented here assume availability levels averaged over the first 10 years of operation and an indication of the expected variation of wind farm production with time is discussed in Appendix 3.

Period	Turbine availability [%]	Turbine performance [%]	Net Energy Production [GWh/annum]		
			Option 1	Option 2	Option 3
Year 1	94.0	99.0	265.8	286.7	257.2
Year 2	95.5	99.0	270.1	291.3	261.3
Year 3	96.0	99.0	271.5	292.8	262.6
Year 4	96.5	99.0	272.9	294.3	264.0
Mature operation	96.5	100.0	275.7	297.3	266.7
Average over first 10 years of operation	**96.1**	**99.6**	**273.4**	**294.9**	**264.5**

7. GH generally recommends that on-site masts are at least three-quarters of the proposed hub height. Both masts are less than three-quarters of two of the proposed hub heights and consequently, the uncertainty associated with the extrapolation of the wind regime to hub height is considerable, particularly for the 100 m hub height. This shear uncertainty at this site is somewhat mitigated by the Sodar measurements, which broadly support the measured shear at the mast locations.

8. In this type of terrain, GH generally recommends that all proposed turbine locations are within 2 to 3 km of a measurement mast. Since this condition is not met, there is considerable uncertainty in predicting the variation in wind flow across the site. This has been accounted for in the uncertainty analysis, as discussed in Appendix 1. Additional measurements conducted at the site in closer proximity to the proposed turbine locations would serve to further reduce these uncertainties.

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9 LIST OF TABLES

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Location	Description of measurements	Period
Faust mast (477013, 4920085)[1]	Ten minute mean, max, min and standard deviation of wind speed at heights of 60 m, 45 m, and 30 m; and mean and standard deviation of wind direction at heights of 59 m, 44 m and 29 m, and temperature.	Sep 2006 to Jan 2010
Crawford mast (477519, 4923943)[1]	Ten minute mean, max, min and standard deviation of wind speed at heights of 60 m, 45 m, and 30 m; and mean and standard deviation of wind direction at heights of 59 m, 44 m and 29 m, and temperature.	Oct 2006 to Jan 2010
Sodar Faust (near the Faust mast) (477147, 4920157) [1]	Ten minute wind speed and direction at heights between 30 m and 140 m at 5 m increments.	May 2007 to July 2007
Sodar Crawford (near the Crawford mast) (477587, 4923861) [1]	Ten minute wind speed and direction at heights between 30 m and 140 m at 5 m increments.	Oct 2006 to Jan 2007
Goderich Meteorological Station (441533, 4786608)[1]	Hourly mean wind speed, direction at a height of 10 m. Temperature and pressure.	Feb 1994 to Dec 2009

Notes: 1. Co-ordinate system is UTM Zone 17T, NAD83 datum.

Table 2.1 Summary of anemometry and Sodar measurements made at the Arran site and Goderich Meteorological Station.

Mast	Height [m]	Orientation [degrees]	Period	Slope applied by datalogger [m]	Offset applied by datalogger [m/s]	Slope desired [m]	Offset desired [m/s]
Faust	60	115	2/9/2006 to 1/9/2009	0.768	0.35	0.765	0.416
			1/9/2009 to 13/1/2010	0.768	0.35	0.761	0.35
	60	292	2/9/2006 to 1/9/2009	0.768	0.35	0.7659	0.3976
			1/9/2009 to 13/1/2010	0.768	0.35	0.754	0.41
	45	115	2/9/2006 to 1/9/2009	0.765	0.35	0.763	0.4049
			1/9/2009 to 13/1/2010	0.765	0.35	0.758	0.38
	45	292	2/9/2006 to 1/9/2009	0.768	0.35	0.7658	0.3902
			1/9/2009 to 13/1/2010	0.768	0.35	0.757	0.34
	30	115	2/9/2006 to 1/9/2009	0.765	0.35	0.7634	0.3936
			1/9/2009 to 13/1/2010	0.765	0.35	0.761	0.33
	30	292	2/9/2006 to 1/9/2009	0.767	0.35	0.7651	0.3921
			1/9/2009 to 13/1/2010	0.767	0.35	0.755	0.40

Table 2.2 Summary of the transfer functions and adjustments applied to wind speed data at Faust.

Mast	Height [m]	Orientation [degrees]	Period	Slope applied by datalogger [m]	Offset applied by datalogger [m/s]	Slope desired [m]	Offset desired [m/s]
Crawford	60	120	28/10/2006 to 6/5/2009	0.765	0.35	0.7613	0.3912
			6/5/2009 to 1/2/2010	0.765	0.35	0.757	0.34
	60	295	28/10/2006 to 6/5/2009	0.771	0.35	0.7702	0.3728
			6/5/2009 to 1/2/2010	0.771	0.35	0.757	0.36
	45	120	28/10/2006 to 6/5/2009	0.766	0.35	0.7674	0.3985
			6/5/2009 to 1/2/2010	0.766	0.35	0.759	0.37
	45	295	28/10/2006 to 6/5/2009	0.77	0.35	0.7679	0.3888
			6/5/2009 to 1/2/2010	0.77	0.35	0.761	0.35
	30	125	28/10/2006 to 6/5/2009	0.77	0.35	0.7643	0.3816
			6/5/2009 to 1/2/2010	0.77	0.35	0.76	0.35
	30	300	28/10/2006 to 6/5/2009	0.77	0.35	0.7677	0.393
			6/5/2009 to 1/2/2010	0.77	0.35	0.757	0.35

Table 2.3 Summary of the transfer functions and adjustments applied to wind speed data at Crawford.

Month	Mean wind speed [m/s]		Wind speed data coverage [%]		Wind direction data coverage [%]
	60 m[1]	60 m[2]	60 m[1]	60 m[2]	29 m
Sep-06	5.2	5.3	96	96	96
Oct-06	6.7	6.7	97	97	97
Nov-06	5.6	5.6	100	100	100
Dec-06	7.1	7.1	100	100	97
Jan-07	-	6.7	0	93	88
Feb-07	7.3	-	97	0	98
Mar-07	6.9	6.9	97	97	98
Apr-07	6.2	6.2	99	99	99
May-07	5.0	5.0	99	99	98
Jun-07	4.8	4.8	100	100	100
Jul-07	4.6	4.5	100	100	100
Aug-07	4.9	4.9	100	100	100
Sep-07	5.8	5.8	100	100	100
Oct-07	6.3	6.3	100	100	100
Nov-07	6.9	6.9	99	99	99
Dec-07	-	6.7	0	98	91
Jan-08	7.4	7.4	98	98	92
Feb-08	6.3	6.3	100	99	81
Mar-08	6.3	6.3	100	100	97
Apr-08	6.5	6.4	100	100	100
May-08	6.0	5.9	99	99	99
Jun-08	-	5.1	0	100	100
Jul-08	5.1	5.0	100	100	100
Aug-08	4.7	4.7	100	100	100
Sep-08	4.7	4.7	99	99	100
Oct-08	5.8	5.8	100	100	100
Nov-08	6.2	6.2	100	100	99
Dec-08	7.8	7.9	98	96	90
Jan-09	-	5.9	0	99	99
Feb-09	6.6	6.5	97	97	93
Mar-09	6.2	6.2	99	99	98
Apr-09	7.0	6.9	98	75	98
May-09	6.1	-	99	0	99
Jun-09	3.9	-	100	0	100
Jul-09	4.6	-	100	0	100
Aug-09	4.9	-	100	0	100
Sep-09	4.5	4.5	99	98	99
Oct-09	5.8	5.8	100	100	100
Nov-09	5.3	5.3	100	100	100
Dec-09	6.3	6.3	100	100	91
Jan-10	6.0	6.0	96	96	92

Notes: 1. Anemometer is orientated to the southeast [115º].
2. Anemometer is orientated to the northwest [292º].

Table 4.1 Measurements made at Faust at a height of 60 m.

Month	Mean wind speed [m/s]		Wind speed data coverage [%]		Wind direction data coverage [%]
	60 m[1]	60 m[2]	60 m[1]	60 m[2]	44 m
Oct-06	9.7	9.9	13	13	12
Nov-06	5.6	5.8	100	93	100
Dec-06	7.3	7.3	98	98	100
Jan-07	6.8	-	95	0	74
Feb-07	7.8	7.8	100	100	98
Mar-07	7.0	7.1	98	98	98
Apr-07	6.4	6.4	100	100	100
May-07	5.1	5.2	100	100	100
Jun-07	4.9	5.0	100	100	100
Jul-07	4.7	4.7	100	100	100
Aug-07	5.2	5.2	100	100	100
Sep-07	5.8	5.9	100	100	100
Oct-07	6.5	6.5	100	100	100
Nov-07	7.0	7.1	99	99	99
Dec-07	-	7.0	0	98	96
Jan-08	7.6	7.6	99	99	99
Feb-08	6.4	6.4	99	99	95
Mar-08	-	6.5	0	100	97
Apr-08	6.5	-	100	0	100
May-08	6.0	6.1	100	100	100
Jun-08	5.2	5.3	100	100	100
Jul-08	5.2	5.2	100	100	100
Aug-08	4.8	4.8	100	100	100
Sep-08	4.8	4.8	100	100	100
Oct-08	5.9	6.0	100	100	99
Nov-08	6.2	6.2	100	100	97
Dec-08	7.9	8.0	97	95	91
Jan-09	6.2	6.2	100	100	100
Feb-09	6.5	6.7	98	95	90
Mar-09	6.3	6.4	99	99	97
Apr-09	7.2	-	94	0	92
May-09	6.6	6.6	67	67	67
Jun-09	3.4	3.5	7	7	7
Jul-09	4.7	4.8	99	99	98
Aug-09	5.0	5.0	99	99	99
Sep-09	4.6	4.7	100	100	100
Oct-09	6.1	6.1	100	100	100
Nov-09	5.5	5.5	100	100	100
Dec-09	6.7	6.7	99	99	97
Jan-10	6.1	6.1	96	96	87
Feb-10	10.6	10.7	0	0	0

Notes: 1. Anemometer is orientated to the southeast [120º].
2. Anemometer is orientated to the northwest [295º].

Table 4.2 Measurements made at Crawford at a height of 60 m.

Month	Mean wind speed [m/s]															
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	-	5.7	5.9	7.0	5.3	6.2	5.4	4.8	6.2	5.9	6.7	5.2	5.7	5.8	6.4	5.2
Feb	5.6	5.9	5.1	5.0	4.1	5.2	4.8	5.6	6.4	5.3	4.5	4.7	5.8	6.6	5.3	4.9
Mar	4.1	4.3	5.2	5.0	5.8	5.4	4.6	4.4	5.8	4.7	5.0	4.0	4.7	5.5	5.1	4.9
Apr	5.1	5.4	5.1	4.7	4.2	4.7	4.7	4.9	4.9	5.2	5.1	4.8	4.6	5.0	4.8	5.8
May	4.0	4.0	4.3	4.9	3.7	4.2	4.5	4.4	5.2	4.7	4.4	3.6	4.4	3.9	4.7	4.4
Jun	3.5	3.3	3.4	3.5	3.5	3.4	4.5	3.2	3.5	3.9	3.9	3.7	3.8	3.7	4.0	3.2
Jul	3.4	3.6	3.4	3.2	3.3	3.4	3.6	3.8	3.4	3.6	3.3	3.1	3.7	3.5	3.6	3.2
Aug	3.5	3.3	2.9	3.7	3.2	3.4	3.6	3.8	3.6	3.2	3.9	3.3	3.5	3.6	3.4	3.9
Sep	3.9	3.9	3.6	4.6	3.8	4.1	4.5	4.3	3.9	4.4	3.3	4.0	4.2	4.2	3.3	3.6
Oct	4.5	5.9	5.3	4.7	5.0	5.3	4.0	5.9	4.7	4.8	5.0	4.0	5.4	5.2	4.8	4.9
Nov	6.5	6.3	5.4	5.0	5.8	5.9	5.6	5.5	5.7	5.8	5.0	7.1	4.1	5.8	5.6	4.4
Dec	4.4	6.0	5.3	5.1	6.0	6.0	5.7	6.2	6.3	5.7	6.5	6.1	6.3	5.9	7.0	6.1
Annual	**4.4**	**4.8**	**4.6**	**4.7**	**4.5**	**4.8**	**4.6**	**4.7**	**5.0**	**4.8**	**4.7**	**4.5**	**4.7**	**4.9**	**4.8**	**4.5**

Table 4.3 Measurements made at the Goderich Meteorological Station.

Hub height wind speed [m/s]	Electrical power [kW]	
	GE 1.6xle	GE 2.5xl
3	0	2
3.5	14	37
4	57	91
4.5	109	149
5	170	221
5.5	239	309
6	320	414
6.5	414	539
7	525	685
7.5	650	853
8	793	1044
8.5	950	1261
9	1114	1506
9.5	1267	1755
10	1412	1977
10.5	1523	2165
11	1583	2308
11.5	1600	2403
12	1600	2457
12.5	1600	2485
13	1600	2495
13.5	1600	2498
14 - 25	1600	2500
Diameter	82.5 m	100 m
Hub height	80 m	85 m or 100 m
Rotor speed	9.0 to 18.0 rpm	5.0 to 14.0 rpm
Air Density	1.225 kg/m^3	1.225 kg/m^3
Turbulence intensity	10 % to 15 %	'Normal'
Peak Cp	0.47	0.43
Cut-out ten-minute mean wind speed	25 m/s	25 m/s

Table 5.1 Performance data for the GE 1.6xle and GE 2.5xl wind turbines.

Turbine	Initiation Mast	Easting[1] [m]	Northing[1] [m]	Effective hub height[2] [m]	Mean hub height wind speed[3] [m/s]	Energy output[4] [GWh/annum]	Wake Loss[5] [%]
01-02-N	Faust	478493	4915888	80	6.4	3.9	5.7
01-02-S	Faust	478475	4915433	80	6.4	4.0	2.9
01-08-N	Faust	480877	4916541	78	6.3	3.8	6.9
01-08-S	Faust	480776	4916122	79	6.4	4.0	4.1
01-09	Faust	481233	4916372	80	6.3	3.8	7.2
01-10	Faust	481563	4916215	80	6.3	3.9	5.1
01-19	Faust	485225	4917262	79	6.2	3.8	3.6
02-01	Faust	477879	4916864	80	6.4	4.0	4.9
02-02	Faust	478296	4916386	78	6.3	3.9	5.8
02-04	Faust	479115	4916475	78	6.3	3.9	4.2
02-10-N	Faust	481345	4917352	78	6.3	3.7	7.6
02-10-S	Faust	481609	4916916	79	6.3	3.7	7.6
02-11	Faust	481895	4917254	79	6.3	3.8	6.4
02-14	Faust	483258	4917525	79	6.3	3.9	3.2
02-16	Faust	483886	4917583	79	6.3	3.9	4.0
02-17	Faust	484313	4917701	77	6.2	3.7	4.8
02-18	Faust	484713	4917676	77	6.2	3.7	5.4
02-19	Faust	485120	4917874	79	6.2	3.8	5.3
03-01	Faust	477820	4917815	79	6.3	3.9	6.0
03-02	Faust	478141	4917587	80	6.4	3.9	7.0
03-14	Faust	482845	4918734	79	6.3	3.9	4.3
03-16	Faust	483564	4918961	79	6.2	3.8	4.6
03-18	Faust	484409	4919172	79	6.3	3.9	4.9
03-19	Faust	484802	4919334	79	6.2	3.8	4.3
04-01	Faust	477471	4918905	80	6.3	3.8	8.1
04-02-N	Faust	477902	4918863	80	6.3	3.6	11.7
04-02-S	Faust	477791	4918478	79	6.3	3.7	8.6
04-03	Faust	478165	4918539	78	6.3	3.7	9.6
04-11	Faust	481611	4919216	80	6.4	4.0	4.2
04-12	Faust	481734	4919702	79	6.3	3.8	5.1
05-02	Faust	477598	4919790	78	6.3	3.8	8.7
05-03	Faust	478005	4919940	78	6.3	3.8	8.2
05-06	Faust	479384	4920171	79	6.2	3.7	7.6
05-07	Faust	479573	4920401	78	6.3	3.6	9.9
05-08-N	Faust	480088	4920463	78	6.3	3.7	7.7
05-08-S	Faust	479948	4920064	79	6.4	3.9	6.9

Notes:
1. Co-ordinate system is UTM Zone 17T, NAD83 datum.
2. Hub height displaced to account for the obstacle effect of nearby trees.
3. Wind speed at the location of the turbine, not including wake effects.
4. Individual turbine output figures include all wind farm losses.
5. Individual turbine wake loss including all wake effects.

Table 5.2 (continued) Turbine Option 1 with predicted wind speed and energy production

Turbine	Initiation Mast	Easting[1] [m]	Northing[1] [m]	Effective hub height[2] [m]	Mean hub height wind speed[3] [m/s]	Energy output[4] [GWh/annum]	Wake Loss[5] [%]
06-01	Faust	477140	4920165	79	6.3	3.7	8.5
06-02	Faust	477358	4920673	79	6.3	3.8	8.2
06-04	Faust	478273	4920663	79	6.4	3.9	7.4
06-05	Faust	478629	4920439	79	6.4	3.8	7.7
07-01	Faust	476788	4921813	80	6.5	4.1	7.8
07-02	Faust	477191	4921899	80	6.5	4.0	9.1
07-03	Faust	477627	4921672	80	6.5	4.1	7.7
08-01	Crawford	476668	4922176	78	6.5	4.0	6.9
08-02	Crawford	477071	4922693	80	6.6	4.1	6.8
08-03	Crawford	477462	4922520	79	6.5	4.0	9.3
08-04	Crawford	477808	4922435	78	6.4	3.8	8.2
09-02	Crawford	476870	4923724	80	6.6	4.2	5.2
09-03	Crawford	477139	4924038	80	6.6	4.2	6.5
09-04	Crawford	477531	4923981	79	6.7	4.3	6.0
14-17	Faust	484629	4915685	79	6.3	4.0	1.6
A-03-E	Faust	476579	4915893	79	6.4	3.9	6.5
A-03-W	Faust	476321	4915626	80	6.4	4.0	2.9
A-05	Faust	476371	4916544	80	6.3	3.9	6.0
A-05	Faust	475935	4916360	80	6.3	4.0	3.5
A-13	Faust	475681	4919844	79	6.4	4.0	4.2
A-17	Faust	475124	4921365	79	6.5	4.2	3.1
A-20	Crawford	475161	4922449	80	6.5	4.1	3.9
B-04	Faust	476865	4916228	78	6.3	3.9	5.8
B-11	Faust	476310	4919006	79	6.3	4.0	4.2
B-12	Faust	476551	4919515	77	6.3	3.8	7.6
B-13	Faust	476507	4919927	79	6.3	3.7	10.2
B-14	Faust	476097	4920196	79	6.4	3.9	7.5
B-15	Faust	476174	4920560	79	6.4	3.8	9.5
RR-07-W	Crawford	473908	4923263	80	6.7	4.4	3.2
RR-08-E	Crawford	474376	4923544	79	6.5	4.1	5.6
RR-08-W	Crawford	473863	4923738	80	6.6	4.2	4.7
RR-09-E	Crawford	474543	4923963	78	6.5	3.9	8.2
RR-09-W	Crawford	474167	4924186	79	6.6	4.1	5.6
RR-10	Crawford	474824	4924284	78	6.5	4.0	5.6

Notes:
1. Co-ordinate system is UTM Zone 17T, NAD83 datum.
2. Hub height displaced to account for the obstacle effect of nearby trees.
3. Wind speed at the location of the turbine, not including wake effects.
4. Individual turbine output figures include all wind farm losses.
5. Individual turbine wake loss including all wake effects.

Table 5.2 Turbine Option 1 with predicted wind speed and energy production (concluded)

Turbine	Initiation Mast	Easting[1] [m]	Northing[1] [m]	Effective hub height[2] [m]	Mean hub height wind speed[3] [m/s]	Energy output[4] [GWh/annum]	Wake Loss[5] [%]
01-02	Faust	478508	4915422	100	6.7	6.3	4.4
01-08	Faust	480722	4916380	98	6.7	6.2	3.6
01-09	Faust	481143	4916344	100	6.7	6.1	5.5
01-10	Faust	481528	4916202	100	6.7	6.2	4.0
02-01	Faust	477879	4916864	100	6.7	6.2	5.3
02-02	Faust	478316	4916419	99	6.7	6.2	5.5
02-04	Faust	479115	4916475	98	6.6	6.1	4.7
02-11	Faust	481965	4917373	100	6.7	6.3	3.1
03-02	Faust	478065	4917864	98	6.7	6.3	5.1
04-11	Faust	481638	4919245	100	6.8	6.4	2.9
05-02	Faust	477645	4919979	97	6.7	6.1	5.7
05-03	Faust	478042	4920055	96	6.7	6.0	6.7
05-07	Faust	479573	4920401	98	6.7	6.1	5.0
05-08-N	Faust	480065	4920512	98	6.7	6.1	6.6
05-08-S	Faust	480183	4919958	100	6.7	6.2	4.8
06-04	Faust	478320	4920740	100	6.9	6.5	6.3
07-01	Faust	476812	4921815	100	7.0	6.6	8.6
07-02	Faust	477191	4921899	100	7.0	6.5	9.9
07-03	Faust	477614	4921670	100	7.0	6.6	7.6
08-01	Crawford	476668	4922176	98	7.0	6.5	7.2
08-03	Crawford	477385	4922386	98	7.0	6.5	7.7
09-03	Crawford	477066	4923795	100	7.2	7.2	4.3
09-04	Crawford	477535	4923984	99	7.3	7.2	4.6
11-17	Faust	473442	4921146	97	6.9	6.8	2.4
14-03	Faust	478977	4914738	98	6.7	6.3	3.2
14-04	Faust	479509	4914725	100	6.7	6.3	3.7
A-03-E	Faust	476615	4915697	97	6.7	6.2	5.7
A-03-W	Faust	476226	4915820	100	6.8	6.5	3.7
A-05	Faust	476008	4916581	100	6.7	6.2	4.2
A-09	Faust	475820	4918195	100	6.7	6.3	3.8
A-11	Faust	475856	4919052	98	6.7	6.0	7.2
A-12	Faust	475507	4919303	100	6.8	6.3	5.5
A-14	Faust	475486	4920202	100	6.8	6.3	5.9
A-17	Faust	475124	4921365	99	7.0	6.7	4.8

Notes:
1. Co-ordinate system is UTM Zone 17T, NAD83 datum.
2. Hub height displaced to account for the obstacle effect of nearby trees.
3. Wind speed at the location of the turbine, not including wake effects.
4. Individual turbine output figures include all wind farm losses.
5. Individual turbine wake loss including all wake effects.

