PERFORMANCE MEASURE INFORMATION SHEET #31

SYSTEM: GREENHOUSE GAS EMISSIONS

Objective / Location	Performance Measure	Units	Description
Reduction in Global Greenhouse Gas emissions / BC system & US Pacific Northwest system	Global Greenhouse Gas impact of operating Non-Treaty Storage	Metric Tonnes of CO2	Total metric tonnes of equivalent CO2 savings

Description

The BC Hydro system is dominated by renewable hydro-electric resources. 90% of the capacity of the BC Hydro system is hydro-electric, while about 95% of the total energy produced from BC Hydro and contracted resources are from renewable hydro-electricity sources. Operation of Non-Treaty Storage will impact the patterns and efficiency of power generation in both British Columbia and the US Pacific Northwest. As such, the operation of Non-Treaty Storage will impact the Greenhouse Gas emissions in these jurisdictions.

The performance measure described below provides an estimate of the impact of the operation of Non-Treaty Storage impact on Greenhouse Gas (GHG) emissions from the BC Hydro and US Pacific Northwest power generating systems.

Performance Measure

Two aspects were considered in estimating the impact of the Non-Treaty Storage on GHG emissions. These included changes in:

1. Hydro-electric generation within the BC Hydro system
2. Hydro and thermal generation within the Pacific Northwest.

In the BC Hydro system, generation capability is affected by the release of Non-Treaty Storage. The principal impact is a reduction in the overall energy output of both Mica and/or Keenleyside generating plants due to lower reservoir levels. This reduction in efficiency (head losses) can be examined utilizing the results from HYSIM. In analysing the change in hydro-electric generation within the BC Hydro system, it is assumed that any change in overall energy production in the BC Hydro system would need to be counteracted by some combination of a change in energy imports/exports, and/or a change in thermal generation within the BC Hydro system. This change in energy production can then be directly equated to a change in GHG emissions. As well, the release of Non-Treaty Storage will provide additional draft flexibility in the BC Hydro system, which will facilitate the reduction of imports of Pacific Northwest thermal energy during periods of energy shortages. This second order benefit has not been included in the estimate. The change in overall generation and the estimated impact on GHG emission within the BC Hydro system is provided in Table 1 below.

In the US Pacific Northwest, the operation of Non-Treaty Storage will result in incremental spill savings across the freshet. The water saved from spilling will ultimately be used to reduce the generation on thermal plants within the region. Another factor that will impact overall GHG emission estimates includes the ability for incremental release of Non-Treaty Storage during periods of energy shortages. During these periods of energy shortages, there is a tendency for

inefficient, high-GHG impact generating plants to be operated. The release of Non-Treaty Storage will tend to reduced generation from these inefficient plants. Through the combination of US plant efficiencies (from Treaty Studies) and projected forward market prices (from 2008 LTAP), sufficient data are available to provide an estimate of the GHG impacts of the Non-Treaty Storage scenarios on the US Pacific Northwest power system. The change in overall generation and the estimated impact on GHG emission within the US Pacific Northwest is provided in Table 1.

In the early years that a reservoir is impounded, there is considered to be an increase in GHG emissions associated with the decomposition of organic matter on the floor of the reservoir. Both Kinbasket and Arrow are considered to have transitioned past this phase. Any incremental changes in GHG emission from BC Hydro reservoirs that result from the decomposition of organic matter was not considered in this performance measure.

Table 1. Incremental Energy Benefit and Carbon Benefit of the Non-Treaty Scenarios

Non-Treaty Scenario Incremental Energy Benefit (GWh)

	Scenario A 4.5 MAF	Scenario B 3.0 MAF	Scenario C 2.0 MAF	Scenario D Zero
BC Hydro System Gen - Hydro:	**(153)**	**(148)**	**(141)**	**-**
US Pacific Northwest:	**224**	**212**	**215**	**-**
Regional/Global Net Saving:	**70**	**64**	**74**	**-**

Non-Treaty Scenario Incremental Carbon Benefit (1,000 Tonnes/Yr)

	Scenario A 4.5 MAF	Scenario B 3.0 MAF	Scenario C 2.0 MAF	Scenario D Zero
BC Hydro System:(1)	**(69)**	**(67)**	**(63)**	**-**
US Pacific Northwest:(2)	**240**	**219**	**240**	**-**
Regional/Global Net Saving:	**171**	**153**	**176**	**-**

Notes:

(1): based on change in hydro energy production as calculated by HYSIM, and assuming lost energy replaced at 8.5 incremental Heat Rate, by either imports or thermal generation in BC.

(2): based on anticipated change in thermal operations in Pacific Northwest using 0.05 Tonnes per MMBTu of natural gas burned.

Results

All scenarios that operated Non-Treaty Storage (Scenarios A, B, C) were found to have significant GHG emissions benefits when compared with the scenario that was absent a Non-Treaty Storage operation (Scenario D). The overall benefit ranged from 153,000 Tonnes/year to 171,000 Tonnes/year. The study determined that a GHG increase would occur within the BC Hydro system due to head losses at Mica and Arrow; however, there would be a more-than-offsetting GHG benefit in the US Pacific Northwest due to spill savings and off-loading of inefficient natural gas generation during periods of regional energy shortages.