Northwest Power and Conservation Council

November 6, 2008

MEMORANDUM

TO: Council Power Committee

FROM: Michael Schilmoeller
Power Planning Analyst

SUBJECT: Representing Carbon Penalty, PTC, and RECs in the Regional Portfolio Model

The Regional Portfolio Model evaluates resource plans against a host of distinct scenarios for carbon penalty, production tax credit (PTC), and renewable energy credit (REC) value. This presentation will not call for any Power Committee decision. Staff, however, will seek the guidance of Committee Members regarding the representations of these sources of uncertainties.

A carbon penalty may be initiated at some undetermined time in the future. It may occur before the beginning of the study or not occur at all. Once initiated, the penalty remains in force and can have any level up to $100/short ton of CO_2.

The production tax credit is subject to cancellation at any time, but the most likely horizon is about five years after the beginning of the study. The PTC is used primarily for valuing wind generation. The credit is also subject to reduction or elimination in the event that a carbon penalty is initiated.

Renewable energy credits, formerly "Green Tags," have value to the developer of renewables if they can be sold. Utilities that must meet Renewable Portfolio Standard (RPS) requirements, however, must retain their RECs. Consequently, we assume that this credit is only available to new renewables that would cause a utility to exceed its RPS acquisition requirements. The value of RECs is subject to market variation, like any other commodity, so their value has corresponding variation among scenarios.

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

Carbon Penalty, Production Tax Credits, and Renewable Energy Credits

Michael Schilmoeller
Power Committee
Friday November 14, 2008

CO2 Penalty Modeling

- In the Fifth Power Plan
  - Likelihood of seeing a penalty: 67%
  - Max before 9/2008: 2004$ 0/ton
  - Max before 9/2016 : 2004$ 15/ton
  - Max before 9/2023 : 2004$ 30/ton
  - Average 2004$ 7.85/ton CO_2 by 9/2023
- Recommended for the Sixth Power Plan
  - Likelihood of seeing a penalty: 95%
  - Likelihood of penalty in Sept 2009: 4%
  - Max : 2006$ 100/ton
  - Average 2006$ 47.72/ton CO_2 by 9/2029

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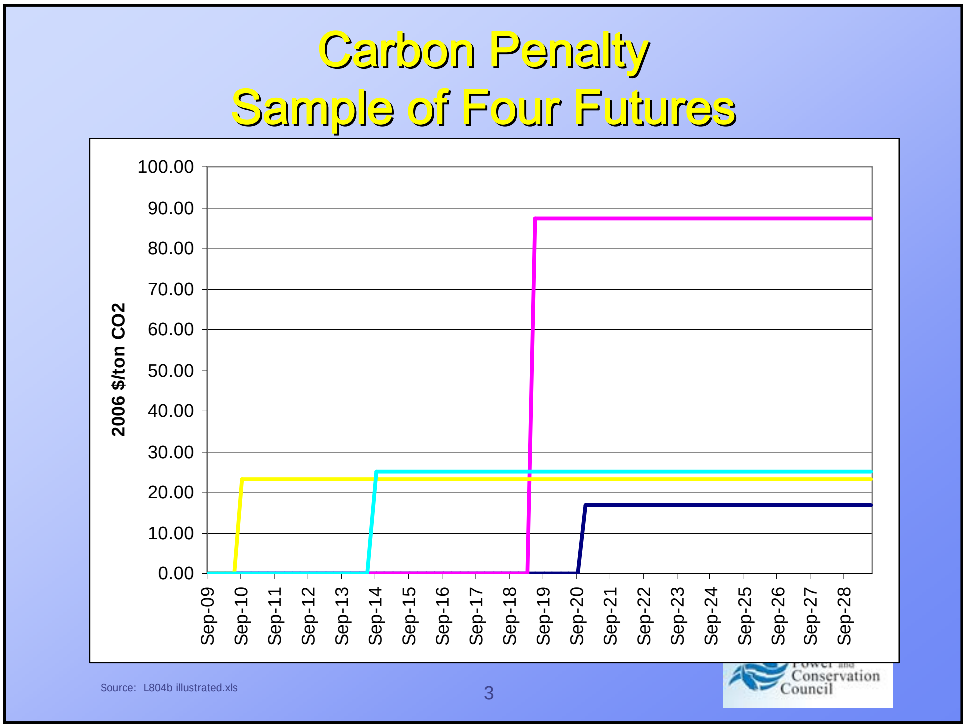
Carbon Penalty
Sample of Four Futures
2006 $/ton CO2
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
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Sep-24
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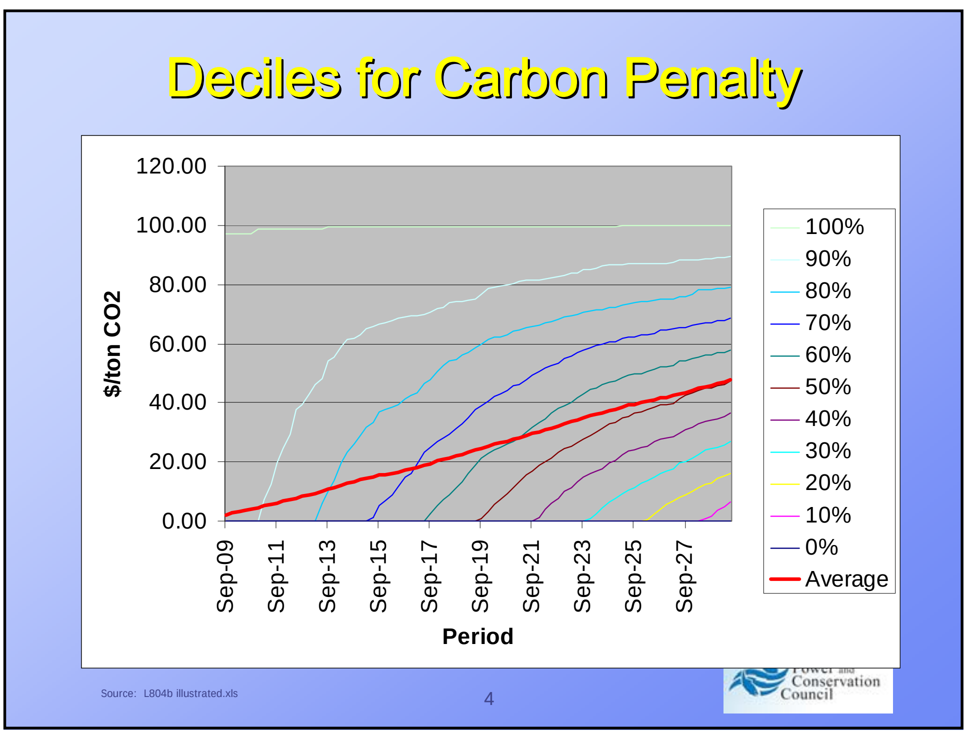
Sep-28
Source: L804b illustrated.xls
3
Conservation
Council