Table 5.3 Turbine Option 2 with predicted wind speed and energy production (continued)

Turbine	Initiation Mast	Easting[1] [m]	Northing[1] [m]	Effective hub height[2] [m]	Mean hub height wind speed[3] [m/s]	Energy output[4] [GWh/annum]	Wake Loss[5] [%]
B-04	Faust	476985	4916176	97	6.7	6.1	5.8
B-11	Faust	476373	4918986	99	6.7	6.1	6.8
B-14	Faust	476097	4920196	99	6.7	6.1	6.8
B-35	Faust	477270	4914012	98	6.6	6.2	1.5
RR-07-E	Crawford	474359	4923158	99	7.0	6.7	5.7
RR-07-W	Crawford	473894	4923225	100	7.1	7.1	4.3
RR-08	Crawford	473783	4923783	100	7.1	6.9	5.1
RR-09-E	Crawford	474543	4923963	98	7.0	6.5	7.0
RR-09-W	Crawford	474063	4924238	99	7.1	6.8	5.9
RR-10	Crawford	474723	4924371	98	7.0	6.6	6.3
RWS-32	Faust	474248	4920079	99	7.0	6.8	3.0
RWS-34	Faust	474085	4920725	99	7.0	6.8	5.0

Notes:
1. Co-ordinate system is UTM Zone 17T, NAD83 datum.
2. Hub height displaced to account for the obstacle effect of nearby trees.
3. Wind speed at the location of the turbine, not including wake effects.
4. Individual turbine output figures include all wind farm losses.
5. Individual turbine wake loss including all wake effects.

Table 5.3 Turbine Option 2 with predicted wind speed and energy production (concluded)

Turbine	Initiation Mast	Easting[1] [m]	Northing[1] [m]	Effective hub height[2] [m]	Mean hub height wind speed[3] [m/s]	Energy output[4] [GWh/annum]	Wake Loss[5] [%]
01-02	Faust	478508	4915422	85	6.5	5.7	4.5
01-08	Faust	480722	4916380	83	6.4	5.6	3.7
01-09	Faust	481143	4916344	85	6.4	5.5	5.7
01-10	Faust	481528	4916202	85	6.4	5.6	4.3
02-01	Faust	477879	4916864	85	6.5	5.7	5.5
02-02	Faust	478316	4916419	84	6.4	5.6	5.7
02-04	Faust	479115	4916475	83	6.4	5.5	5.0
02-11	Faust	481965	4917373	85	6.4	5.7	3.3
03-02	Faust	478065	4917864	83	6.5	5.7	5.3
04-11	Faust	481638	4919245	85	6.5	5.8	3.1
05-02	Faust	477645	4919979	82	6.4	5.4	5.9
05-03	Faust	478042	4920055	81	6.4	5.4	7.0
05-07	Faust	479573	4920401	83	6.4	5.5	5.2
05-08-N	Faust	480065	4920512	83	6.4	5.4	6.9
05-08-S	Faust	480183	4919958	85	6.4	5.6	5.1
06-04	Faust	478320	4920740	85	6.6	5.8	6.7
07-01	Faust	476812	4921815	85	6.7	5.9	8.9
07-02	Faust	477191	4921899	85	6.7	5.7	10.4
07-03	Faust	477614	4921670	85	6.6	5.9	8.1
08-01	Crawford	476668	4922176	83	6.6	5.8	7.5
08-03	Crawford	477385	4922386	83	6.7	5.8	8.3
09-03	Crawford	477066	4923795	85	6.8	6.3	4.6
09-04	Crawford	477535	4923984	84	6.8	6.3	5.0
11-17	Faust	473442	4921146	82	6.6	6.1	2.4
14-03	Faust	478977	4914738	83	6.4	5.6	3.3
14-04	Faust	479509	4914725	85	6.4	5.7	3.9
A-03-E	Faust	476615	4915697	82	6.4	5.6	5.9
A-03-W	Faust	476226	4915820	85	6.6	6.0	3.7
A-05	Faust	476008	4916581	85	6.4	5.6	4.2
A-09	Faust	475820	4918195	85	6.4	5.7	3.9
A-11	Faust	475856	4919052	83	6.4	5.4	7.5
A-12	Faust	475507	4919303	85	6.5	5.7	5.6
A-14	Faust	475486	4920202	85	6.5	5.6	6.1
A-17	Faust	475124	4921365	84	6.6	6.0	4.9

Notes:
1. Co-ordinate system is UTM Zone 17T, NAD83 datum.
2. Hub height displaced to account for the obstacle effect of nearby trees.
3. Wind speed at the location of the turbine, not including wake effects.
4. Individual turbine output figures include all wind farm losses.
5. Individual turbine wake loss including all wake effects.

Table 5.4 Turbine Option 3 with predicted wind speed and energy production (continued)

Turbine	Initiation Mast	Easting[1] [m]	Northing[1] [m]	Effective hub height[2] [m]	Mean hub height wind speed[3] [m/s]	Energy output[4] [GWh/annum]	Wake Loss[5] [%]
B-04	Faust	476985	4916176	82	6.4	5.5	6.0
B-11	Faust	476373	4918986	84	6.4	5.5	7.1
B-14	Faust	476097	4920196	84	6.4	5.5	7.2
B-35	Faust	477270	4914012	83	6.4	5.7	1.5
RR-07-E	Crawford	474359	4923158	84	6.7	6.0	6.0
RR-07-W	Crawford	473894	4923225	85	6.8	6.3	4.3
RR-08	Crawford	473783	4923783	85	6.8	6.2	5.1
RR-09-E	Crawford	474543	4923963	83	6.6	5.8	7.4
RR-09-W	Crawford	474063	4924238	84	6.7	6.0	6.2
RR-10	Crawford	474723	4924371	83	6.6	5.8	6.9
RWS-32	Faust	474248	4920079	84	6.7	6.3	3.1
RWS-34	Faust	474085	4920725	84	6.7	6.1	5.2

Notes:
1. Co-ordinate system is UTM Zone 17T, NAD83 datum.
2. Hub height displaced to account for the obstacle effect of nearby trees.
3. Wind speed at the location of the turbine, not including wake effects.
4. Individual turbine output figures include all wind farm losses.
5. Individual turbine wake loss including all wake effects.

Table 5.4 Turbine Option 3 with predicted wind speed and energy production (concluded)

Site: Faust at 80 m **Period: Annual (September 2006 to January 2010)**

Wind speed (m/s)	Wind Direction (degrees)												No direction	Total [%]
	0	30	60	90	120	150	180	210	240	270	300	330		
0	0.05	0.04	0.06	0.04	0.04	0.11	0.13	0.08	0.06	0.08	0.08	0.05	0.03	0.87
1	0.15	0.18	0.18	0.13	0.18	0.30	0.34	0.19	0.17	0.21	0.25	0.19	0.10	2.57
2	0.23	0.34	0.32	0.24	0.31	0.52	0.54	0.34	0.27	0.45	0.55	0.39	0.10	4.60
3	0.44	0.66	0.58	0.38	0.46	0.75	0.74	0.56	0.47	0.81	1.14	0.74	0.15	7.89
4	0.69	1.06	0.85	0.54	0.59	1.04	0.99	0.90	0.66	1.14	1.69	1.08	0.23	11.49
5	0.97	1.25	1.01	0.64	0.75	1.45	1.38	1.25	0.89	1.17	1.69	1.29	0.26	14.00
6	0.88	1.16	0.97	0.72	0.84	1.96	1.74	1.65	0.93	1.06	1.40	1.22	0.20	14.72
7	0.69	0.82	0.79	0.58	0.73	1.98	1.97	1.70	0.91	0.92	1.10	0.91	0.14	13.23
8	0.43	0.49	0.50	0.33	0.53	1.56	1.70	1.51	0.87	0.84	0.93	0.67	0.13	10.50
9	0.26	0.27	0.27	0.19	0.37	0.99	1.15	1.13	0.76	0.71	0.74	0.48	0.12	7.45
10	0.14	0.14	0.12	0.11	0.23	0.60	0.79	0.81	0.57	0.53	0.51	0.29	0.09	4.93
11	0.08	0.07	0.05	0.07	0.14	0.39	0.51	0.53	0.41	0.39	0.33	0.17	0.05	3.18
12	0.04	0.02	0.02	0.03	0.09	0.27	0.28	0.31	0.28	0.28	0.21	0.11	0.02	1.96
13	0.02	0.01	0.01	0.01	0.05	0.16	0.15	0.16	0.18	0.19	0.15	0.07	0.01	1.16
14	0.01	+	+	+	0.03	0.08	0.09	0.08	0.13	0.11	0.11	0.04	+	0.68
15	0.01		+	+	0.02	0.04	0.05	0.04	0.08	0.06	0.06	0.02	+	0.37
16	+				0.01	0.02	0.02	0.02	0.05	0.04	0.03	0.01	+	0.20
17					+	0.01	0.01	0.01	0.03	0.03	0.01	+		0.10
18					+	+	+	0.01	0.01	0.01	0.01			0.05
19						+	+	0.01	+	+	+			0.02
20							+	+	+	+	+			0.01
21							+	+	+					+
22								+	+					+
23								+						+
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														
36 and over														
Total [%]	5.10	6.51	5.74	4.00	5.35	12.23	12.59	11.31	7.76	9.03	11.00	7.73	1.63	100
Mean speed [m/s]	5.65	5.37	5.39	5.53	6.02	6.52	6.68	6.98	7.19	6.55	6.07	5.87	5.60	6.28

Note + indicates non-zero percentage <0.005%, blank indicates zero percentage

Table 6.1 Predicted long-term wind speed and direction frequency distribution at Faust at a hub height of 80 m.

Site: Crawford at 80 m **Period: Annual (October 2006 to January 2010)**

Wind speed (m/s)	Wind Direction (degrees)												No direction	Total [%]
	0	30	60	90	120	150	180	210	240	270	300	330		
0	0.02	0.04	0.02	0.04	0.04	0.04	0.04	0.03	0.05	0.04	0.04	0.03	0.02	0.46
1	0.08	0.12	0.16	0.19	0.19	0.21	0.20	0.18	0.16	0.15	0.12	0.12	0.08	1.96
2	0.17	0.26	0.36	0.42	0.36	0.44	0.36	0.27	0.29	0.38	0.33	0.25	0.09	3.98
3	0.33	0.50	0.58	0.56	0.59	0.67	0.60	0.46	0.42	0.80	0.73	0.54	0.13	6.90
4	0.59	0.81	0.87	0.74	0.72	0.86	0.85	0.64	0.62	1.28	1.17	0.87	0.19	10.20
5	0.90	1.02	0.99	0.83	1.02	1.12	1.16	0.97	0.84	1.41	1.46	1.15	0.26	13.13
6	0.96	0.98	0.87	0.80	1.13	1.52	1.56	1.28	0.91	1.40	1.43	1.27	0.21	14.32
7	0.90	0.72	0.79	0.72	0.87	1.82	2.02	1.49	1.02	1.11	1.21	1.20	0.15	14.02
8	0.62	0.46	0.62	0.44	0.44	1.41	1.79	1.45	0.95	0.97	0.98	0.99	0.10	11.23
9	0.29	0.23	0.42	0.28	0.22	0.78	1.09	1.31	0.82	0.88	0.90	0.74	0.08	8.04
10	0.15	0.13	0.23	0.15	0.13	0.42	0.61	1.06	0.66	0.77	0.78	0.60	0.07	5.75
11	0.10	0.07	0.09	0.09	0.07	0.24	0.31	0.70	0.52	0.55	0.58	0.43	0.04	3.79
12	0.06	0.03	0.03	0.06	0.03	0.13	0.15	0.40	0.39	0.41	0.40	0.25	0.02	2.36
13	0.03	0.01	0.01	0.03	0.02	0.05	0.10	0.22	0.30	0.31	0.27	0.15	0.01	1.51
14	0.02	+	+	0.01	0.02	0.02	0.04	0.12	0.20	0.20	0.18	0.11	0.01	0.92
15	+		+	+	+	0.01	0.02	0.07	0.11	0.13	0.12	0.08	0.01	0.57
16	+			+	+	+	0.01	0.04	0.07	0.10	0.08	0.05	0.01	0.38
17						+	+	0.02	0.05	0.06	0.06	0.02	0.01	0.22
18						+	+	0.01	0.04	0.03	0.04	0.01	+	0.13
19							+	+	0.03	0.01	0.02	+	+	0.07
20								+	0.02	+	0.01	+		0.03
21									0.01	+	0.01	+		0.01
22								+	0.01		+			0.01
23								+	+		+			+
24									+		+			+
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														
36 and over														
Total [%]	5.23	5.37	6.04	5.36	5.87	9.72	10.91	10.75	8.50	10.99	10.90	8.85	1.51	100
Mean speed [m/s]	6.11	5.51	5.68	5.51	5.49	6.35	6.70	7.55	7.74	7.12	7.20	6.97	5.87	6.67

Note + indicates non-zero percentage <0.005%, blank indicates zero percentage

Table 6.2 Predicted long-term wind speed and direction frequency distribution at Crawford at a hub height of 80 m.

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Turbine Type	Hub Height [m]	Proportion of Energy Production [% of total]											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GE 1.6xle	80	12.8	10.7	9.4	8.6	6.8	4.6	3.6	3.9	5.8	9.1	11.7	13.1
GE 2.5xl	85	12.9	10.7	9.4	8.6	6.8	4.5	3.6	3.8	5.7	9.1	11.8	13.2
GE 2.5xl	100	12.7	10.6	9.4	8.6	6.9	4.7	3.7	4.0	5.9	9.1	11.6	12.9

Table 6.3 **Predicted monthly energy production of the Arran Wind Energy Project as a percentage of total energy production using data recorded during the period of October 2006 to February 2010.**

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Source of uncertainty	Wind speed		Energy output[1]	
	[%]	[m/s]	[%]	[GWh/annum]
Anemometer	2.0	0.13		
Period representative of long-term	1.5	0.10		
Correlation from Goderich	1.8	0.11		
Extrapolation to hub height	1.3	0.08		
Overall historical wind speed		**0.21**		**16.15**
Substation metering			0.3	0.65
Wake and topographic calculation			7.0	15.11
Energy loss factor assumptions			2.5	5.40
Future wind variability (1 year)	6.0	0.38		29.10
Future wind variability (10 years)	1.9	0.12		9.20
Overall energy uncertainty (1 year)				**36.95**
Overall energy uncertainty (10 years)				**24.57**

Notes: 1. Sensitivity of net production to wind speed is calculated to be 77.21 GWh/annum.(m/s)

Table 6.4 Uncertainty in the projected energy output of the turbines initiated from Faust for the GE 1.6xle turbine at a hub height of 80 m (Option 1)

Source of uncertainty	Wind speed		Energy output[1]	
	[%]	[m/s]	[%]	[GWh/annum]
Anemometer	2.0	0.13		
Period representative of long-term	1.5	0.10		
Correlation from Goderich	1.6	0.11		
Extrapolation to hub height	1.8	0.12		
Overall historical wind speed		**0.23**		**4.22**
Substation metering			0.3	0.17
Wake and topographic calculation			7.0	4.03
Energy loss factor assumptions			2.5	1.44
Future wind variability (1 year)	6.0	0.40		7.34
Future wind variability (10 years)	1.9	0.13		2.32
Overall energy uncertainty (1 year)				**9.49**
Overall energy uncertainty (10 years)				**6.44**

Notes: 1. Sensitivity of net production to wind speed is calculated to be 18.34 GWh/annum.(m/s)

Table 6.5 Uncertainty in the projected energy output of the turbines initiated from Crawford for the GE 1.6xle turbine at a hub height of 80 m (Option 1)

Source of uncertainty	Wind speed		Energy output[1]	
	[%]	[m/s]	[%]	[GWh/annum]
Anemometer	2.0	0.13		
Period representative of long-term	1.5	0.10		
Correlation from Goderich	1.8	0.12		
Extrapolation to hub height	2.8	0.18		
Overall historical wind speed		**0.28**		**20.82**
Substation metering			0.3	0.68
Wake and topographic calculation			7.0	15.88
Energy loss factor assumptions			2.5	5.67
Future wind variability (1 year)	6.0	0.40		30.21
Future wind variability (10 years)	1.9	0.13		9.55
Overall energy uncertainty (1 year)				**40.39**
Overall energy uncertainty (10 years)				**28.45**

Notes: 1. Sensitivity of net production to wind speed is calculated to be 75.46 GWh/annum.(m/s)

Table 6.6 Uncertainty in the projected energy output of the turbines initiated from Faust for the GE 2.5xl turbine at a hub height of 100 m (Option 2)

Source of uncertainty	Wind speed		Energy output[1]	
	[%]	[m/s]	[%]	[GWh/annum]
Anemometer	2.0	0.14		
Period representative of long-term	1.5	0.11		
Correlation from Goderich	1.6	0.12		
Extrapolation to hub height	3.3	0.24		
Overall historical wind speed		**0.32**		**6.15**
Substation metering			0.3	0.20
Wake and topographic calculation			7.0	4.76
Energy loss factor assumptions			2.5	1.70
Future wind variability (1 year)	6.0	0.43		8.37
Future wind variability (10 years)	1.9	0.14		2.65
Overall energy uncertainty (1 year)				**11.56**
Overall energy uncertainty (10 years)				**8.39**

Notes: 1. Sensitivity of net production to wind speed is calculated to be 19.25 GWh/annum.(m/s)

Table 6.7 Uncertainty in the projected energy output of the turbines initiated from Crawford for the GE 2.5xl turbine at a hub height of 100 m (Option 2)

Source of uncertainty	Wind speed		Energy output[1]	
	[%]	[m/s]	[%]	[GWh/annum]
Anemometer	2.0	0.13		
Period representative of long-term	1.5	0.10		
Correlation from Goderich	1.8	0.11		
Extrapolation to hub height	1.5	0.10		
Overall historical wind speed		**0.22**		**16.16**
Substation metering			0.3	0.61
Wake and topographic calculation			7.0	14.30
Energy loss factor assumptions			2.5	5.11
Future wind variability (1 year)	6.0	0.38		28.24
Future wind variability (10 years)	1.9	0.12		8.93
Overall energy uncertainty (1 year)				**35.91**
Overall energy uncertainty (10 years)				**23.91**

Notes: 1. Sensitivity of net production to wind speed is calculated to be 73.71 GWh/annum.(m/s)

Table 6.8 Uncertainty in the projected energy output of the turbines initiated from Faust for the GE 2.5xl turbine at a hub height of 85 m (Option 3)

Source of uncertainty	Wind speed		Energy output[1]	
	[%]	[m/s]	[%]	[GWh/annum]
Anemometer	2.0	0.14		
Period representative of long-term	1.5	0.10		
Correlation from Goderich	1.6	0.11		
Extrapolation to hub height	2.0	0.14		
Overall historical wind speed		**0.24**		**4.70**
Substation metering			0.3	0.18
Wake and topographic calculation			7.0	4.22
Energy loss factor assumptions			2.5	1.51
Future wind variability (1 year)	6.0	0.41		7.87
Future wind variability (10 years)	1.9	0.13		2.49
Overall energy uncertainty (1 year)				**10.21**
Overall energy uncertainty (10 years)				**6.96**

Notes: 1. Sensitivity of net production to wind speed is calculated to be 19.24 GWh/annum.(m/s)

Table 6.9 Uncertainty in the projected energy output of the turbines initiated from Crawford for the GE 2.5xl turbine at a hub height of 85 m (Option 3)

Figure 2.1 Location of the Arran Wind Energy Project showing the Goderich meteorological station.

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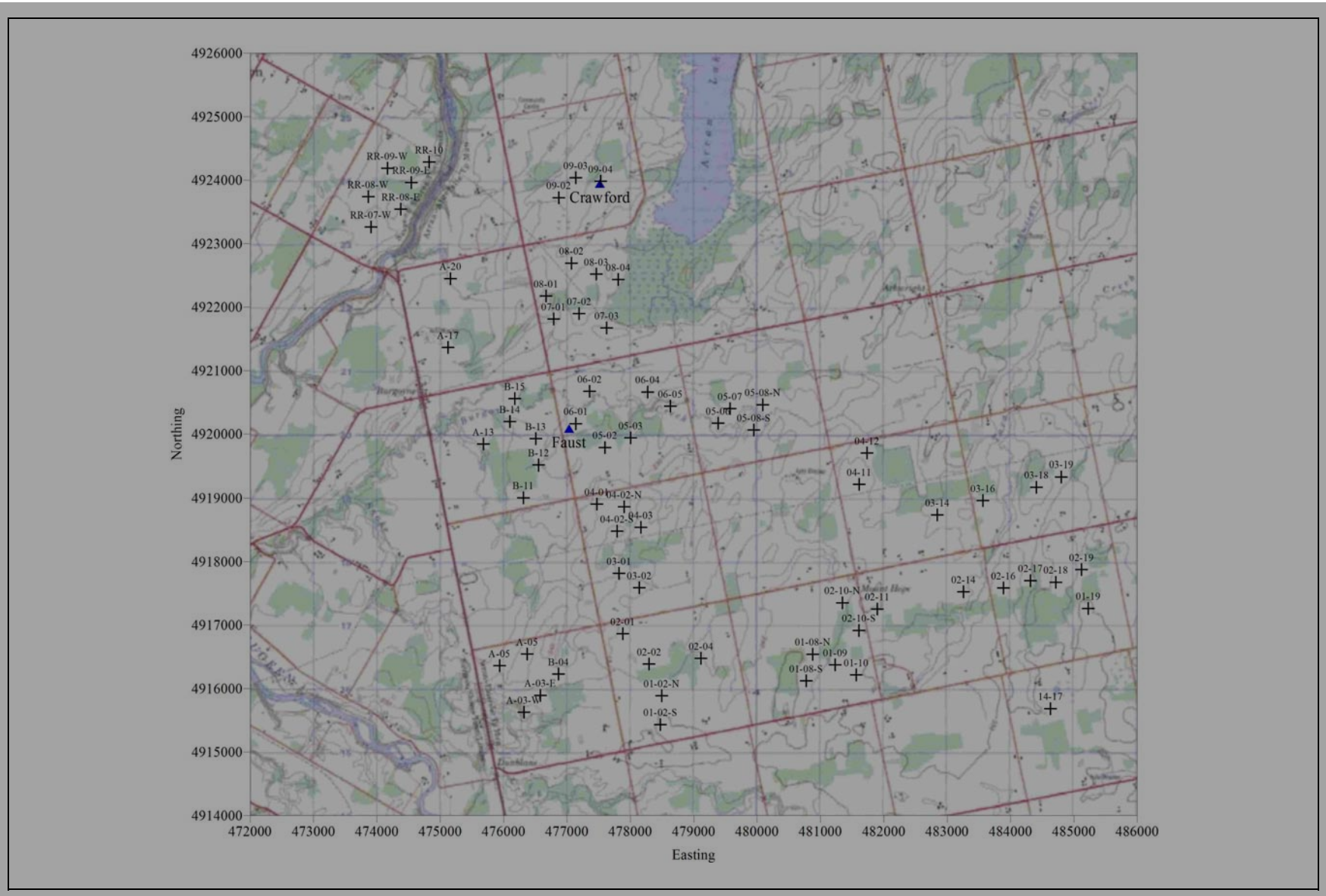


Figure 2.2 Map of the Arran Wind Energy Project showing Layout Option 1.

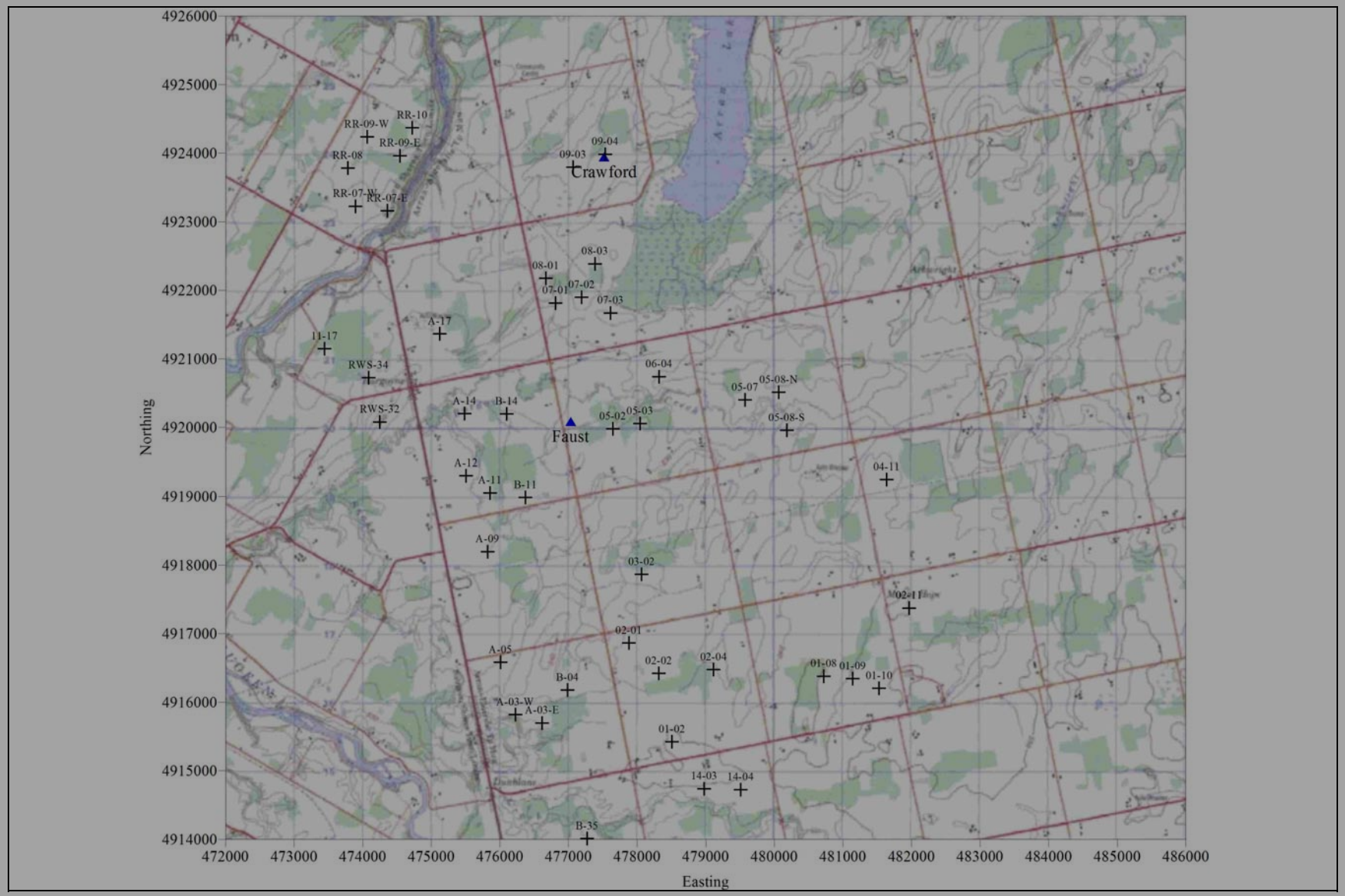


Figure 2.3 Map of the Arran Wind Energy Project showing Layout Options 2 and 3.

Figure 2.4 Panoramic view of a representative area of the site (taken at: 476387 , 4922632).

Figure 2.5 View of Faust looking northeast.

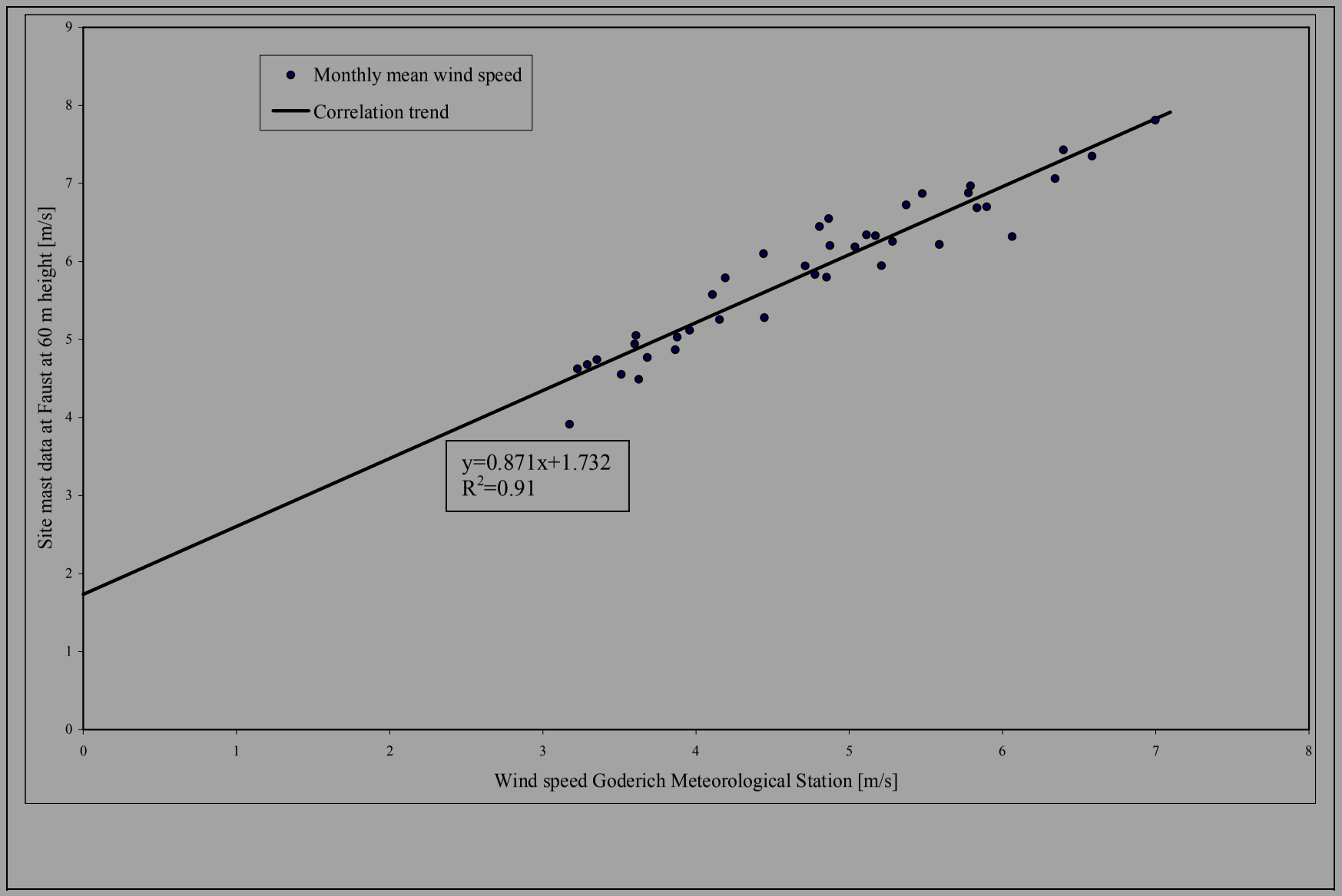


Figure 6.1 Correlation of monthly mean wind speeds at the Goderich Meteorological Station and Faust.

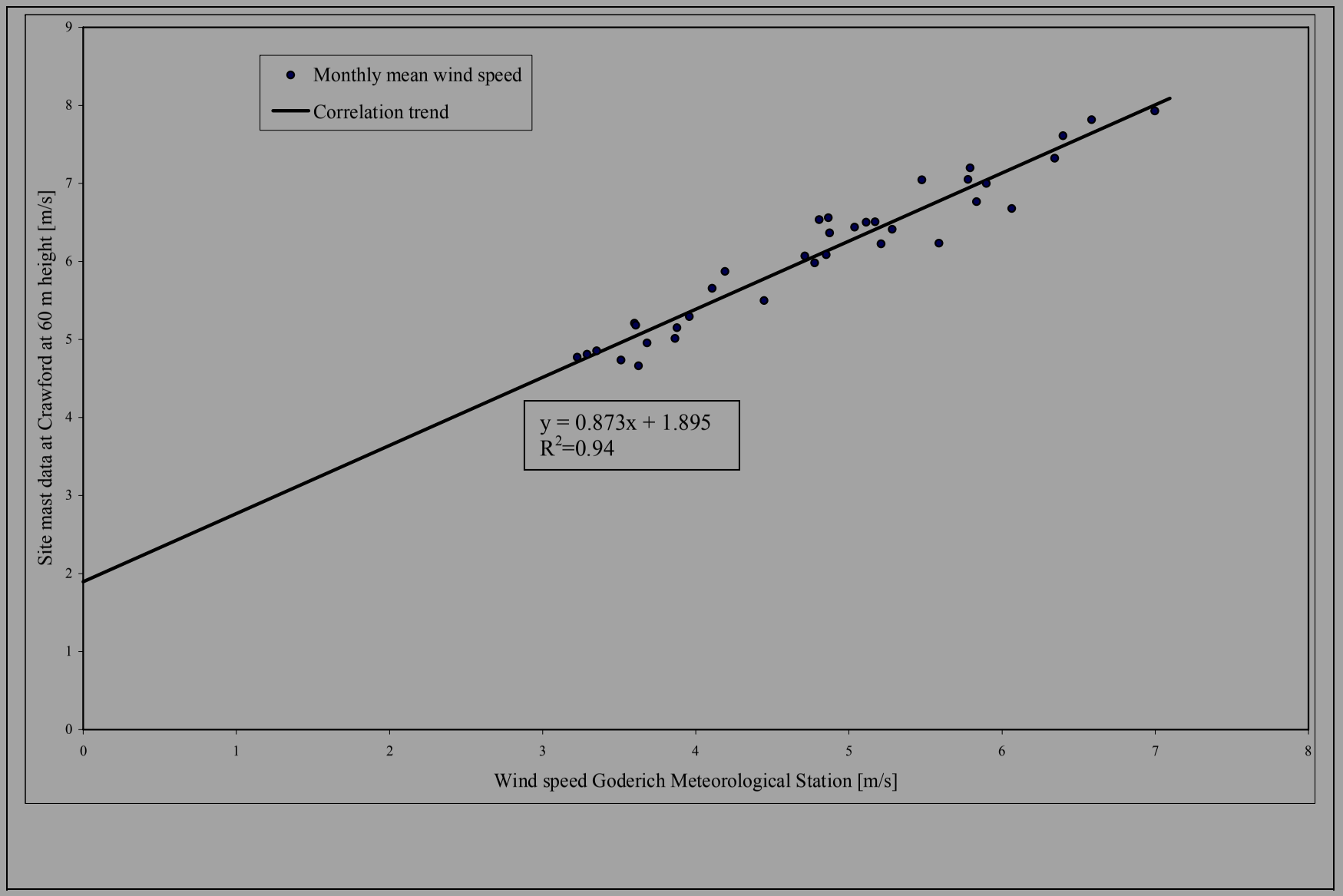


Figure 6.2 Correlation of monthly mean wind speeds at the Goderich Meteorological Station and Crawford.

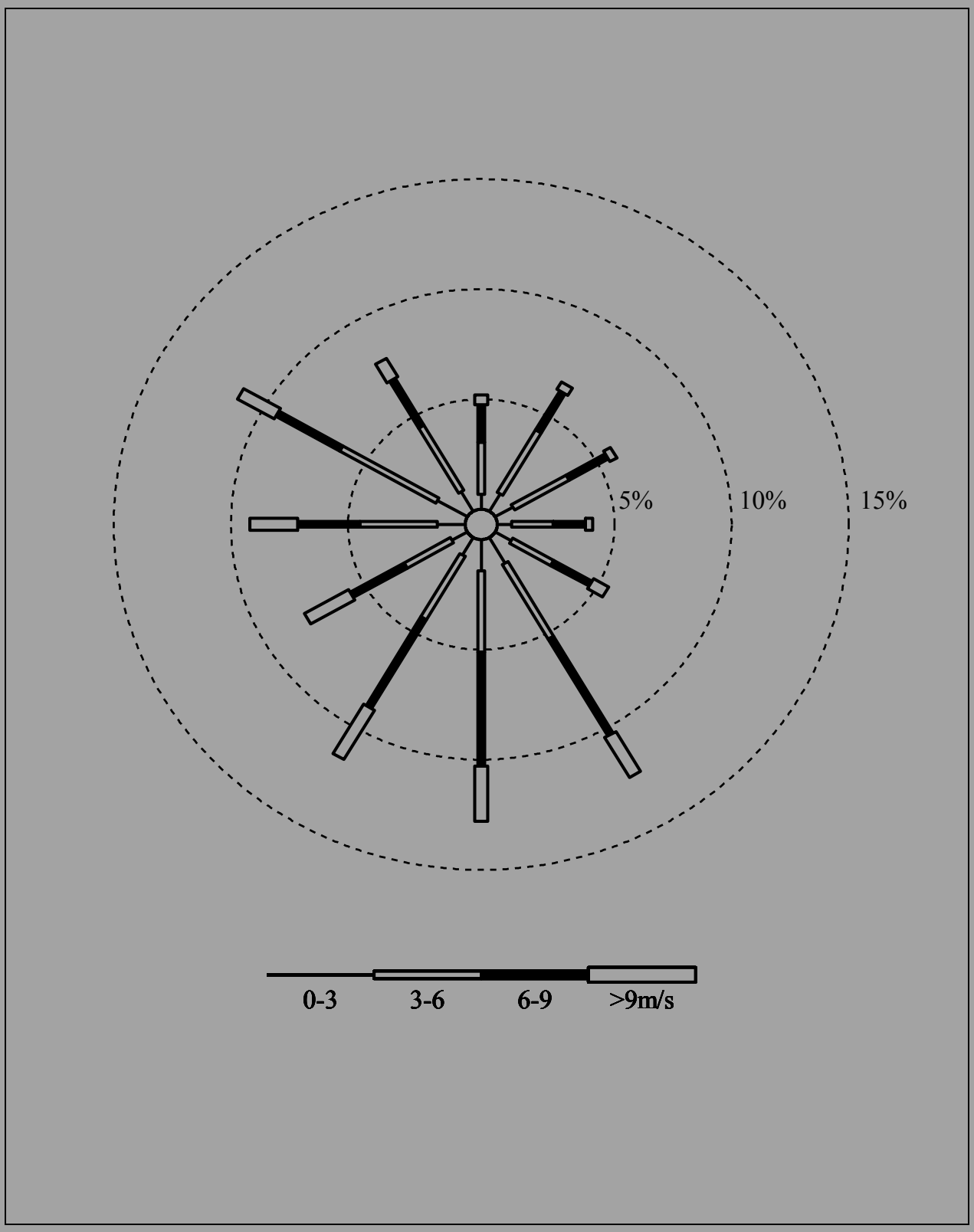


Figure 6.3 Predicted long-term annual wind rose at Faust at 80 m.

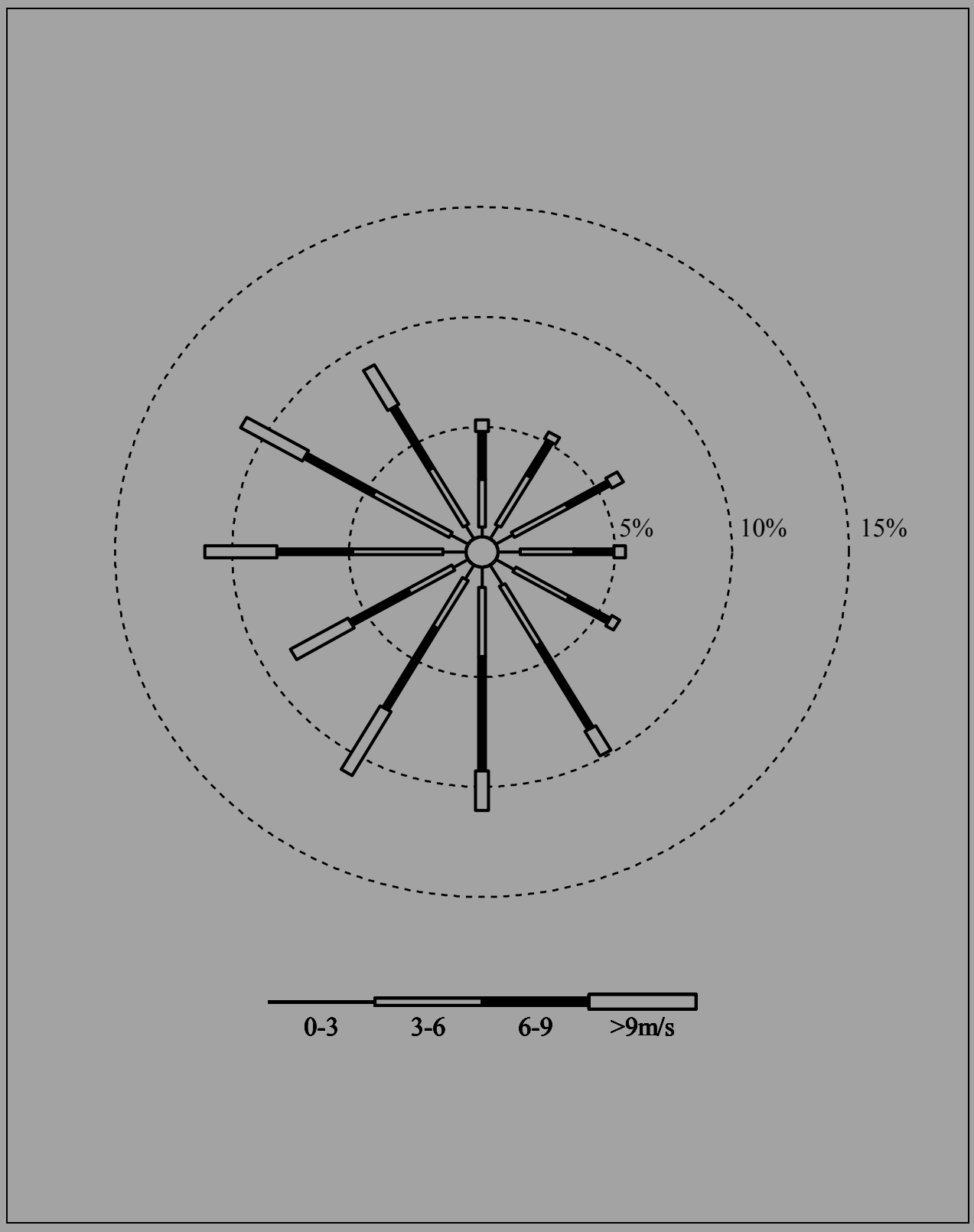


Figure 6.4 Predicted long-term annual wind rose at Crawford at 80 m.

APPENDIX 1

Data analysis procedure

1. Correlation of wind speed and direction at the site
2. Site wind speed variations
3. Projected energy production
4. Confidence analysis
5. References

1. Correlation of wind speed and direction at the site

The long-term mean wind speed and direction frequency distributions at the location of the site masts are derived using measured data and synthesised data.

The first stage in the synthesis approach is to measure concurrent wind data from the "target" mast location and a "reference" mast location for which longer-term wind records are available. The concurrent measured wind data are then used to establish the correlation between the winds at the two locations. This correlation is then used to synthesise data at the "target" location from the "reference" location.

The concurrent data are correlated by comparing monthly wind speeds at the two locations. Wind speed ratios are determined using a principal component analysis.

In order to minimise the influence of localised winds on the wind speed ratio, the data are screened to reject records where the speed recorded at the "reference" location falls below 3 m/s or an equivalent level at the "target" location. The directionally-averaged wind speed ratio is used to adjust the 3 m/s wind speed level for the "reference" location to obtain this equivalent level for the "target" location, to ensure unbiased exclusion of data. The wind speed at which this level is set is a balance between excluding low winds from the analysis and still having sufficient data for the analysis. The level used excludes only winds below the cut-in wind speed of a wind turbine, which do not contribute to the energy production.

The result of the analysis described above is a slope and offset which is used to factor the wind data measured at the "reference" mast location, thereby obtaining synthesised wind data for the period of missing data at the "target" mast location.

2. Site wind speed variations

WAsP Approach

To calculate the variation of mean wind speed over the site, the computer wind flow model, WAsP is used. Details of the model and its validation are given by Troen and Petersen [1].

The inputs to the model are a digitised map of the topography and surface roughness length of the terrain for the site and surrounding area. A digitised contour map of an area surrounding the site of 20 km by 20 km was supplied by the client and roughness contours added by hand, using map and satellite image information as knowledge gathered during the site visit. Although this domain size is much larger than the area of the site itself, such an area is necessary since the flow at any point is dictated by the terrain several kilometres upwind. Additionally, the shore lines of Lake Huron up to 100 km from the site were included in the map as experience has shown that shore lines may influence the flow regime from a long distance away.

Wind flow is affected by the roughness of the ground. The surface roughness length of the site and surrounding area has been estimated, as detailed in the main text.

The wind flow calculations were carried out for 30 degree steps in wind direction corresponding to the measured wind rose and results were produced as speed-up factors relative to the mast location for a grid encompassing the site area.

To determine the long-term mean wind speed at any location, the speed-up factor for each wind direction was weighted with the measured probability previously derived for the mast location. All directions were then summed to obtain the long-term mean wind speed at the required location.

3. Projected energy production

The gross energy production is the energy production of the wind farm obtained by calculating the predicted free stream hub height wind speed distribution at each turbine location and the manufacturer's supplied turbine power curve. In defining the gross energy output it is assumed that there are no wake interactions between the turbines and no energy loss factors are applied. This calculation undertaken within the WindFarmer computational model [2, 3] includes adjustments to the power curve to account for differences between the predicted long-term annual site air density and the air density to which the power curve is referenced.

GH uses a standard detailed set of energy loss factors, which aims to ensure that all potential sources of energy loss are considered by the relevant parties. For some projects certain loss factors will not be relevant in which case an efficiency of 100 % is assumed. Additionally some losses may only be sensibly estimated when comprehensive information is available from a project and review of such documentation is within the scope of GH's work. The comprehensive list of potential losses included within Appendix 2 allows clarity on what losses have and have not been considered within the analysis, and what assumptions have been made.

Six main sources of energy loss are considered: wake effect, availability, electrical efficiency, turbine performance, environmental and curtailments. Each source is fully described and further subdivided into more detailed loss factors in Appendix 2.

The energy loss factors are applied the gross energy production to estimate the wind farm net energy output production.

4. Confidence analysis

There are five categories of uncertainty associated with the site wind speed prediction at the proposed site:

1. There is an uncertainty associated with the measurement accuracy of the anemometers. The instruments used across the site have been individually calibrated and the mounting arrangements of the instruments are consistent with the recommended standards. A figure of 2.0 % is assumed to account for second order effects such as over-speeding, degradation, air density variations and additional turbulence effects.

2. The long-term mean wind speeds at the site masts were derived from correlation analyses. The uncertainty associated with correlating and extrapolating between masts is evaluated from the statistical scatter in the correlation plots.

3. There is an uncertainty associated with the assumption made here that the historical period at the meteorological site is representative of the climate over longer periods. A study of historical wind records indicates a typical variability of 6 % in the annual mean wind speed [4]. This figure is used to define the uncertainty in assuming the long-term mean wind speed is defined by a period of 15.7 years.

4. There is an uncertainty associated with the extrapolation of the long-term wind regime from the mast measurement heights to the turbine hub height. This uncertainty has been evaluated by considering the accuracy of the shear measurement and magnitude of the extrapolation.

5. Additionally, even if the long-term mean wind speed were perfectly defined there will be variability in future mean wind speeds observed at the wind farm site. The variability in future mean wind speeds is dependent on the period considered. Performances over one and ten years of operation are therefore included in the uncertainty analysis. Account is taken of the future variability of wind speed in the energy confidence analysis but not the wind speed confidence analysis.

It is assumed that the time series of wind speed is random with no systematic trends. Care was taken to ensure that consistency of the reference measurement system and exposure has been maintained over the historical period and no allowance is made for uncertainties arising due to changes in either.

Uncertainties type 1 to 4 from above are added as independent errors on a root-sum-square basis to give the total uncertainty in the site wind speed prediction for the historical period considered.

It is considered here that there are five categories of uncertainty in the energy output projection:

1. Long-term mean wind speed dependent uncertainty is derived from the total wind speed uncertainty (types 1 to 4 above) using a factor for the sensitivity of the annual energy output to changes in annual mean wind speed. This sensitivity is derived by a perturbation analysis about the central estimate.

2. For this development an uncertainty in the wake and topographic modelling of 7.0 % has been assumed due to the large separation between the masts and the proposed turbine locations.

3. Future wind speed-dependent uncertainties described in type 5 above have been derived using the factor for the sensitivity of the annual energy output to changes in annual mean wind speed.

4. Accuracy of the fiscal substation energy meter. An uncertainty of 0.3 % is assumed here based on typical utility meter accuracy.

5. Uncertainties associated with energy loss factors can sometimes be mitigated through appropriate warranty provisions. However, to account for the likelihood that such contracts will not typically remove all the uncertainties associated with the energy loss factor assumptions, an uncertainty of 2.5% has been assumed here.

Again those uncertainties that are considered are added as independent errors on a root-sum-square basis to give the total uncertainty in the projected energy output.

5. References

1. I Troen and E L Petersen, “European Wind Atlas”, Risø National Laboratory, Denmark, 1989.

2. “GH WindFarmer, Theory Manual”, Garrad Hassan and Partners Ltd, November 2007.

3. “GH WindFarmer, User Manual”, Garrad Hassan and Partners Ltd, July 2007.

4. P Raftery, A J Tindal and A D Garrad, “Understanding the risks of financing windfarms”, Proc. EWEA Wind Energy Conference, Dublin, 1997.

APPENDIX 2

Energy Loss Factors

1. Wake effect
2. Availability
3. Electrical transmission efficiency
4. Turbine performance
5. Environmental
6. Curtailments
7. References

GH uses a standard detailed set of loss factors that aims to ensure that all potential sources of energy loss are considered by the relevant parties. For some projects certain loss factors will not be relevant in which case an efficiency of 100 % is assumed. Additionally some losses may only be sensibly estimated when comprehensive information is available from a project and review of such documentation is within the scope of GH's work. The comprehensive list of potential losses included within the table below allows clarity on what losses have and have not been considered within the analysis, and what assumptions have been made. Following the table below a description of each of the losses is provided. Following the descriptions, a table which presents the specific value that has been assigned for each loss for this analysis is included, along with the rationale and assumptions behind the value used. Six main sources of energy loss are considered in the table below; wake effect, availability, electrical efficiency, turbine performance, environmental and curtailments, each of which is subdivided into more detailed loss factors.

Wind farm availability and the influence of tree growth on energy production may be time dependent factors. Appendix 3 describes these time dependent factors.

	Option	**1**	**2**	**3**	
	Wind Farm Rated Power	**112.0**	**115.0**	**115.0**	**MW**
	Gross Energy Output	319.3	340.9	306.6	GWh/a
1	**Wake effect**				
1a	Wake effect internal	93.8	94.7	94.5	%
1b	Wake effect external	100.0	100.0	100.0	%
1c	Future wake effect	100.0	100.0	100.0	%
2	**Availability**				
2a	Turbine availability (10 years)	96.1	96.1	96.1	%
2b	Balance of Plant availability	99.8	99.8	99.8	%
2c	Grid availability	99.8	99.8	99.8	%
3	**Electrical efficiency**				
3a	Operational electrical efficiency	97.0	97.0	97.0	%
3b	Wind farm consumption	100.0	100.0	100.0	%
4	**Turbine Performance**				
4a	Generic power curve adjustment	100.0	100.0	100.0	%
4b	High wind speed hysteresis	100.0	100.0	100.0	%
4c	Site specific power curve adjustment	100.0	100.0	100.0	%
4d	Turbine power performance ramp (10 years)	99.6	99.6	99.6	%
5	**Environmental**				
5a	Performance degradation – non icing	99.5	99.5	99.5	%
5b	Performance degradation – icing	99.8	99.8	99.8	%
5c	Icing shutdown	99.5	99.5	99.5	%
5d	Temperature shutdown	100.0	100.0	100.0	%
5e	Site access	100.0	100.0	100.0	%
5f	Tree growth (year 1 status assumed)	100.0	100.0	100.0	%
6	**Curtailments**				
6a	Wind sector management	100.0	100.0	100.0	%
6b	Grid curtailment	100.0	100.0	100.0	%
6c	Noise, visual and environmental curtailment	100.0	100.0	100.0	%
	Net Energy Output	**273.4**	**294.9**	**264.5**	**GWh/a**

The loss factors used to estimate the derivation of the wind farm net energy output prediction are described below. For each loss factor a general description is given.

1. Wake effect

Wind turbines extract energy from the wind and downstream there is a wake from the wind turbine where wind speed is reduced. As the flow proceeds downstream there is a spreading of the wake and the wake recovers towards free stream conditions. The wake effect is the aggregated influence on the energy production of the wind farm which results from the changes in wind speed caused by the impact of the turbines on each other. The wake effects are calculated using the WindFarmer computational model [1, 2]. The eddy viscosity model within WindFarmer is employed using a site specific definition of the turbulence intensity as an input.

Much of the original validation of the eddy viscosity wake model within WindFarmer was undertaken on what now would be considered to be medium sized wind farms and as data from large wind farms has become available such data are clearly valuable to extend the validation of the model. Large offshore wind farms provide a unique validation data source as the extreme flatness and homogeneity of the sea, when compared with even relatively flat onshore sites, allow differentiation between wake effects and terrain effects which is generally very difficult to achieve onshore. Validation of wake loss models against actual production from large offshore projects indicates that wake loss models are under-predicting the actual wake impacts under some scenarios [3, 4]. There is currently significant debate over the physical mechanisms which may be causing the observed results to deviate from the predictions obtained with a conventional wake model for large offshore wind farms.

GH is currently involved with internal and externally funded research projects aimed at improving modelling techniques for large offshore wind farms. As part of the research GH has developed a Large Wind Farm Wake Model which has been successfully validated for two offshore wind farms [5, 6].

It is likely that the mechanisms which are causing under prediction of the wake effects for large offshore wind farms will also be experienced for large onshore wind farms at least to a certain degree. Therefore GH has undertaken an investigation of deep array effects for very flat large onshore wind farms and found evidence of a more modest deep array effect onshore. As part of this work the large wind farm wake model has been successfully applied to one large onshore wind farm [7]. The model is designed to scale to different sizes and geometries of wind farm. However, given the limited set of validation cases currently assessed, there is considerable uncertainty in the results obtained.

Nevertheless given the current findings that the standard wake models start to under predict the wake effects for onshore wind farms as wind farms become large, GH has used the large wind farm wake model available in GH WindFarmer to account for the deep array effect.

1a Wake effect internal

This is the effect that the wind turbines within the wind farm being considered have on each other.

1b Wake effect external

This is the effect that the wind turbines from neighbouring wind farms (if any) have on the wind farm being considered.

1c Future wake effect

Where future wind farms are to be constructed in the vicinity of the project under consideration, the wake effect of these has been estimated and taken into account. If appropriate this factor can be derived as a profile over the project lifetime.

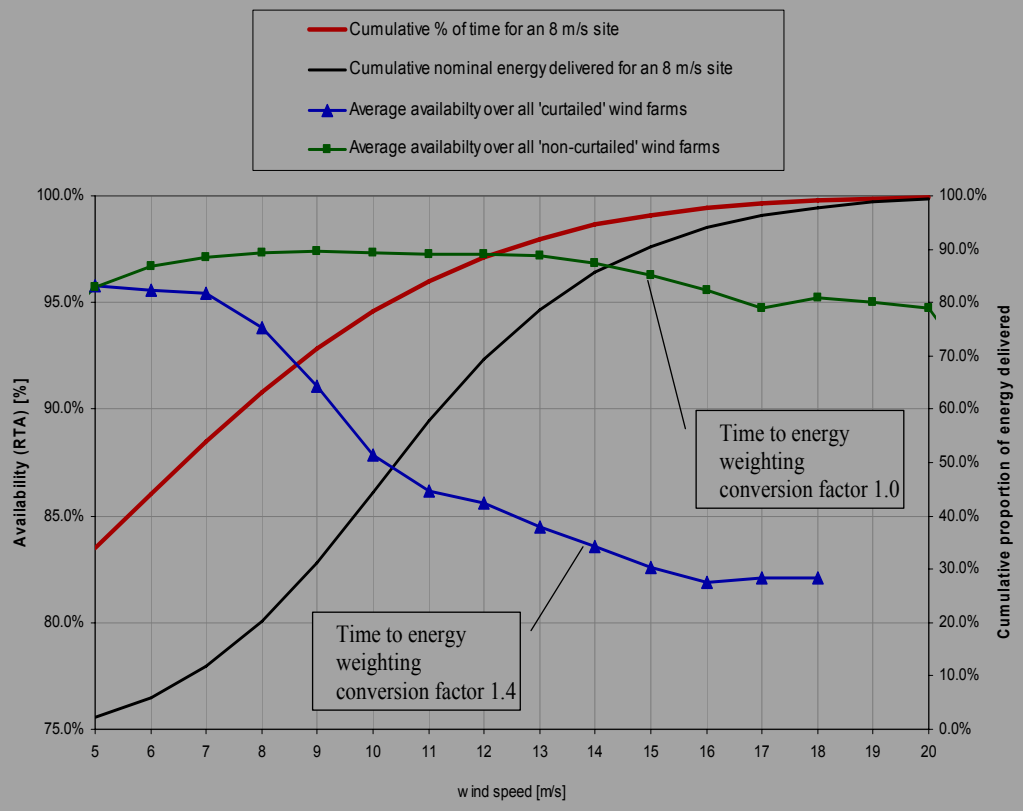
2. Availability

Wind turbines, the balance of plant infrastructure, and the electrical grid will not be available the whole time. Estimates are included for likely levels of availability for these items averaged over the first 10 years of operation.

2a Turbine availability

This factor defines the expected average turbine availability of the wind farm over the first 10 years of operation of the project. It represents, as a percentage, the factor which needs to be applied to the gross energy to account for the loss of energy associated with the amount of time the turbines are unavailable to produce electricity.

GH maintains a data base of the availability achieved by wind farms. This has been used to investigate the distribution of availability against wind speed. The data base, containing 25 wind farms, includes a range of turbine models representative of typical machines and covering a variety of different wind regimes. Wind farms that had experienced grid curtailment, as might be expected, showed a strong correlation of downtime to wind speed. This is indicated by the blue line in the figure below. When the data base was screened to include only wind farms without grid curtailment availability levels which were relatively constant with wind speed were observed as shown in the green line below. Although a slight drop off in availability was observed at high wind speeds this was compensated by a drop off in availability at low wind speeds. It was found that the downtime to energy weighting conversion factor was 1.0.



Distribution of availability against wind speed

For the analysis reported here a downtime to energy conversion factor of 1.0 was therefore used. That is, the assumption that a wind farm available for 97% of the time captures 97% of the available energy. This is a generic assumption which has not specifically considered the turbine model in question.

2b Balance of Plant (BOP) availability

This factor defines the expected availability of the turbine transformers, the on site electrical infrastructure and the substation infrastructure up to the point of connection to the grid of the wind farm. It represents, as a percentage, the factor which needs to be applied to the gross energy to account for the loss of energy associated with the downtime of the balance of plant.

2c Grid availability

This factor defines the expected grid availability for the wind farm in mature operation. It is stressed that this factor relates to the grid being outside the operational parameters defined within the grid connection agreement as well as actual grid downtime. This factor also accounts for delays in the wind farm coming back to full operation following a grid outage. It represents, as a percentage, the factor which needs to be applied to the gross energy to account for the loss of energy associated with the downtime of the balance of plant.

Reconciliation of availability from operational wind farms with pre-construction loss factors

When considering operational wind farms, the metrics used for assessing the overall wind farm availability are different from those described above. This is because a number of the issues that impact availability sometimes cannot be discretely quantified due to, for example, the concurrency of downtime events.

Also, production data from wind farms may be recorded on a variety of temporal resolutions for example from 1 minute to 1 month. The metric that is used to assess the availability of an operational wind farm is dependent upon the type of data that are available for the analysis.

Two common metrics used to assess operational wind farm availability are Counter-Based Availability (CBA) and Run Time Availability (RTA). The CBA and RTA are measures of the availability that count any down-time against the availability regardless of the cause, although the CBA may allow some flexibility with regard to the definition of down-time.

Due to the indivisibility of some of the loss factors that will impact availability, the following line items are included when assessing CBA or RTA:

2a	Turbine availability
2b	Balance of Plant availability
2c	Grid availability
5c	Icing shutdown
5d	Temperature shutdown
5e	Site access
6a	Wind sector management
6b	Grid curtailment
6c	Noise, visual and environmental

It should be noted that the inclusion of line items 6a, 6b and 6c is dependent on the details of the curtailment strategies applied. Forensic analysis of detailed SCADA data may allow a reasonable subdivision of downtime into the loss factors defined above in some cases.

3. Electrical transmission efficiency

There will be electrical losses experienced between the low voltage terminals of each of the wind turbines and the wind farm Point of Connection, which is usually located within a wind farm switching station.

3a Operational electrical efficiency

This factor defines the electrical losses encountered when the wind farm is operational and will manifest themselves as a reduction in the energy measured by an export meter. This is presented as an overall electrical efficiency and is based on the long-term average expected production pattern of the wind farm.

3b Wind farm consumption

This factor defines the electrical efficiency due to the electrical consumption of the non-operational wind farm due to transformer no load losses and consumption by electrical equipment within the turbines and

substation. For most wind farms this value is set to 100% within the table and this impact on wind farm energy production is considered as a wind farm operational cost rather than an electrical efficiency factor. However, for some metering arrangements it may be appropriate to include this as an electrical efficiency factor rather than an operational cost and therefore this factor is included within the table.

4. Turbine performance

In an energy production calculation, a power curve supplied by the turbine supplier is used within the analysis.

4a Generic power curve adjustment

It is usual for the supplied power curve to represent accurately the power curve that would be achieved by a wind turbine on a simple terrain test site, assuming the turbine is tested under an IEC power curve test. For certain turbine models there may be reason to expect that the supplied power curve does not accurately represent the power curve that would be achieved by a wind turbine on a simple terrain site under an IEC power curve test. In such a situation a power curve adjustment is applied. This may be thought of as estimating that a turbine would not meet the turbine sales power curve in an IEC power curve test on a simple terrain turbine test site.

4b High wind hysteresis

Most wind turbines will shut down when the wind speed exceeds a certain limit. High wind speed shut down events can cause significant fatigue loading. Therefore to prevent repeated start up and shut down of the turbine when winds are close to the shut down threshold hysteresis is commonly introduced into the turbine control algorithm. Where a detailed description of the wind turbine cut-in and cut-out parameters are available this is used to estimate the loss of production due to high wind hysteresis by repeating the analysis using a power curve with a reduced cut-out wind speed. If such information is unavailable then a realistic assumption is made.

4c Site specific power curve adjustment

Wind turbine power curves are usually based on power curve measurements that are made on simple terrain test sites. Certain wind farm sites may experience wind flow conditions that materially differ from the wind flow conditions seen at simple terrain test sites. Where it is considered that the meteorological parameters in some areas of a site differ substantially from those at a typical wind turbine test station, then the impact on energy production of the difference in meteorological parameters at the site compared with a typical power curve test site is estimated. This may be undertaken where turbulence or up flow angle are considered to be substantially different at the wind farm site than that which is experienced at a typical test site and sufficient data are available to inform on the appropriate adjustments. Such effects are described in [4, 5].

4d Turbine power performance ramp up

It is typically assumed that wind turbine power curves will be controlled and operated with minimal deviations from their sales power curve output. However, for significant periods of time for significant numbers of wind turbines on any given wind farm, in GH's experience there are material performance deviations from the expected sales power curve of the machines. It is considered that some of these issues are caused by teething hardware issues but of more importance typically are software issues which cause

the machines to not reach their intended power curve or operate in a non-optimal way. It is also considered that it takes time and focus to ensure wind turbines continuously operate as they should. In order to capture these effects, it has been concluded that while there is a ramp up in availability it is also likely that there will be non-optimal control of the machines. A typical allowance for this factor is an effect of 1 % on annual energy production during the period of ramp up.

5. Environmental

In certain conditions dirt can form on the blades and the blades or over time the surface of the blade may degrade. Also ice can build up on a wind turbine. These influences can impact the energy production of a wind farm in ways which are described in 5a, 5b and 5c below. Extremes of weather can also impact the energy production of a wind farm, as described in 5d and 5e below. Tree growth and tree felling may impact the production of a wind farm in a time varying manner and this impact is considered in Appendix 3. However a line item here is included to define, where appropriate, the impact from trees at a given year of project operation.

5a Performance degradation – non-icing

The performance of wind turbines can be affected by blade degradation, which includes the accretion of dirt, which may be washed off by rain from time to time, as well as physical degradation of the blade surface over prolonged operation.

5b Performance degradation - icing

Small amounts of icing on the turbine blades can change the aerodynamic performance of the machine resulting in loss of energy.

5c Icing shutdown

As ice accretion gets more severe wind turbines will shutdown or will not start. Icing can also affect the anemometer and wind vane on the turbine nacelle, which also may cause the turbine to shut down.

5d Temperature shutdown

Turbines are designed to operate over a specific temperature range. For certain sites this range may be exceeded and for periods when the permissible temperature range is exceeded the turbine will be shutdown. For such sites an assessment is made to establish the frequency of temperatures being outside the operational range and the correlation of such conditions with wind speed. From this the impact on energy production is estimated.

5e Site access

Severe environmental conditions can influence access to more remote sites, which can impact availability. An example of this might be an area prone to severe snow drifts in winter. As the impact on energy will be dependent on the Operation and Maintenance arrangements a factor will only usually be included where GH has reviewed the operations and maintenance arrangements for the wind farm.

5f Tree growth / felling

For wind farm sites located within or close to forestry or areas of trees the impact of how the trees may change over time and the effect that this will have on the wind flow over the site and consequently the energy production of the wind farm must be considered. The impact of future felling of trees, if known, may also need to be assessed. The results presented within the table identify whether tree modelling is required for the site and whether it has been carried out. If carried out the time dependent results are presented within Appendix 3 and the main table within this appendix defines the point in time assumed for the results presented. Such analyses may not be required where nearby trees are considered to be mature.

6. Curtailments

Some or all of the turbines within a wind farm may need to be shut down to mitigate issues associated with turbine loading, export to the grid or certain planning conditions.

6a Wind sector management

Turbine loading is influenced by the wake effects from nearby machines. For some wind farms with particularly close machine spacings it may be necessary to shut down certain turbines for certain wind conditions. This is referred to as wind sector management and will generally result in a reduction in the energy production of the wind farm.

6b Grid curtailment

Within certain grid connection agreements it may be necessary to curtail the output of the wind farm at certain times. This will result in a loss of energy production. This factor also includes the time taken for the wind farm to become fully operational following grid curtailment.

6c Noise, visual and environmental curtailment

In certain jurisdictions there may be requirements to shut down turbines during specific meteorological conditions to meet defined noise emission, shadow flicker criteria at nearby dwellings, or environmental conditions due to such aspects as birds or bats.

The specific assumptions made for the analysis here are summarised in the table below.

Loss	Assumption for this analysis and rationale
1	**Wake Effect**
1a	*The wake effects have been calculated using the GH WindFarmer wake model.*
1b	*It considered that the wake effect of the nearby Enbridge Ontario Wind Farm is negligible. There are currently no other wind farms in the immediate vicinity of the project.*
1c	*It has been assumed that no future wind farms will be built in the vicinity of the wind farm.*
2	**Availability**
2a	*A turbine availability of 96.1% has been assumed for the first 10 years of operation to account for the ramp up in the turbine availability. See Appendix 3 for availability ramp up assumptions.*
2b	*A BOP availability of 99.8 % has been assumed.*
2c	*A grid availability of 99.8 % has been assumed.*
3	**Electrical transmission efficiency**
3a	*An electrical efficiency of 97 % has been assumed.*
3b	*It is assumed that non operational wind farm electrical consumption is an operational cost and not a loss factor.*
4	**Turbine performance**
4a	*No power curve adjustments were deemed to be necessary..*
4b	*It has been assumed that the High Wind Speed Hysteresis effectively reduces the cut out wind speed from 25 m/s to 23.3 m/s for both of the turbine models considered for the purpose of the energy calculation.*
4c	*It is assumed that there are no site specific wind flow issues that will adversely affect the performance of the turbines.*
4d	*A factor of 99.6% has been assumed for the first 10 years of operation to account for the ramp up in the power performance of the turbines. See Appendix 3 for performance ramp up assumptions.*
5	**Environmental**
5a	*It has been assumed that a factor of 99.5 % is appropriate to account for the effect of performance degradation due to dirt accretion and blade degradation.*
5b	*It has been assumed that a factor of 99.8 % is appropriate to account for the effect of performance degradation due to ice accretion on the blades when the turbine is operational.*
5c	*It has been assumed that a factor of 99.5 % is appropriate to account for the energy effect of downtime due to ice accretion on the turbine causing the turbine to shut down or not to start.*
5d	*It is understood that the GE turbines will be equipped with a Cold Weather Option designed to allow the turbine to operate down to a temperature of -30°C. Based on temperature measurements on site and at the Goderich Reference station, it has been estimated that low temperature shutdown losses will be insignificant.*
5e	*It has been assumed that there are no specific adverse impacts on site access due to extreme remoteness or weather conditions.*
5f	*It is assumed that there is no significant influence from tree growth in the vicinity of the wind farm.*
6	**Curtailments**
6a	*It has been assumed that no wind sector management is required.*
6b	*It has been assumed that no grid curtailment is required.*
6c	*It has been assumed that no noise, visual or environmental curtailment is required.*

7. References

1 "GH WindFarmer, Theory Manual", Garrad Hassan and Partners Ltd, November 2007.

2 "GH WindFarmer, User Manual", Garrad Hassan and Partners Ltd, July 2007.

3 R J Barthelmie, et al, "Flow in wakes and complex terrain and offshore: Model Development and verification in UPWIND", EWEC 2007.

4 Johnson C, Tindal A, LeBlanc M, Graves A & Harman K, Validation of GH North American Energy Predictions by Comparison to Actual Production, 2008 AWEA WINDPOWER Conference, June 2008.

5 Schlez W; Neubert A: " New Developments in Large Wind Farm Modeling", EWEC 2009, Marseille, France.

6 Barthelmie, R.J., Hansen, etal. 2009: Modelling the impact of wakes on power output at Nysted and Horns Rev, EWEC2009, Marseilles, France, March 2009

7 Johnson C, Graves A., Tindal A, Cox S, Schlez W, and Neubert A, New developments in Wake Modeling for Large Wind Farms, 2009 AWEA WINDPOWER Conference, May 2009.

8 Tindal A, Johnson C, LeBlanc M, Harman K, Rareshide E & Graves A, Site-Specific Adjustments to Wind Turbine Power Curves, 2008 AWEA WINDPOWER Conference, June 2008.

APPENDIX 3

Time dependent loss factors

The results presented in the main text of this report represent annual average energy production values for a wind farm averaged over the first 10 years of operation. However, for some wind farms there will be loss factors that change over time such as the availability of the wind farm and the influence of trees (if any). This section provides more detail on the likely variation of wind farm production over time.

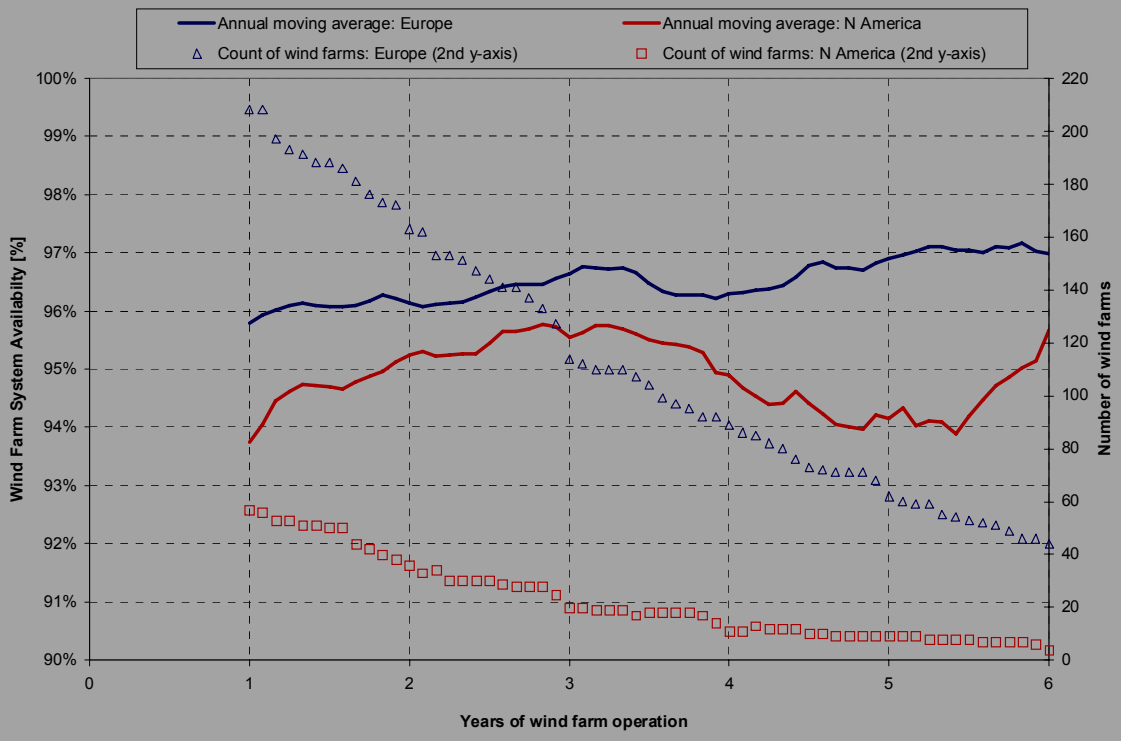
Time dependence of turbine availability

There may be a significant variation in the availability achieved by a wind farm over its lifetime. Such a "profile" of availability is wind farm and wind turbine specific and is also dependent on the operation and maintenance (O&M) regime and budgets over the lifetime of the project. Such a review is outside the scope the work reported here. However, the table below allows a site specific availability profile to be introduced.

In the absence of a turbine specific review GH consider that a mature availability of 96.5 % can typically be achieved by modern wind turbines with appropriate O&M arrangements. However, it is very common for a ramp up of availability to be observed in the first year or years of operation. GH maintains a data base of the availability achieved by wind farms in North America.

The graph below presents the variation of availability with time for the currently available data base of North American wind farms. This includes a range of different turbine models, including the majority of recently installed turbine models, and a range of geographic locations. The data base is screened to consider only wind farms that may be considered representative of typical new build projects. These data have been used to inform an assumed ramp up of availability, which is included in the table below. It is noted that the availability ramp up characteristic is a generic characteristic. Review of the specific turbine model, O&M arrangements, O&M budgets and warranties are not within the scope of this work. The assumption in the table below is subject to amendment were the listed factors to be reviewed as a part of a comprehensive Independent Engineer review of the project.

Similarly, GH has found through analysis of the same wind farm database that turbine power performance is sub-optimal in the initial years of operation. The assumption in the table below for power performance ramp-up is subject to amendment, were the listed factors to be reviewed as a part of a comprehensive Independent Engineer review of the project.



Availability ramp up for North American wind farms

Time dependence of impact of tree growth / felling on energy production

Where the wind farm is close to areas of trees and the assessment of tree growth is included within the scope of the work then the impact of tree growth on energy production is modeled. It is assumed that tree growth and felling is not an issue at this site.

Summary

The likely variation of the other parameters with time has been considered and is presented in the summary table below. This profile, of course, does not include the effect of future variability annual wind conditions, which is an unknown. Wind variability is, however, considered within the uncertainty analysis.

Year	Turbine availability (2a) [%]	Power Performance (4d) [%]	Tree Growth (5f) [%]
1	94.0	99.0	100.0
2	95.5	99.0	100.0
3	96.0	99.0	100.0
4	96.5	99.0	100.0
5	96.5	100.0	100.0
6	96.5	100.0	100.0
7	96.5	100.0	100.0
8	96.5	100.0	100.0
9	96.5	100.0	100.0
10	96.5	100.0	100.0
11	96.5	100.0	100.0
12	96.5	100.0	100.0
13	96.5	100.0	100.0
14	96.5	100.0	100.0
15	96.5	100.0	100.0
16	96.5	100.0	100.0
17	96.5	100.0	100.0
18	96.5	100.0	100.0
19	96.5	100.0	100.0
20	96.5	100.0	100.0

Tait, Benjamin -JLTB

From:	Tait, Benjamin -JLTB
Sent:	October 30, 2020 4:32 PM
To:	'Barry Appleton'; Ed Mullins; Ben Love; Cristina Cardenas (MIA); Nabeela Latif; Tennant Claimant
Cc:	Squires, Heather -JLTB; Ouellet, Annie -JLTB; Harris, Maria Cristina -JLTB; Klaver, Mark -JLTB; Bakelaar, Darian -JLTB; Girvan, Krystal -JLTB; Dosman, Alexandra -JLTB
Subject:	Tennant Energy LLC v. Canada - Canada's Proposed Designations to Claimant's Memorial and Supporting Documents (Email 1 of 2)
Attachments:	2020-08-07 - Tennant - Claimant Memorial - Canada's Proposed Designations.pdf; CWS-1 - Pennie (7Aug2020) - Canada's Proposed Designations.pdf; C-108 - Canada's Proposed Designations.pdf; C-179 - Canada's Proposed Designations.pdf; C-214 - Canada's Proposed Designations.pdf
Follow Up Flag:	Follow up
Flag Status:	Completed

Dear Mr. Appleton,

In accordance with paragraph 16 of the CO, and the Tribunal's letter of October 16, 2020, providing Canada until today's date to provide its proposed designations, we attach for your review Canada's proposed designations to the Claimant's Memorial, Witness Statement of John Pennie, and Exhibits C-108, C-179, C-214, C-215, C-216, and C-218. Due to the size of these files, we will be sending these documents in two separate emails, with this being the first. With regard to the *Mesa Power* Hearing videos that were exhibited with the Claimant's Memorial on August 7, 2020, Canada proposes that these exhibits be designated as Confidential in accordance with the confidentiality review process that was done in the *Mesa Power* arbitration. The *Mesa Power* hearing videos are on record in this arbitration as C-107, C-201, C-204, C-205, C-206, C-208, and C-224 through C-243; in light of the file sizes, they have not been attached to this email. Canada proposes that the public versions of the *Mesa Power* Hearing transcripts take the place of the public versions of the *Mesa Power* Hearing videos. Normal practice would be to propose that the public versions of the *Mesa Power* Hearing videos be submitted in this arbitration. However, we have reviewed the Amended *Mesa Power* Hearing videos that the PCA had uploaded to the private, file sharing site for that arbitration, and it appears that the hearing videos have still not been edited properly to redact all confidential information. It would take considerable resources in time, cost, and manpower for either disputing party to prepare the properly redacted videos. Submitting the public versions of the transcripts would be the most efficient way to proceed, and given that the public transcripts provide the exact same information that would be in the public videos, if the videos existed, there is no prejudice to either side, as the confidential videos would still be available for use in this arbitration, and public access will be upheld in the same manner. Designating the *Mesa Power* videos as Confidential in their entirety conforms to the Tribunal's decision in paragraph 50 of Procedural Order No. 7.

Additionally, we write to confirm that we have no proposed designations in the materials exchanged relating to the *Mesa Power* Hearing videos. This includes:

- Canada's Motion of August 10, 2020;
- Tribunals Email of August 11, 2020
- Claimant's Response of August 18, 2020
- Tribunal's Email of August 19, 2020
- Canada's Reply of August 26, 2020
- Claimant's Rejoinder of September 2, 2020

We look forward to hearing from you in accordance with the timelines under the CO.

Best regards,

Benjamin Tait
Paralegal
Trade Law Bureau (JLTB)
Global Affairs Canada
Tel: (343) 203-6868

Global Affairs Canada | Affaires mondiales Canada

Tait, Benjamin -JLTB

From: Tait, Benjamin -JLTB
Sent: October 30, 2020 4:36 PM
To: 'Barry Appleton'; Tennant Claimant; Ben Love; Ed Mullins; Cristina Cardenas (MIA); Nabeela Latif
Cc: Squires, Heather -JLTB; Ouellet, Annie -JLTB; Dosman, Alexandra -JLTB; Harris, Maria Cristina -JLTB; Klaver, Mark -JLTB; Bakelaar, Darian -JLTB; Girvan, Krystal -JLTB
Subject: Tennant v. Canada - Canada's Proposed Designations to Claimant's Memorial and Supporting Documents (Email 2 of 2)
Attachments: C-218 - Canada's Proposed Designations.pdf; C-215 - Canada's Proposed Designations.pdf; C-216 - Canada's Proposed Designations.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Dear Mr. Appleton,

Please find attached the remaining documents with Canada's proposed designations, further to our email of a few minutes ago.

Kind regards,

Benjamin Tait
Paralegal
Trade Law Bureau (JLTB)
Global Affairs Canada
Tel: (343) 203-6868

Global Affairs Canada | Affaires mondiales Canada

Tait, Benjamin -JLTB

From: Barry Appleton <bappleton@appletonlaw.com>
Sent: November 20, 2020 4:52 PM
To: Squires, Heather -JLTB; Tait, Benjamin -JLTB; Klaver, Mark -JLTB; Ouellet, Annie -JLTB; Dosman, Alexandra -JLTB; Girvan, Krystal -JLTB; Bakelaar, Darian -JLTB; Harris, Maria Cristina -JLTB
Cc: Cristina Cardenas (MIA); Ben Love; Ed Mullins; Nabeela Latif; Tennant Claimant
Subject: Tennant v. Canada - Investors confidentiality designation - Nov 20 2020
Attachments: CWS-3 -Justin Giovannetti Witness Statement - September 2 2020.pdf; CWS-1 - Pennie (7Aug2020) - Canada's Proposed Designations with Investor's Additions.pdf; 2020-11-20 - Investor's objections to Respondent's Proposed Designations.docx; 2020-08-07 - Tennant - Claimant Memorial - Canada's Proposed Designations with Investor's Additions.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Heather,

We are writing to address a number of procedural matters.

- In accordance with Paragraph 16 of the *Confidentiality Order* the Investor has enclosed a Redfern Schedule setting out Objections to the Respondent's preliminary confidentiality designations in connection with the publication of the Investor's Memorial.
- In accordance with Canada's November 18th email, the Investor has set out preliminary confidentiality designations with respect to the Investor's Memorial and the Witness Statement of John Pennie (CWS-1). These designations are based on our earlier agreement.
- We also have enclosed the Witness Statement of Justin Giovannetti in accordance with the Investor's November 13th email and the Tribunal's November 16th email. We have made preliminary confidentiality designations on only his home address and birth date for personal data privacy reasons. We have enclosed these documents with this email.
- Finally, we are responding to Mr. Tait's email of October 30, 2020 where Canada's proposes that the *Mesa Power* Hearing videos (C-107, C-201, C-204, C-205, C-206, C-208, and C-224 through C-243) be designated as confidential in accordance with the confidentiality review process that was done in the *Mesa Power* arbitration.

Unfortunately, we are not in a position to concur with Canada's proposal to hide the video exhibits behind a confidentiality shield. The approach proposed by Canada would needlessly restrict portions of the Mesa Power Hearing video that should now be considered public. The reason is that information that was confidential at the time that the video was made has subsequently become public. As a result, portions of the original confidential hearing video can no longer be confidential.

Public interest demands public access wherever reasonably possible. If Canada's proposal were to be followed, there would be unnecessary obstacles to transparency and barriers to public scrutiny of conduct of government officials. These non-confidential portions of the exhibits must be made public. They cannot meet the requirements of confidentiality under the Tennant Energy *Confidentiality Order*. .

Information that has been made public cannot no longer be restricted in the transcript or the videos. Such actions would be inconsistent with the Tribunal's decision in paragraph 50 of Procedural Order No. 7.

Canada is aware of those areas which have been made public subsequently to the Mesa Power Hearing, and thus can propose appropriate redactions to the video exhibits and the transcripts The public video and the public transcripts are currently overly restrictive and thus are not a reliable or accurate substitute for the evidence.

To facilitate this process, we are prepared to have Canada make the proposals initially on the transcript and then, after agreement has been established, move to the video.

There is a serious public interest in open access and open justice in this arbitration. This is especially important when questions of misconduct from government officials arise. We believe that the public in each of the three NAFTA states have a right to see this information. There would be significant prejudice to the administration of international justice and due process arising from Canada's disrespect to the principles of transparency. This should not be lightly countenanced.

We note that these videos were available to the public on the internet for nearly five years. This would be a basis for these videos to be fully public now. We simply cannot see why Canada would not support the principle of transparency for information that was part of the public domain.

The Investor sees little benefit for Canada to continue in its charade that this evidence is still private given the extensive and unlimited public exposure on the internet arising from Canada's own NAFTA website. However, if Canada still wishes to persist in this needless and wasteful pursuit, then Canada will need to devote the resources to property redact the transcript and the videos.

Wishing you and your team the very best of health, on behalf of Counsel for the Investor, Tennant Energy

APPLETON & ASSOCIATES
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Annex A: Investor's Disputed Designations Schedule

No.	Ref. to Designation	Objections to Designation			Reply to Objections	Tribunal's Decision
		Proposed Redaction	Reasons	Designation Requested		
CHALLENGES TO RESPONDENT'S PROPOSED CONFIDENTIALITY DESIGNATIONS IN CLAIMANT'S MEMORIAL AND SUPPORTING DOCUMENTS						
1.	Investor's Memorial	Sentence in paragraph 166: "*Skyway 127 had placed into the group of successful candidates during the "dry run," but it did not award the FIT Contract."*	The Investor objects to Canada's designation of Memorial paragraph 166 as confidential. In particular, Canada seeks to designate the following: "*Skyway 127 had placed into the group of successful candidates during the "dry run," but it did not award the FIT Contract."* However, all this information is publicly available. . Thus, it does meet the definition of Confidential Information under the *Confidentiality Orde*r. For example, this information is in the public January 2020 Procedural Hearing Transcript. For example, see page 285, lines 17 – 25 of the Day 2 Transcript (January 15, 2020). "*But the fact of the matter is that the issues about the use for International Power Canada, a favored company because of its political connections, they took the spot of Skyway 127, the investment owned by Tennant Energy. It had what was called the "dry run." It had a vested position in the queue, and they bounced them from that vested position. They ran the test, they found out that their friends didn't get it, and then they modified it over a weekend*."	This information is not confidential. The Investor objects to any confidentiality designation.		

No.	Ref. to Designation	Objections to Designation			Reply to Objections	Tribunal's Decision
		Proposed Redaction	Reasons	Designation Requested		
			This information was also publicly disclosed in Day 2 on page 301 lines 1-10 : "*So, Tennant had shares in the Skyway Project. GE had shares in the Skyway Project. GE was very interested. They thought this would be an excellent Project. Being in sixth place gave them basically what they thought was guaranteed access because they did what is called the "dry run." In the dry run, they had access. Six projects for sure. Could have been actually more at the time, I think, but for sure they were in the gold zone. They were in the green. They were getting a contract and then all of a sudden they didn't*." Further, paragraph 780 of the Public Version of the Investor's Reply Memorial in *Mesa Power* discusses the dry run: "*Once it was determined that the ECT would not be used to award FIT contracts, the OPA and the Ministry of Energy began to develop a process to award contracts in regions enabled by the new Bruce to Milton transmission line. As of April 2011, the OPA was proposing a "special TAT" process that did not include either connection point changes or generator-paid upgrades. In mid-April 2011, the OPA conducted a "dry run" of the Bruce to Milton Allocation process that determined which projects would receive contracts using the OPA's preferred approach. The OPA shared this information with the Ministry of Energy, despite its reluctance to do so*."			

No.	Ref. to Designation	Objections to Designation			Reply to Objections	Tribunal's Decision
		Proposed Redaction	Reasons	Designation Requested		
			Paragraphs 781-785 of the Public Version of the Investor's Reply Memorial in *Mesa Power* indicate that companies on the priority que were harmed by the changes made after the dry run was conducted. Both the January 15, 2020 Day 2 Procedural Hearing Transcript and the Public Version of the Investor's Reply Memorial from *Mesa Power* are disclosed as public information. Canada's request must fail as the information does not meet the definition of Confidential Information.			
2.	Investor's Memorial	Sentence in paragraph 513: *"These consultations showed that the interest in the FIT program exceeded the available capacity in the transmission system."*	The Investor objects to the confidentiality designation of *"These consultations showed that the interest in the FIT program exceeded the available capacity in the transmission system."* in paragraph 513 of the Investor's Memorial. This information is already available to the public on the internet. Thus, it cannot meet the definition of Confidential Information under the Confidentiality Order. The information contained in this sentence Canada seeks to designate is derived from the Public Version of the Investor's Post-Hearing Brief in the *Mesa Power* case. Specifically, this information is found in paragraph 293 of the Public Version of the Investor's Post Hearing Brief. This Investor's Post Hearing Brief is public and available on the internet. Thus, this information cannot meet the definition of Confidential Information under the Confidentiality Order.	This information is not confidential. The Investor objects to any confidentiality designation.		

No.	Ref. to Designation	Objections to Designation			Reply to Objections	Tribunal's Decision
		Proposed Redaction	Reasons	Designation Requested		
3.	C-108	All proposed designations in this exhibit.	The Investor objects to all proposed confidentiality designations in Exhibit C-108 as this information is already available to the public on the internet. Thus, it cannot meet the definition of Confidential Information under the Confidentiality Order. This was an exhibit to the Investor's Valuation Report, filed with the Investor's Memorial. Information from C-108 was reviewed by the Valuation Team in the process of drafting their Report. The exhibit was referenced in the Valuation Report. Canada did not assert any confidentiality over the disclosure of this information in the Valuation Report, and this information in Exhibit C-108 is public through the publication of the Valuation Report on the PCA website.	This information is not confidential. The Investor objects to any confidentiality designation in this exhibit.		

HOUSE OF COMMONS
CHAMBRE DES COMMUNES
CANADA

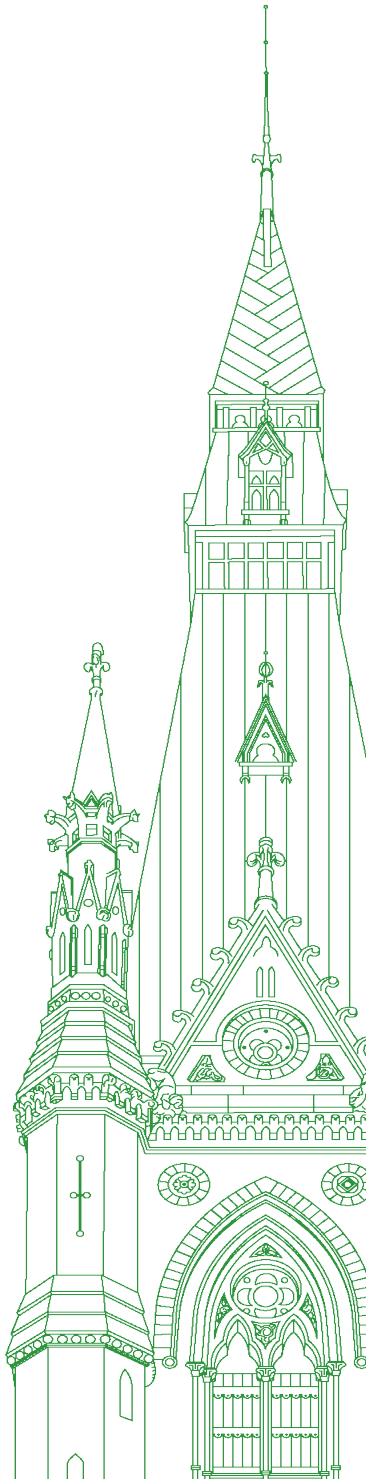
43rd PARLIAMENT, 2nd SESSION

Standing Committee on International Trade

EVIDENCE

NUMBER 021

Friday, March 26, 2021



Chair: The Honourable Judy A. Sgro

Standing Committee on International Trade

Friday, March 26, 2021

● (1310)

[*English*]

The Chair (Hon. Judy A. Sgro (Humber River—Black Creek, Lib.)): Good afternoon, everyone.

I call this meeting to order. Welcome to meeting number 21 of the House of Commons Standing Committee on International Trade.

Today's meeting is webcast and is taking place in a hybrid format, pursuant to the House order of January 25, 2021.

Pursuant to Standing Order 108 and the motion adopted by the committee on October 23, 2020, the committee will proceed with its study of the investor-state dispute settlement mechanisms.

I would like to welcome our terrific group of witnesses we have here today, a very high-level panel, to provide us with sufficient information on the ISDS and for the debate that will follow.

I could take all afternoon to list all of the contributions of this group of witnesses. I don't want to take away that time from their presentations and from our committee, so I'm going to just welcome the Honourable Yves Fortier from Cabinet Yves Fortier; Barry Appleton, professor at New York Law School; Charles-Emmanuel Côté, professor at Université Laval; Armand de Mestral, emeritus professor of law at McGill University; and Patrick Leblond, associate professor at the University of Ottawa.

Welcome, and thank you to all of you for sharing your expertise and your time with us today.

Mr. Fortier, you have the floor, please.

[*Translation*]

Hon. Yves Fortier (Cabinet Yves Fortier, As an Individual): Thank you.

Good afternoon, Madam Chair, distinguished members of the committee and fellow guests.

I'd like to begin by thanking the committee for inviting me to give evidence today in my capacity as an arbitrator and as a lawyer who specializes in international arbitration.

I'm here today to report on how highly successful the ISDS investor-state dispute settlement mechanism has been.

The one message I would really like to get across to you today is that ISDS works. Canada should continue to advocate this option in its bilateral and multilateral treaties.

[*English*]

Mr. Chandra Arya (Nepean, Lib.): Madam Chair.

The Chair: I'm sorry, Mr. Fortier. Could you just hold on for one second?

Yes, Mr. Arya.

Mr. Chandra Arya: I can barely hear the translation. The French language is dominant and the English language is a bit muted.

The Chair: Okay, just give us a second.

Mr. Sukh Dhaliwal (Surrey—Newton, Lib.): On my end, it's fine.

The Chair: Mine is working. How about the others?

Mr. Ziad Aboultaif (Edmonton Manning, CPC): It's working here.

Mr. Sukh Dhaliwal: It works here too, Judy.

The Chair: Okay.

Christine, have you mentioned it to the translators?

The Clerk of the Committee (Ms. Christine Lafrance): IT is in the room and he's looking after that.

Mr. Chandra Arya: Okay, let's not hold.... Please continue.

The Chair: Okay.

Mr. Fortier, let's continue, please.

Hon. Yves Fortier: You don't want me to start from the beginning, do you?

The Chair: No. Your time with us is very valuable, so please continue.

Hon. Yves Fortier: Very well.

[*Translation*]

ISDS, as you know, gives foreign investors protection against the actions of states in which they have invested. Treaties that promote and protect investments provide foreign investors with protection against illegal expropriation, as well as fair and equitable treatment. They require states to offer the same conditions to foreign investors as to their own nationals. In short, they provide a dynamic and welcoming environment for foreign investors.

Canada's policy on promoting and protecting foreign investment, since the introduction of NAFTA in 1994, has been extremely successful. I believe that it's essential for Canada to continue to provide foreign investors with ISDS protection to maintain Canada's international economic appeal and reputation.

Canada's recent trade agreements are comprehensive, modern and detailed. Removing ISDS from the agreements might suggest that Canada is not a reliable and serious partner.

I spoke on this very topic at American University Washington College of Law in October 2019, before the pandemic.

[*English*]

The debate about the merits of arbitration is not new. International arbitration has long been the object of hostility and hyperbole. The World Bank's own International Centre for Settlement of Investment Disputes has often been a lightning rod for criticism. Detractors have accused the institution of bias in favour of corporations and lamented its prohibitive costs and lack of an appeal mechanism.

In my humble view, most of these critics are unfamiliar with the world of international arbitration. They call for ISDS eradication. They claim that ISDS lacks “the normal safeguards of a serious legal system”. Despite the consistently verified fact that states win more investment cases than they lose, they insist on the old canard that the system is biased against states and encourage states “to actively explore the termination of ISDS provisions”.

These critics usually propose no alternative to ISDS. Some envision a multilateral investment court with permanent members and an appellate mechanism. In its submission to UNCITRAL working group III, the European Union recently stressed three main categories of “concern” with ISDS: one, “Lack of consistency, coherence, predictability and correctness of arbitral Decisions by [arbitral] tribunals”; two, concerns pertaining to “Arbitrators and decision makers”; and three, “Cost and duration of ISDS cases”.

This standing court would resemble the promised but yet to be delivered CETA investment court system. The European Union proposes a permanent body comprised of two levels, which are a first-instance tribunal and then an appellate tribunal, staffed with full-time adjudicators held to strict ethical and diversity requirements.

● (1315)

[*Translation*]

I'll be referring in my evidence to the European proposal, in order to underscore the advantages of ISDS, and also talk about existing reform proposals.

[*English*]

In Washington at the end of 2019, I said that for decades international arbitration has developed and improved, achieving success in new markets and on an ever-increasing scale. In 2018, parties registered a record 56 cases at ICSID, which was a record. The year 2018 was also a record-breaking year for the London Court of International Arbitration and the ICC International Court of Arbitration.

I stress that the same year, in a wide-ranging study of practitioners, academics, judges, third party funders and government officials, 97% responded that international arbitration is their preferred method of resolving cross-border dispute.

Yet, for decades, we've been told that arbitration must be stopped. Recently, the death chants have intensified. You've heard some of them recently. Investor-state dispute settlement, ISDS, “should be dismantled and either discarded or rebuilt from scratch”.

[*Translation*]

Debate on the merits of arbitration is nothing new, and extends beyond Canada's borders. It is a heated subject of debate. The most virulent criticisms condemn an unfair system that always rules in favour of the multinationals and makes contradictory decisions at prohibitive cost. Very often, these criticisms come, at least in part, from those who don't benefit from the system's strengths. The reality is much more nuanced.

I believe that Canada needs to keep ISDS in its agreements. I'll go over what I said in Washington once again.

● (1320)

[*English*]

The popularity of arbitration is not circumstantial. It stems from advantages inherent to arbitration as a process for settling disputes. International arbitration has outlasted, and will outlast, its critics because it functions well.

Fortunately, in recent years, many members of the international arbitration community have reacted vigorously to this contestation. Gary Born, an eminent U.S. international arbitrator, recently said that to “ensure [our own] survival”, we must stress “the five Es” of arbitration: “efficiency, expedition, expertise, evenhandedness, and enforceability.”

[*Translation*]

I'd like to briefly describe the advantages of ISDS and, at the same time, the reasons why I believe that this mechanism should continue to be part of Canada's trade and foreign policy arsenal.

As you all know, arbitration is a mechanism based on consent. It allows for the selection of a neutral and respected arbitrator to settle conflicts definitively. Giving the parties the opportunity to choose their own arbitrator, generally a specialist in the field, is a fundamental component of arbitration. Once the final ruling is made, it can receive recognition from the vast majority of countries under the New York Convention.

[*English*]

Again, I quote from my conference in Washington. These fundamental characteristics at the heart of arbitration have been scapegoated for perceived problems with arbitration. Most notably, critics submit that ad hoc party appointees may be biased. Resolving disputes definitely without an appellate process may force parties to live with flawed decisions. Now, in my view, such criticism mistakes advantages for disadvantages. These characteristics are the hallmarks of arbitration that make the process successful; they are not flaws that need correction.

I commence with the appointment of arbitrators. The European Union’s proposal refers to arbitrator bias, procedural delays and gender disparity, caused, the European Union says, by the fact that parties select their own arbitrator. Well, yes, this is of course a principal difference between arbitration and litigation. Each party to an arbitration selects one of his adjudicators.

Proponents of a standing body claim that it would improve ISDS’s perceived lack of impartiality. Their reasoning, in my view, is somewhat suspect and myopic. A standing body would supposedly “insulate decision-makers from 'powerful private interest'” and eliminate the pressure to deliver awards that will encourage parties to reappoint them. Whether a standing body of arbitrators is more independent than arbitrators appointed by the parties depends on one’s perspective.

Are we prepared to deny disputing the right of parties associated with arbitration to select decision-makers with the expertise, experience and overall DNA they consider essential for the fair resolution of their dispute, and substitute women and men of a quasi-judicial institution endowed with general, as opposed to specific, qualifications? I don’t think so. The system as it exists today works. Eliminating the appointment by parties of their adjudicators is not a guarantee that the system would be improved.

[*Translation*]

I will now very briefly address the second aspect of the ISDS that is frequently criticized, which is the absence of an appeal process. This has been condemned as a weakness of the mechanism, but I feel that it is instead one of its greatest strengths. Indeed, the fact that decisions are definitive and avoid the inherent delays of the judicial process is essential to the mechanism.

[*English*]

In the arbitration system as we know it, it should not be assumed that inconsistency between awards is necessarily problematic. It is a truism that different results may stem from the arbitrators’ different backgrounds, experience, or expertise. Factual matrices may be different. Every dispute is unique, and what may be seen as a mistake today may be found tomorrow to be justified as a valid distinction that fits the unique factual matrix of a case.

● (1325)

[*Translation*]

Although many continue to fuel arguments over the purported failings of arbitration, the speed at which the system has developed and continues to do so beyond Canadian borders is remarkable. In Asia, whether in Hong Kong, Singapore or China, all the recent statistics show record numbers of cases registered with arbitration bodies.

Its popularity is also evidenced by the inclusion of ISDS in the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, and in China's new Silk Road project called the Belt and Road Initiative. China has said that it will create an international tribunal for disputes related to the project. China's confirmed interest in arbitration is a further argument for keeping ISDS.

To conclude, I'd like to make a few comments about recent geopolitical developments that should convince you of the need to continue to include ISDS in Canadian treaties. As parliamentarians, you are no doubt very well informed about the situation.

A number of countries have recently said that they were against international trade, as evidenced by Trumpism and the imposition of tariffs. Arbitration thus becomes even more attractive as the allure of domestic courts declines. Brexit and trade tensions between the United States and China will have little or no effect on arbitration.

[*English*]

I read recently a statement by Eric Tuchmann: “In an unruly world, international arbitration offers a safe haven for business disputes”. Any perception that certain jurisdictions are unfriendly to foreign businesses will simply encourage those businesses to take their capital elsewhere or to avoid domestic courts and seek out neutral forums where they can settle disputes with the assistance of impartial and skilled facilitators.

Arbitration's success is not circumstantial. Its popularity has grown, despite the criticism it faces, because it is a proven and effective method for settling complex disputes that do not lend themselves well to adjudication in domestic courts. Given its track record for success, as well as the increasing uncertainty and risk on our fragile planet, arbitration's success should continue.

[*Translation*]

I believe that Canada should continue to include ISDS in its bilateral and multilateral agreements.

Thank you, Madam Chair and members of the committee.

[*English*]

The Chair: Thank you very much, Mr. Fortier.

We'll go on to Mr. Appleton, please.

The Clerk: Mr. Appleton just came in. Can we go to the next witness, please?

The Chair: We'll hold Mr. Appleton for a minute until he gets settled.

Go ahead, Mr. Côté, please.

[*Translation*]

Mr. Charles-Emmanuel Côté (Professor, As an Individual): Thank you, Madam Chair.

I too would like to thank the members of the committee for their invitation to appear this afternoon to discuss ISDS. I'm honoured to share this forum with others I have had the pleasure of encountering in the course of my career, namely Mr. Fortier, Mr. de Mestral and Mr. Leblond.

My perspective is that of an academic who has had an interest in ISDS for some 20 years. I would like to step back and put a number of ISDS issues into perspective. I'd like to begin by saying that I'm generally in agreement with Mr. Fortier.

It's important to remember that foreign investment existed before, that it still exists today and that it will continue to exist whether or not there is an ISDS mechanism. The ISDS is one of several considerations to be weighed in making investment decisions. If ISDS is were to disappear, foreign investment would not disappear. Foreign investment will always continue, just as foreign investment disputes will continue, whether or not ISDS exists. The disappearance of ISDS would not cause such disputes to disappear. Basically, ISDS is a tool or instrument for the settlement of the kinds of disputes that have always existed and that will in any event continue to exist.

Another factor that needs to be given consideration is the relative size of the amounts at issue—the amount of the claims being made under ISDS, the actual amount of damages eventually awarded, and the value of foreign investment stocks in a particular state. When these figures are put in perspective, it can be seen that apart from a number of fairly well-known exceptions, damages awarded amount to only a tiny fraction of the capital invested in states, which they need to grow their economies.

I'd also like to discuss Canada's changing stance towards ISDS, and particularly its overall position on foreign investment.

Until the 1990s, Canada was essentially a net importer of foreign capital. Since then, Canada has been a net exporter of foreign capital. Canada belatedly joined the shift towards investment agreements and ISDS. It took until the late 1980s for it to sign its first such agreements. However, it caught up quickly, in practice, because although ISDS had been included in treaties in the early 1960s, it really only gathered momentum in the 1990s. Canada was therefore one of the pioneers in the use of ISDS. I am referring here to the use of ISDS against Canada, because there were numerous claims from American investors.

I was looking at the numbers again yesterday. Of the countries most frequently sued under ISDS, Canada is ranked seventh. A total of 30 claims were made against Canada, 29 of which were from American investors. They did not always win, and we can return to this later. Canadian investors also ranked fifth in terms of most frequent users of ISDS globally. This must not be forgotten in reviewing Canada's stance towards ISDS. Thus far, 55 claims have been made by Canadian investors abroad.

I'd like to comment briefly on the origins of the ISDS mechanism.

As I was saying earlier, foreign investment disputes will continue to exist, whether or not there is an ISDS mechanism. All states around the world are bound by the international custom that provides minimal standards for dealing with foreign individuals and goods. In the absence of an investment agreement that spells out the protections included and an ISDS mechanism providing arbitration for investors that have been harmed and the state that harmed them, the system of international law works as follows: the foreign investor's state of nationality or state of origin must make an international claim against the state that wronged the foreign investor. This is what is called diplomatic protection. It's a system that has been around for a long time.

● (1330)

The downside of the system is that a dispute between a private investor and foreign state turns into a dispute between two sovereign states. Historically, this has contributed to deteriorating international relations. There have also been all kinds of diplomatic protection abuses, mainly before, but also in, the 20th century.

States therefore sought to avoid this politicization of investment dispute settlements. Hence the emergence of the idea of establishing direct joint international remedies between the wronged investor and the state in which the investor invested, rather than involving the investor's state of nationality. Several bodies were established, like joint arbitration commissions and joint tribunals, until investment agreements began to include provisions for the ISDS system.

When all is said and done, I cannot stress too strongly that beyond its technical advantages, ISDS primarily provides a political advantage by helping to depoliticize the settlement of investment disputes. It means that a state is not required to get involved in problems being experienced by its investors abroad. It prevents the souring of relations between investors' state of residence and the foreign states in which they invest.

For example, many Canadian investors brought claims against Venezuela for all kinds of reasons. All of these were dealt with by the ISDS process and Canada, as a state, did not have to trigger an avalanche of international claims against Venezuela. Each of these disputes remained limited matters between the company that was wronged and the state in question, in this instance, Venezuela.

Another example is the high-profile Keystone XL pipeline. For the time being, it's still possible to bring a claim under former NAFTA Chapter 11. However, if a situation like this one were to occur in a framework where there was no longer an ISDS mechanism, once the internal remedies had been exhausted, on the assumption that there are such remedies in the United States, Canada would be subject to political pressure and would have to decide whether or not to bring a claim against the United States, whether diplomatically or in court. A company's problem would accordingly become Canada's problem. It's important to keep this aspect in mind.

Problems with ISDS were brought up frequently and I will therefore not address these here. We can return to them in the discussion, if required.

I'd now like to mention a number of options and recommendations for Canada.

First of all, it would be a good idea for Canada to develop a foreign legal policy that is more in tune with ISDS. Canada has in fact embraced just about all of the scenarios being talked about in connection with ISDS. The first suggestion was to completely abandon ISDS in the Canada-United States-Mexico Agreement. Then, there was an in-depth reform of the system put forward by the European Union, which proposed establishing an investment tribunal and an appeal court. And finally, in its bilateral agreements and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, Canada maintained the status quo, merely making some ad hoc improvements to the existing system.

It is therefore difficult at this time to ascertain the underlying mindset for all these decisions. It seems to me that Canada should have a more considered and systematic approach. What should this approach be? In my view, it's imperative to begin by identifying the needs of Canadian investors abroad. It's impossible to come up with an approach without being aware of the needs of Canadian businesses investing abroad. It's also essential to establish whether Ottawa wants the responsibility of settling disputes on behalf of all Canadian companies abroad if the decision is made to abandon ISDS. It's important to keep this in mind.

● (1335)

Should our approach be matched to our trading partner's level of development? That's more or less what we appear to be doing, without actually saying so. If that's what we want, it seems to me that our decision should be based on analysis, rather than simply on what the negotiating partner wants. A well-thought-out and consistent policy seems to be lacking in this area.

I believe that some fundamentals need to be dealt with.

One of the problems stemming from Canada's rather kaleidoscopic approach is that there are still some loose ends that need to be tied up. For example, even though Canada is a member of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, it still has some bilateral agreements, including an ISDS mechanism, with some states that are also its CPTTP partners. This peculiar approach means having sets of coexisting treaties with different obligations. It allows investors to choose the most recent treaty, or the oldest, depending on what they want.

Other states, like Australia, systematically abrogate previous treaties when they sign a multilateral treaty that includes the same parties. It's surprising that Canada hasn't done the same.

Canada did so, however, with the European Union. Hence, if the CETA chapter on investment comes fully into force, then it is expected that the six or seven bilateral treaties that Canada still has with European states will be abrogated.

It's unusual to take two different approaches in this area. Once again, I find Canada's approach inconsistent.

Another problem we have is that Canada still has some old bilateral treaties that are still in effect. They were negotiated at a time when the scope of protections, applicable rules of procedure and process transparency were less carefully defined. These older treaties are still out there and could come back to haunt Canada. It is indeed possible that investors might try to invoke the better protection provided in a treaty with other states, under the most favoured nation clause. We therefore run a real risk of seeing efforts to improve the system through more modern treaties thwarted by the invocation of older treaties.

Many states around the world have begun to modernize older treaties. Canada should begin the task of doing so as well.

To conclude, the end of ISDS does not mean the end of regulating disputes with foreign investors. These disputes will continue to exist, but they will simply have to be dealt with otherwise. In the end, whether or not they are settled mainly by domestic courts, there will be pressure on Canada, and it will have to decide whether it is willing to handle claims made by Canadian companies abroad. This needs to be taken into account if the abandonment of ISDS is being considered.

Canada is not the only country to consider discarding ISDS. China was mentioned a short while ago. China appears to have sidelined ISDS in the recent chapter on investment In the regional comprehensive economic partnership signed by 10 member states of the Association of Southeast Asian Nations. One agreement with the European Union also appears to have dropped ISDS. Some states are therefore moving in this direction. It must not be forgotten, however, that disputes will continue. Removing ISDS may simply lead to a renewed politicization of dispute settlement.

We also need to pay attention to the possibility that foreign investors, through careful business planning, might invest in Canada via subsidiaries located in those states with which Canada has investment agreements. Moreover, it might be relatively effortless for investors to circumvent the abandonment of ISDS. Once again, this provides an illustration of the problem caused by Canada's somewhat inconsistent approach, which does not address the matter systematically. In some circumstances, careful business planning could allow private investors to benefit from ISDS in treaties with other states. I repeat that this may not be possible in all instances, because certain conditions need to be complied with, but it is a possibility.

● (1340)

I'll leave it at that for now. Thank you for your attention.

[*English*]

The Chair: Thank you, Monsieur Côté.

Go ahead, Mr. Appleton, please.

Mr. Barry Appleton (Professor, As an Individual): Thank you very much, Madam Chair.

I'd like to thank you and the committee for the invitation to present today on investor-state dispute settlements.

I've studied and engaged in this area for more than 25 years, and I hope to provide some useful and practical views to the committee, so that will take it a little bit outside of some of the other things.

I had the opportunity to hear some of my esteemed colleagues. We had a slight technical problem, and I heard most, but not all. I'll try not to repeat what they've said, and I'll try to focus on what could be the most practical here.

Let me just tell you a little bit about myself. I'm a Canadian and an American lawyer. I'm the co-director of the New York Law School Center for International Law. I serve as the co-chair of the American Bar Association international arbitration committee of its section on international law. I'm the author of many works on international economic law, including two books on NAFTA, the North American Free Trade Agreement. I serve as the editor of Westlaw's investor-state reports and the Westlaw investment treaty series. I served as an adviser to governments in Canada on NAFTA and the WTO, including on the defence of investor-state cases. I have also acted repeatedly for investors with claims against the Government of Canada under NAFTA as the managing partner of Appleton & Associates International Lawyers LP, based in Toronto.

My remarks today, of course, are only in my personal capacity. They do not reflect any of my associations with those institutions, organizations or clients. They're my comments alone. I take full responsibility for them.

Now that we have that out of the way, I want to point out that investor-state arbitration provides a depoliticized and independent mechanism that allows for the application of the rule of law to disputes between states and investors. That's what Professor Côté was just talking about, and he gave a very good overview with respect to that. As this committee is very well aware, Canadians can and do succeed globally in international business and with investment. Canadians can be competitive. We're innovative, we're resilient and we can deal well with diversity of language, culture and legal systems.

Canada does not have oversized economic, military or political weight, and to succeed, we need to understand how to be clever rather than how to be mighty. We succeed by following the rules. We succeed by developing rules. We succeed by having our businesses provide a better value proposition, and we expect that our companies will win—they will succeed abroad—or they will lose entirely based on the application of the rules in a fair manner. Canada wins by the application of trade rights rather than by the application of trade mights. When it comes to trade might, we just don't have it, so we need to be able to find rules.

Because of the need for a rules-based system, Canada has traditionally long underscored the need for multilateral, rules-based institutions. We support the World Trade Organization and the United Nations. This is the Canadian way. An investor-state dispute settlement is another part of a multilateral rules-based system.

As you heard from Professor Côté and you've heard from other witnesses, we're part of the CPTPP, the CETA, the CUSMA, the NAFTA and many other bilateral investment treaties. As Professor Côté just pointed out, investor-state arbitration prevents the escalation of low-level disputes, international disputes, and in this way, investor-state arbitration is critical because it keeps these disputes compartmentalized and de-escalated. ISDS ensures that determinations of the application of discriminatory, improper, unfair or even corrupt treatment against Canadians can be addressed without Canada as a country having to engage in a diplomatic skirmish, the principle of diplomatic protection that you've heard before this committee.

The majority of ISDS claimants that I've represented are small and medium-sized businesses. They are not the Fortune 100 mega caps. The treaty protections are really more important to the small companies because they don't have access to influence and wealth, and access to justice needs to be available for the small as well as for the mighty.

This committee has heard a great deal about the potential for regulatory chill about ISDS, and I'd like to devote the rest of my comments to ISDS in Canada. I want to focus on some practical things that I think this committee can do with respect to its supervision and review of the issues.

● (1345)

ISDS is integrated into our network of investment and free trade treaties. Basically the deal is a quid pro quo. We ask foreign countries to treat Canadian investors at a high level, and then in return we guarantee that same protection to the foreign investments in Canada. It's really that simple. We obtain benefits from others, but we're required to provide those same benefits ourselves.

We think we're a wonderful country. We have wonderful institutions. We have a robust legal system. It should be easy for us to be able to provide that relief.

Restrictions upon Canadian public policy come from the treaty text, not from the ISDS process. Many ISDS complaints misplace the root of the problem on the tribunal, rather than correctly on what's in the treaty text itself. Our treaties are crafted with broad public policy exceptions. They permit broad public policy regulation. However, our officials need to scrupulously rely on the existing exceptions.

The committee here plays a vital role in the supervision and amendment of the trade treaties, and you may wish to consider in particular the impact of exceptions in the treaties in your future work.

I'd like to turn to some actual examples of things we could do that would be better.

First is that discretion is the better part of valour. What do I mean? Much of Canada's difficulties with ISDS arise from Canada's failure to pick the right fights. Every day a Crown counsel, before the court begins, has to decide which cases to fight and which to settle. Not every case is worth the fight.

In ISDS we fight everything. Perhaps we might want to reconsider how we do that, because states lose when they are defending against poor public policy. They lose the imprimatur of the state, the things that come with being a state. Cases that are based on bad public policy should be settled at an early stage. This would save considerable amounts of taxpayers' money, and there's little public purpose that's served from promoting poor public policy. What we want to do is promote strong public policy.

Canada has actively defended against poor public policy in the past, and it's not surprising that Canada has not been particularly successful when it does that. That's a defect, in my view, in Canada's approach to investor-state disputes. I think it helps to explain why Canada has been the most unsuccessful state with respect to NAFTA in investor-state cases. You need to pick winners. Discretion is the better part of valour.

I'd like to turn to the regulatory chill issue. As a government adviser myself, I never experienced a situation of a government policy constraint because of the risk of an investor-state case. In general, treaties are worded to give a wide ambit for government policy. Nothing prevents governments from protecting their subjects. That's their duty. That's what they do.

However, in every situation where I've been involved—and I've been involved in the creation of a number of situations that needed this type of consideration—I've found that governments would move forward with a policy and then subsequently address potential issues later. This is commonly what the government does with respect to WTO-related concerns on policies, and increasingly what the government is starting to do with concerns about the regulation of digital platforms.

These are all issues that now come into the purview of this committee on international trade. This supervisory power from this committee has been, in my view, constrained by some of the government's own actions.

I'd like to advise the committee on some areas they might want to look at.

The first is that Canada has taken steps that restrict public access and public knowledge of materials in NAFTA cases. For example, Canada does not give public access to declassified evidence from NAFTA tribunals. It's all declassified and all has a process. In my view, Parliament and the public should have full access. Transparency is a very important value that we express internationally, and we need to do it so Parliament can supervise it properly.

In a current NAFTA case where I'm counsel, Tennant Energy v. Canada, there are admissions of internationally wrongful behaviour from public officials that come from a previous NAFTA case. Those admissions, astonishingly, talk about how Canadian public procedures were circumvented to assist governmental friends and supporters by a secret high-level group of officials. This is the evidence. Canada posted a link on the Internet to a video with all of this material. It was quite scandalous.

● (1350)

It was public for five years, but then Canada took steps in the Tennant NAFTA arbitration case to prevent the public and Parliament from actually seeing this material after it was posted for five years on the Internet. Parliament and Canadians have no access because of the government's decision to suppress this information.

Perhaps it may be embarrassing, but this may explain why Canada hasn't done so well. It's not because of the ISDS system. It's because of the decisions that we take along the way. It would seem to me that Canadians have a right to know. I would suggest that the standing committee really should have a right to know what's going on, especially with something that's been posted for five and a half years on the Internet. I simply don't know how it could be confidential.

Another very practical matter that would enhance Canada's success in ISDS would be to engage in meaningful consultations at an early stage. The CUSMA and the NAFTA both have provisions that mandate this, but our consultation process has moved from meaningful consultations to active listening. It would seem to me that we could resolve matters much earlier and much more easily if we could deal with that.

Let me give you an example. I was counsel in an early NAFTA case where Canada was unsuccessful. It was a case called S.D. Myers. In that case, a small business brought a case against Canada. It sought meaningful consultations with Canada. Had Canada engaged in the meaningful consultations, I'm of the view that the case would have settled. The government lost the case and had to pay millions of taxpayers' dollars, but all the company really wanted was to be heard at an early stage and to have an apology for something that they thought was wrong.

It would seem to me that these are all specific things that we could do to be better and to enhance our handling of ISDS. These are specific powers and approaches that I think this committee can do.

These opening remarks provide some practical and specific suggestions as to how Canada could enhance its success with ISDS. I've engaged in a considerable amount of study on the ISDS system, its operation and the new reforms that are under way. While I thank the committee for the opportunity to present today and I'd be delighted to take questions on any of the new ramifications or the new approaches as well as the other ones, I didn't want to miss the opportunity to provide some very specific things that I think this committee could consider to make our process better.

That's something that we can do, but you cannot do that if you don't have the information. You need this information from the government; you need that reporting. All Canadians will be better and you'll have a much better and meaningful process if you're able to obtain that information.

I thank you very much for the opportunity today. I look forward to questions.

● (1355)

The Chair: Thank you, Mr. Appleton.

We move on to Professor de Mestral.

[*Translation*]

Mr. Armand de Mestral (Emeritus professor of Law, As an Individual): Madam Chair and distinguished committee members, thank you for this invitation.

I must say that generally speaking, I agree with my distinguished colleagues.

We heard from Mr. Yves Fortier earlier. I can tell you that he is the most highly respected arbitrator in the world, which is remarkable. We are fortunate to be able to hear his point of view, even though I do not fully agree with him on certain points.

Since my speaking time is very short, I will simply focus on the main question. Does arbitration between an investor and a state work against Canada's interests? Like my colleagues, I would say that my general answer is definitely not. It does not run counter to Canada's interests. Quite the contrary. Although I will mention a number of reservations, I would like to point out that these reservations are already largely built into Canadian practice in recent agreements.

I'd like to begin by addressing the criticisms and responses to them. I will then ask whether there are alternatives to arbitration between an investor and a state? After that, I have a few things to say about the proposed establishment of an international arbitration tribunal.

There have certainly been criticisms, throughout history. There are sometimes complaints about contradictory decisions or poor decisions that have been handed down. As there have been some 700 such decisions, it's not unlikely that this should occur along the way.

There have been questions about the appointment of arbitrators. At the outset, there were questions about whether certain arbitrators might not deal with the process strictly as trade arbitrators, by which I mean they would view disputes as essentially trade decisions. As you can see, trade interests exist alongside public and policy interests. I believe that most arbitrators today understand this.

Who are these arbitrators? At the beginning, arbitrators were mainly Canadians, Americans and Europeans. This was gradually extended to include others, but the developing states' initial trepidation was well-founded. Some claims were said to have been clearly frivolous or politically sensitive. The more fundamental problem, or at least the problem that many academics have studied, is the fact that states can struggle to respond to certain types of claims. For example, in mining disputes, when a company blamed the state for contravening a number of the conditions in a treaty, South American states tended to argue that the company had infringed some fundamental human rights, that it had made things terribly difficult for their indigenous communities, or other similar claims. From the procedural standpoint, it's very difficult for a company to submit a defence of this kind.

Are there answers to these criticisms? I believe that there are, not only with respect to the rules but also the process.

● (1400)

It's true that much has been done in terms of the appointment of arbitrators. There are codes of conduct. Arbitrators are appointed much more carefully. Attempts are gradually being made to appoint women and people in Asia who have thus far never been appointed, and these efforts are beginning to pay off. From this clearly important standpoint, there is now much more diversity in the community of arbitrators. I can tell you that those who in a position to appoint Yves Fortier are very pleased.

From a procedural standpoint, many treaties, including some signed by Canada, the European Union and the United States, now allow certain types of claims to be excluded. This may not make the claimants happy, but claims deemed to be frivolous or clearly unfounded will be excluded under certain treaties, including Canadian treaties. So in terms of procedure, that's one answer.

An examination of bilateral treaties, and the chapters on investment in some of Canada's major trade treaties, shows that procedural reforms have been added. The process is therefore well underway, but certainly not finished.

Are there other options? Some say that the system can be eliminated. My colleague Mr. Côté has given a good explanation of why governments don't want to be responsible for many of these cases. We don't have the gunboats, unfortunately. The gunboat era is over. States prefer to have these disputes dealt with independently in a much less politicized framework.

It is often argued that all cases should be sent to domestic courts, but that's a simplistic solution. In a book that I wrote on this topic, the first chapter goes into considerable detail on how this issue affects Canada. If 80% of cases against Canada were sent to Canadian courts, we would end up dealing with administrative tribunals that render justice formally, but that do not award compensation. For businesses bringing the complaints, this option is therefore thoroughly inadequate.

Were we to return to the situation in which all disputes are sent to domestic courts, there would be 189 different solutions. That's not what we want. The obvious advantage of arbitration in the existing system is that the treaty creates applicable rules on the one hand, and on the other hand, an arbitration tribunal has all the advantages of such tribunals in terms of procedure and sentencing. The system works. But if there were 180 different systems, it wouldn't work. These so-called solutions, unfortunately, really don't cut the mustard.

So some of my views may differ somewhat from those of my colleague Mr. Fortier.

● (1405)

Upon lengthy political debate, the European Union proposed a system, the creation of an international investment arbitration tribunal. The judges on that tribunal would be known and no doubt selected from among the world's leading experts in the field. Rather than abolish the law of the investor state, the tribunal would enforce the treaties. The law would thus always be applied, but by a known tribunal and, let's hope, one whose members would enjoy considerable respect.

Would it be preferable to have a system such as the one we now have, under which the parties appoint their own judges, that is to say, their adjudicators? It's hard to say. First of all, there's a political issue. How many states will follow Canada in emulating the European Union? Some would, but, for now, not many. The tribunal would likely be established, but how many states would expose their investment interests to the tribunal's decisions? It remains to be seen, and this is a solution for certain states, but perhaps not for others.

Let's not forget the Appellate Body of the World Trade Organization, or WTO, which has been so successful that the United States, under the Trump administration, feared it and halted its proceedings. However, it can't be denied that the tribunal has consolidated WTO jurisprudence and made a strictly arbitral system more consistent. Consequently, I'd be inclined to give it a chance, and I understand why Canada has emulated the European Union. I don't think we should fear that system.

The risk, of course, is that we'll have a two-tiered system that both arbitrates and is subject to the decisions of this tribunal as a result of the some 3,000 trade and bilateral investment treaties. This may be the biggest problem left for countries like Canada, which are trying to modernize the system. At least 2,000 treaties will probably not be renewed in the near future.

Thus, in any case, we'll have a system in which most, but not all, treaties will be much more modern, like most Canadian treaties, as Professor Charles-Emmanuel Côté said. Those treaties won't be modernized in many states, and certain provisions will therefore be subject to interpretation and, in some instances, to criticism. We will very likely be living in what, for now, will remain more or less a two-tiered system. In my view, however, Canada would do well to forge ahead and try to clarify rules and procedures. We have an interest in trying to support the international investment arbitration tribunal model.

● (1410)

[*English*]

If I may, just to conclude, you don't throw the baby out with the bath water. You try to ensure that the heat of the bath water is right for the baby. What's right for one baby might not be right for another.

There are serious issues out there, but personally I have a lot of respect for the way the Canadian government has tried to modernize as far as it can go. It modernized its own treaties, it modernized the system and it encouraged modernization. That is the way that I would hope to see the system advancing.

Thank you very much.

The Chair: Thank you very much, Professor.

We move on to Professor Leblond, please. The floor is yours.

[*Translation*]

Mr. Patrick Leblond (Associate Professor, Public and International Affairs, Faculty of Social Sciences, University of Ottawa, As an Individual): Thank you, Madam Chair.

It is an honour and a pleasure for me to address the members of the committee today.

My remarks this afternoon will focus on the logic of the investor-state dispute settlement mechanisms, or ISDS, and on the choice you members of the committee face as part of this study. I should therefore remind you that the objective of investor-state dispute settlement mechanisms is to reassure businesses, that is to say, investors, when they do business abroad.

Those mechanisms, which are set forth in the free trade and foreign investment protection agreements, are designed to provide a neutral—meaning non-politicized and impartial—and efficient conflict resolution framework for determining situations where an investor has suffered a loss of assets, as in an expropriation, or a loss of asset value as a result of discriminatory action by a government against that investor and the investor's investment.

In exchange for a more predictable business environment in which foreign investment is afforded greater protection, foreign businesses are expected to invest more. The purpose of these agreements is to encourage investment in the hope that it will contribute to economic growth. This therefore means, at least in principle, that there is no reason for such a mechanism if a country provides this kind of protective national framework for foreign investment. In other words, if businesses operating internationally can rely on national tribunals, and if those tribunals are effective and impartial, then, in principle, they should not need to rely on international agreements to protect them or on an investor-state dispute settlement mechanism.

As Professor de Mestral mentioned, the issue of compensation arises in certain cases, but this mechanism logically exists because foreign businesses often operate in countries where tribunals are not very reliable. They therefore prefer this kind of supranational protection, as it were.

We in Canada can theoretically offer foreign investors this kind of framework, notwithstanding the factors that Professor de Mestral cited. In fact, the problem is not with us. The question you members of the committee must consider is whether you want to protect the interests—meaning assets—of Canadians and Canadian businesses investing abroad.

If the answer is yes, then we need agreements including ISDS mechanisms. That of course requires reciprocity among the signatory parties. If we ask others to participate in this kind of mechanism, they will in turn ask us to participate in it as a state. We must also offer these protective mechanisms to foreign investors who come to Canada. This is the world we live in. There is this concept of reciprocity. We want to protect the foreign assets of our businesses, and, in exchange, we naturally request that foreign businesses do the same when we negotiate and sign foreign investment protection agreements.

If the answer is no, Canadian businesses will then face greater uncertainty when they operate abroad, but that's one transaction cost among many. Professor de Mestral said they would be dealing with 189 different rules, one for each country. That's true, but the reality is that, every day, companies engaged in international business face rules, procedures and legal and cultural systems that differ from one country to the next.

Businesses operating internationally would theoretically have one more decision to make if there were no investor-state dispute settlement mechanism. They would have to consider how that would affect their sales, production costs and, in some instances, access to inputs, markets and so on.

However, if the foreign assets of Canadian businesses were not protected as well as those of their competitors in other countries, because those of their competitors would be protected by the ISDS mechanisms negotiated by their governments, then those Canadian businesses would be put at a disadvantage.

● (1415)

If we decide to let the market operate and leave businesses to their own devices, because we can protect foreign investors that come to Canada and Canadian businesses operating abroad, then it's up to them to address this additional risk in their business decisions. That's the way it is.

The problem in this case is that, since other countries may protect their businesses by means of these dispute settlement mechanisms, our businesses face operating risks, which entail additional costs. They thus become less competitive.

We find ourselves in a situation where we are somewhat affected by this lack of coordination. We are ultimately talking about a lack of coordination among states. If you withdraw Canada from this kind of mechanism, Canadian businesses will then be abandoned and will face much tougher international competition. They will be less competitive in those markets, and even in Canada.

Consequently, assuming world governments are unlikely to agree to eliminate these agreements, then the problem is the reverse. We then need to focus the energies of the Canadian and other governments on improving ISDS mechanisms to make them more transparent, accessible and fair for all Canadian and international businesses.

My distinguished colleagues have naturally suggested a number of ideas for improving those mechanisms and ensuring that Canadian businesses are competitive with their international counterparts.

I'll stop here. That's all I have to say, since the others were much more eloquent than I on the specific challenges associated with these mechanisms.

Thank you, Madam Chair.

● (1420)

[*English*]

The Chair: Thank you very much, Professor Leblond.

We will go on to Mr. Aboultaif, for six minutes, please.

Mr. Ziad Aboultaif: Thank you, Madam Chair.

Thanks to the great witnesses with wonderful testimonies today. We have learned a lot.

Businesses, capital investment and investment in general look for security, for certainty; otherwise, they will not be able to do business. ISDS works because they work in both directions: They work for investment coming our way, and they work for our companies that invest abroad.

We have heard from the witnesses—from Monsieur Fortier, Monsieur Côté, Mr. Appleton and all the great witnesses today—and I would like to say something. In life, we say you don't get what you deserve; you get what you negotiate. With ISDS, we know there are different models that will be tailored to fit the different markets you're targeting or the different agreements you are trying to put together.

I would like to ask the witnesses—I will start with Monsieur Fortier, and then to Monsieur Côté and Mr. Appleton—if they can give us some real-life examples of situations and cases where ISDS was the right solution and having it there was good for Canada and for Canadian companies.

[*Translation*]

Hon. Yves Fortier: Madam Chair, would you like me to begin?

[*English*]

Mr. Ziad Aboultaif: I would like to start with Mr. Fortier, then Mr. Côté and Mr. Appleton, if that's okay.

Hon. Yves Fortier: First of all, thank you for your question.

I would be remiss if I did not acknowledge and thank my friend Professor de Mestral for his generous comments in the course of his excellent presentation. Coming from an authority in the domain, as Armand de Mestral is, it's a great compliment.

[*Translation*]

Thank you, professor.

[*English*]

Mr. Aboultaif, I don't know where to start. I could give you so many instances of cases in which I've been involved, either as a counsel or as an arbitrator, where Canadian corporations have benefited.

I'll give you one, because it's a case in which I'm presently involved as a member of an international tribunal. This is on a no-name basis, obviously, because, as I said, the case is pending. It's a Canadian mining company from British Columbia that has a subsidiary in Poland. It was awarded some exploration concessions a few years ago by a department of the Government of Poland. Its competitor was a Polish mining company. After the decision was issued, the then president of Poland complained and asked why they favoured a Canadian company rather than a Polish company. He was followed by a number of influential people in Poland, and eventually the mining concession was cancelled.

Canada has a bilateral investment treaty with Poland, and the Canadian company shareholder of the Polish company availed itself of a provision of the treaty and gave a notice of arbitration against Poland. The case was argued in Warsaw a couple of years ago, when we could still travel.

We are now deliberating, my colleagues and I, and whatever the result is going to be.... Don't expect me, of course, to speak about the merits of the case. This is a case where the subsidiary of a Canadian company benefited from the existence of a bilateral investment treaty with an arbitration clause and instituted proceedings before an international tribunal. I was appointed by the Canadian company. The chairperson of the tribunal is Swiss, and the arbitrator appointed by Poland is a very eminent German jurist.

That's a short answer, Mr. Aboultaif, to your very important question.

● (1425)

Mr. Ziad Aboultaif: Thank you.

I move to Mr. Côté.

The Chair: I'm so sorry, Mr. Aboultaif. You have 26 seconds left.

Mr. Ziad Aboultaif: Sure.

Hon. Yves Fortier: That's my fault. I'm sorry.

The Chair: It was a terrific answer and valuable information.

We go on to Ms. Bendayan.

[*Translation*]

Ms. Rachel Bendayan (Outremont, Lib.): Thank you, Madam Chair.

I'd also like to thank all the witnesses here today. I'm very proud to see so many Quebec experts here with us to clarify this important matter for us.

I obviously have many questions, but my speaking time is short.

I'll start with Mr. Fortier.

A few minutes ago, Professor Côté said that the disputes we're discussing today should remain limited matters and that it's a good thing that countries and governments don't need to intervene. I must admit I agree with that.

[*English*]

We also heard from Mr. Appleton, who was talking about a greater public disclosure of information and greater involvement of parliamentarians in the dispute resolution process.

I was wondering if we could get your comments on these views and what you think the government's role should be, particularly as we are dealing with.... It is an alternative dispute mechanism process, but it is a dispute resolution process nonetheless, and we need to respect that.

Mr. Fortier.

[*Translation*]

Hon. Yves Fortier: Ms. Bendayan, as you very well know, it's important to be in the right place at the right time. When you practised law at a certain firm with a certain lawyer who is pleased to see you again today, you were in the right place at the right time. That's true again today, because you're the member for Outremont and you sit in Parliament and on this committee, the mandate of which is precisely to provide answers to these many questions.

[*English*]

You have often heard me say that being at the right place at the right time is very important.

[*Translation*]

You've been in the right place both times, and I congratulate you on that.

[*English*]

Ms. Rachel Bendayan: Thank you very much, Mr. Fortier.

I'd also like to take the opportunity, with my limited time, to ask Professor de Mestral a question. Full disclosure, he is also my former professor.

I have read your book *Second Thoughts*, Professor. I certainly recommend to all of my colleagues on committee to do the same.

You mention in your book that, originally, the idea of ISDS was viewed by western countries as a way to bring developing countries in line, but quite soon thereafter, western countries were surprised to be sued by many developing nations.

Could you comment on the idea that ISDS is being used by developing countries and is in fact a tool that we should be looking at in order to level the playing field? I'm also interested in any other comments you may have with respect to the importance of ISDS internationally.

● (1430)

Mr. Armand de Mestral: I think you're right in noting that.... The original treaty, the very first one that's always mentioned, between Germany and Pakistan certainly was designed to protect German investments in Pakistan. There weren't very many in the fifties, sixties and seventies. Things gradually took off, particularly with NAFTA, in fact.

NAFTA was a bit of a wake-up call for Canada. Everybody said that we were going to buy into investor-state arbitration under chapter 11 because we may have to deal with these Mexicans who are a bit unruly. Lo and behold, who got sued first? Canada. Who got sued second? Canada. Then somebody had the good sense to sue the USA and one thing led to another.

In fact, in many ways, in terms of the thinking that went into the lawyership and into the decision-making by arbitrators, NAFTA was certainly an important moment in the development. There was certainly a phenomenon where more developed countries were being sued, but I think over the last 15 to 20 years, we have seen something of a rebalancing. People wondered whether China would ever get into it. Finally they've accepted to be sued and now they're suing other countries themselves. India has been reticent, but Indian investors are out there suing both developing and developed countries.

I think the idea that it is simply some sort of conspiracy to pull down the developing world is no longer true. You have developing country investors, as between each other, and people like Tata in Europe and in Great Britain who have taken cases against European governments.

I think things have rebalanced quite a bit. We have over 700 cases now, and those who are suing really constitute quite a remarkable mix of countries. As Barry Appleton noted, it's not just big corporations, but a great many smaller corporations are using the system as well.

The Chair: Thank you very much, Professor.

Mr. Armand de Mestral: I'll hold my peace, Madam Chair.

Ms. Rachel Bendayan: Thank you very much, Professor.

The Chair: I'm sorry; your time is up.

We're on to Mr. Savard-Tremblay, please.

[*Translation*]

Mr. Simon-Pierre Savard-Tremblay (Saint-Hyacinthe—Bagot, BQ): Thank you, Madam Chair.

Greetings to my colleagues and thanks to the witnesses for being here.

My questions are for Mr. Côté.

Mr. Côté, thank you for your presentation. I've never been a professor, but I was particularly interested in this issue in my former academic life. You provided an overview of the political and legal factors that led to the creation of the investor-state dispute settlement mechanism. However, it seems to me the ideological circumstances in which that mechanism was created can't be overlooked.

When the concept began to spread and the mechanism was introduced under NAFTA, it was a time of neoliberalism and globalization. People talked about the end of states and nations. The purpose of that mechanism was to protect investors and multinationals from certain political decisions. That seems to me a return to the old idea of the invisible hand, according to which the more private interests are freely pursued, the better off a community will be. You can't disregard that now and wonder whether the idea is still relevant.

Earlier you talked about the depoliticization of certain economic decisions and ways of doing things. I think instead that we should go back to politicization. Before NAFTA, we had the Canada-United States Free Trade Agreement, the FTA, under which a business seeking to sue a state had to go through its home state.

Some time ago, I heard you say in the media that the fact this mechanism is no longer included in the CUSMA was good for Canada. I'd like you to comment on that.

My second question is related to the first. You said you were prepared to speak at greater length about the mechanism's flaws during the period of questions. Here's an opportunity for you to do that.

● (1435)

Mr. Charles-Emmanuel Côté: Thank you very much.

I'll try to be concise.

First, I'll address the initial point you raised, which concerned the political context. As it happens, ISDS was expanded around the time the Berlin Wall fell. However, these treaties and the idea of joint arbitration largely preceded all that. For example, the ICSID Convention was adopted in the mid-1960s, when the European bilateral investment treaties were negotiated and signed starting in the late 1950s and in the 1960s and 1970s.

Why was ISDS not implemented? The first case dates back to 1990 and involved Sri Lanka. Then another case concerned Zaire, as it was called at the time, in 1997. Lastly, yet another case was brought against Canada in 1998.

As Mr. Fortier said, the fundamental feature of arbitration is the parties' consent to it. However, one of the characteristics of ISDS is the dissociation of consent. In short, the states give their consent in advance, whereas investors do so when they file a claim.

Until it was tested, it was unclear whether the technique was consistent with the ICSID Convention, for example. Ultimately, the successful resolution of two or three cases showed that it worked and that the state didn't need to grant authorization on a case-by-case basis. So arbitration took off.

More treaties followed. I'm not an economist, but I've read around the topic and studied the matter, and I believe this happened at a time when developing countries were tapping out and genuinely needed foreign capital. They completely changed their approach to foreign investment and began to promote bilateral investment treaties precisely so they could attract the investment they needed in order to develop. That was the economic reality of the time.

As for a return to politicization, I would have liked to discuss it, but my speaking time is limited. Is ISDS suited to all disputes? That's the question. Should certain disputes be resolved at the state level instead? That's a legitimate question. Beyond a certain amount of damages, doesn't a dispute become too big to be resolved that way? It's an open question.

Then there are cases in which decisions aren't enforced. As someone said, decisions are binding. However, if a state doesn't wish to offer compensation, it must have goods that can be seized. Politicization is therefore still possible. If the ISDS system doesn't work, the state of nationality comes back, reappears and may intervene.

Another way in which the process may be repoliticized is through intervention by the state of nationality, which is not a party to the dispute. It may intervene in two ways, either through arbitration proceedings, if it wishes to raise a point of law in treaty interpretation, for example, which regularly occurs. In some instances, it may agree with the state concerned by the claim against its own investor that, for example, “indirect expropriation” does not mean that in such a case. This is a form of repoliticization.

Or else the states may agree....

● (1440)

[*English*]

The Chair: I'm sorry to cut you off, Professor, but the time is up.

We're on to Mr. Blaikie, please.

Mr. Daniel Blaikie (Elmwood—Transcona, NDP): Thank you very much, Madam Chair.

Thank you to our witnesses for appearing today.

I doubt it will come as a surprise—to many on the committee, certainly, and perhaps to our witnesses—that I count myself, and New Democrats have counted themselves, among the strong critics of investor-state dispute settlement chapters over the years in trade agreements.

I am going to resist the urge to offer some of the more polemic articulations of that critique today at committee, because I think it's a good discussion. Canada now finds itself, as was mentioned earlier, in many agreements. These are facts that we have to contend with, even if we don't like them.

I want to address my remarks to Mr. Appleton first, and then perhaps if other witnesses want to jump in, they can.

I thought your comment about some of the criticism of investor-state dispute settlement chapters being more about the other substantive content of the deals that they appear in to be an interesting comment. I think there is a fair point there, but it does seem to me that these things are related and that the advancement of ISDS has gone hand in hand with agreements that prioritize a certain way of looking at international trade, agreements that frankly put the interests of large corporations and investors before the interests of working Canadians. I would certainly argue that view; it is hard to tease those things apart.

I think that if you had investor-state dispute settlement mechanisms—or they might need another name if it was no longer solely about the rights of investors but others as well—that had the same teeth to enforce common environmental standards and common standards in respect of human rights, including collective bargaining, you might see more support for those kinds of enforcement mechanisms. It's hard not to notice that the enforcement mechanism with teeth revolves solely around the rights of investors and not anybody else or any other important policy goals.

When we hear calls, for instance, from the Alberta premier to invoke ISDS in response to the recent decision by the new administration in the U.S. on Keystone XL, I think that highlights some of the frustration that people have with ISDS provisions as well. I would argue that the decision on Keystone XL, whether you agree with it or not, represents an important set of issues that have to do with the environment and with the way not just Canada but, in this case, the United States as well treat their indigenous peoples and relate to their indigenous peoples, and the extent to which they respect their rights as well when it comes to major natural resource projects.

Those are not decisions that ought to be taken at an international trade tribunal. Those are decisions that are important. There are a lot of different kinds of values at play, and in a democracy it's appropriate to deliberate publicly about those things and to make those kinds of decisions in a deliberative fashion, preferably in Parliament, but at the very least by a government that is sensitive to those issues and tries to mediate those disputes in the best possible way. That's not the mandate of an arbitrator in an investor-state proceeding.

I am trying to characterize for you a little bit the way critics from the outside see this. It's very much part of a system designed to protect the rights of investors. In so doing, it cuts off debate and decision-making potential for other very important issues. I would say that citizens in general should be concerned to protect their right to deliberate in those ways and to protect the right of governments to make decisions in those ways. The ISDS system doesn't appropriately balance off what is a legitimate concern for investors, who want to have some security that their investment will be protected. ISDS has really put that on such a pedestal that every other kind of issue isn't really even within the scope of the proceedings.

How do you maintain the appropriate space and authority to make those kinds of decisions when you're signing on to quasi-constitutional documents that are narrowing the scope to a very limited conversation about the rights of investors, when those decisions have very clear and far-reaching implications on other issues?

● (1445)

I realize that's a long question, and it's taken up a lot of my time, but if you could begin to hazard an answer, Mr. Appleton, I would appreciate that.

Mr. Barry Appleton: Mr. Blaikie, I want to thank you because it's a deeply probative question, and I spend a lot my time thinking about exactly these types of issues.

I'm going to try to hit this in bullet points to fit it into your time because I'm worried that we won't have very much time.

On the issue of indigenous peoples.... I'm very committed and focused on indigenous peoples issues. In fact, I want to commend you and all the other residents of Manitoba on the opening of the Qaumajuq at the Winnipeg Art Gallery. It is a new Inuit art centre that was opening today and yesterday.

They're mostly excluded. Canada put very broad exclusions into treaties like the NAFTA, the CUSMA and other treaties like that so that we don't get that conflict.

I would like to focus on labour rights in particular. I've been a strong proponent of labour rights and was actually very concerned when the Government of Canada pushed the NAFTA free trade commission to restrict the meaning of NAFTA article 1105, which gives specific rights to enforce labour rights. I have had detailed discussions with members of the U.S. Congress, as well as many different parliamentarians and legislators in Canada, about my concern of restricting the coverage.

The problem—again, it's still sort of a chicken and egg—is that we have a lot of things we did because we were concerned about cases. I believe that Professor de Mestral mentioned the first two NAFTA cases. I brought them. The first case Canada lost, and the second case, as I said, Canada would never have lost if it had just given an apology or met—

The Chair: Professor Appleton, I'm so sorry.

Mr. Barry Appleton: No problem. Thank you.

The Chair: Possibly you can communicate in writing between yourself and Mr. Blaikie.

We're on to Mrs. Gray, please, for five minutes.

Mrs. Tracy Gray (Kelowna—Lake Country, CPC): Thank you, Madam Chair.

Thank you to all the witnesses for their very informative testimony here today. There really does seem to be a lot of consensus that without ISDS it would politicize trade disputes, so that was really informative.

I have two questions, and I think maybe the easiest way of doing this is to say what both of them are, and then to call on some of the witnesses to answer. If you don't mind expediting your answers, we'll try to get through as many witnesses as we can, if that's all right.

First, we often hear criticism that ISDS measures have cost Canada and that they put our domestic agenda at risk, but we heard testimony on Monday that Canada wins ISDS cases by about a three-to-one margin, and when we lose, it usually relates to fair and equitable treatment or because of processes when municipal or provincial governments may have acted arbitrarily. What are your thoughts on that three-to-one margin?

Second, we know that Canada has started consultations on a potential free trade agreement with Indonesia, which has a significantly lower score on the rule of law index from the World Justice Project compared to Canada. Would you recommend that Canada seek to negotiate some form of ISDS provisions as they're negotiating this agreement?

Maybe we'll start with Professor Côté.

Mr. Charles-Emmanuel Côté: Thank you for your questions. I'll try to be brief.

It is true that on the record Canada has not lost a lot of cases. For the cases that Canada lost, if you look at them carefully, you'll see that there were indeed problems in the situation where Canada was found in breach of the agreement. I don't know of any cases where Canada lost in a way that was absolutely impossible to accept. I think those were cases where Canada was, indeed, in breach of its agreements. And it continues. The latest decisions that were rendered continue.... Canada has not lost recently in cases, and this average of wins and losses is continuing, I would say.

As for Indonesia, it was mentioned that one has to think about ISDS, and one has to think about the substantive provisions. Those are two different things. It's important to continue to have very well-drafted, circumscribed and substantive provisions, possibly with exceptions, as Professor Appleton mentioned, and basically to continue what we have done with CPTPP and with CETA.

As for the ISDS, as I said, we should have a clear and coherent way of handling this, and I think we should continue to have ISDS with Indonesia, definitely. As for which type of ISDS, well, in our bilateral agreements, we have incrementally improved ISDS, and we should continue in that way. So yes, I would continue to basically apply our latest drafting of bilateral agreements with Indonesia.

● (1450)

Mrs. Tracy Gray: That's great. Thank you very much.

I'll ask the same two questions of Professor Appleton.

Mr. Barry Appleton: Thank you very much. I'll be very quick.

The answer to the first question is yes; they all come from regulatory failure.

The answer to the second question is a little bit more detailed. Canada was able to succeed. Canadian companies succeeded when we had treaties, for example, in Venezuela. When we invested in the mining sectors in Venezuela, we didn't know there would be a problem. Later on those were great success stories. Because ISDS was there, Canadians were protected. We would have had massive problems at home.

I would say for sure that I agree that we should be deeply, thoughtfully considering ISDS with any treaty we might enter into in Indonesia.

Mrs. Tracy Gray: That's great. Thank you.

Professor de Mestral.

The Chair: You have 28 seconds left. Perhaps we could get a quick answer, if that's possible on a complex subject.

Mr. Armand de Mestral: It certainly doesn't help to have a Minister of Environment who wants to help Canadians and wants to stop American imports, so yes.

In Indonesia, certainly, I think we should try. We should try very hard. Canadians are there, and I think this is one of the examples where Canadians have a greater interest than Indonesians in Canada, in all likelihood.

The Chair: Thank you very much, Professor.

Now we go to Ms. Bendayan.

Go ahead, please, for five minutes.

[*Translation*]

Ms. Rachel Bendayan: Thank you, Madam Chair.

I would like to ask Mr. Côté a question.

Do you have any statistics on small and medium Canadian enterprises that use our ISDS system? We often sense that multinationals use the system, but it would be interesting for the committee to see your research on the subject.

I'd also like to hear your comments on a point that Mr. Fortier raised earlier.

[*English*]

Mr. Fortier, I believe, was quoting someone with respect to the implication of removing ISDS and how that would possibly take capital elsewhere.

[*Translation*]

We obviously have an interest in keeping our investments in Canada.

Do you have any comments to make on that subject, Mr. Côté?

Mr. Charles-Emmanuel Côté: Thank you very much for your question.

I don't have any specific statistics on SMEs. We would also have to agree on a clear definition of what constitutes an SME. I think that's a problematic unknown in the system right now.

I personally know a very small contractor that has a dispute with Venezuela and simply doesn't have the resources to arbitrate the matter again; the cost to do so would be completely disproportionate to the matter in issue. Since Venezuela offered him no domestic remedy, he turned to Ottawa for some good old diplomatic protection, which was denied him on the ground that there's a treaty in place. Ottawa has washed its hands of the matter. It's a real problem.

The problem has even been noticed by the Court of Justice of the European Union, which issued an opinion on CETA's compliance with the European Union's law to the effect that its law includes a right of access to a tribunal. Access to justice is therefore a guaranteed right. Relying on the guarantees given, the Court of Justice determined that the right of access to arbitration justice would be violated if nothing were done for SMEs. Canada and the European Union have promised in joint declarations to improve access to arbitration Justice.

This is a subject that might be of interest to you. I had planned to discuss it with you but didn't have the time to do so. I think it's really a concern. However, I unfortunately don't have any statistics on the subject.

I'm not an economist, but one thing is certain: Brazil is an excellent example of a country where foreign investments are made despite the absence of a treaty providing for ISDS. Would there be more investment in Brazil if it had a treaty providing for ISDS? No one knows.

I'm one of those people who say that the benefit of ISDS isn't that it attracts foreign capital. I think that's one of the factors that influence a business decision, but the decision to make foreign investments is based on many factors, including an assessment of potential return. ISDS of course reassures investors. However, I don't think Americans will suddenly stop investing in Canada.

I don't think we'll necessarily run into an economic wall if we don't have ISDS. The most important aspect is the depoliticization of dispute settlement.

● (1455)

Ms. Rachel Bendayan: Thank you, Mr. Côté.

In closing, I'm going to ask Mr. de Mestral and Mr. Fortier a question on the same topic.

We've discussed the fact that these disputes often concern highly specialized matters, a fact that requires the parties to ask experts to act as judges or arbitrators. In many cases, the parties may appoint their own arbitrator.

Do you think that's an important element of the system? Could we lose it without ISDS?

Hon. Yves Fortier: The answer is yes…

[*English*]

The Chair: Please give just a very brief answer, sir.

[*Translation*]

Hon. Yves Fortier: The answer is an unqualified and unreserved yes.

[*English*]

Mr. Armand de Mestral: It's just possible that a world court of arbitration would end up being fifty-fifty men and women. That is not the case right now with arbitration, although it is changing. It is changing quite significantly. The arbitral world is definitely open to women, but that is a change that's taking time.

The Chair: Yes, it's taking a lot of time, a little too much time.

Hon. Yves Fortier: I'm sitting on two tribunals at the moment, two three-person tribunals, on which I have two female colleagues, just for the record.

The Chair: We're gradually getting there.

Thank you to this illustrious panel. Thank you so very much for providing the committee with such valuable information and your time today. We can excuse the witnesses.

Just for the information of our committee, and to the clerk, we have approval of our agenda, so on April 12 we will deal with the two draft reports we've received from the analysts, and then we will proceed with Mr. Blaikie's motion on trade and vaccines in Canada.

To everybody, have a very happy Easter. Stay well. Stay safe. Follow all the rules so we can get through all of this together.

The meeting is adjourned.