Deciles for Carbon Penalty
$/ton CO2
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Sep-19
Sep-21
Sep-23
Sep-25
Sep-27
Period
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Average
Source: L804b illustrated.xls
4
Conservation
Council

Production Tax Credits
PTC

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Two-Part Determination

- Viability
  - Economic competitiveness
  - Spontaneous (legislative) termination of the PTC
- Advent of a carbon penalty
  - If there is a carbon penalty, we want some continuity of support for renewables

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Characterizing Availability in the Sixth Power Plan

- Staff estimated it is most likely that the legislature would discontinue this credit relatively soon, perhaps in five years
- Staff assumed the chance of the PTC surviving beyond the life of the study to be very small (< 1 percent)

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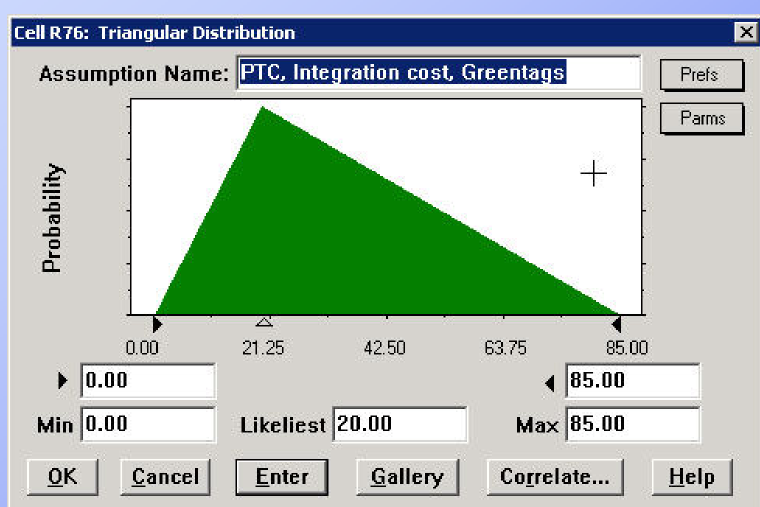
Termination Distribution in the Sixth Power Plan



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Source: L804b

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Cost in Absence of Carbon Penalty

- Real levelized value $9.90/MWh in 2004 dollars. This value corresponds to the current credit of roughly 1.7 cents/kWh in year 2000 dollars, using Council assumptions for wind capacity factor and inflation
- Staff elected not to make the PTC value a random variable and saw no compelling reason to assume this would either increase or decline over time, except in response to the emergence of a carbon penalty.

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Cost in Presence of Carbon Penalty

- PTC corresponds to a $15.47/ton CO2 tax, given Council assumptions.
  - The conversion factor is in pounds of CO2 per kWh, so the conversion is $/MWh = $/ton • tons/pound • pounds/kWh • kWh/MWh or $/MWh = $/ton • pounds/kWh • 1000/2000
- If the carbon penalty is below half the initial value, the full value of the PTC remains
- If the tax is fifty percent higher than this, it disappears entirely.
- Between those values, it declines dollar for dollar with the tax rate.

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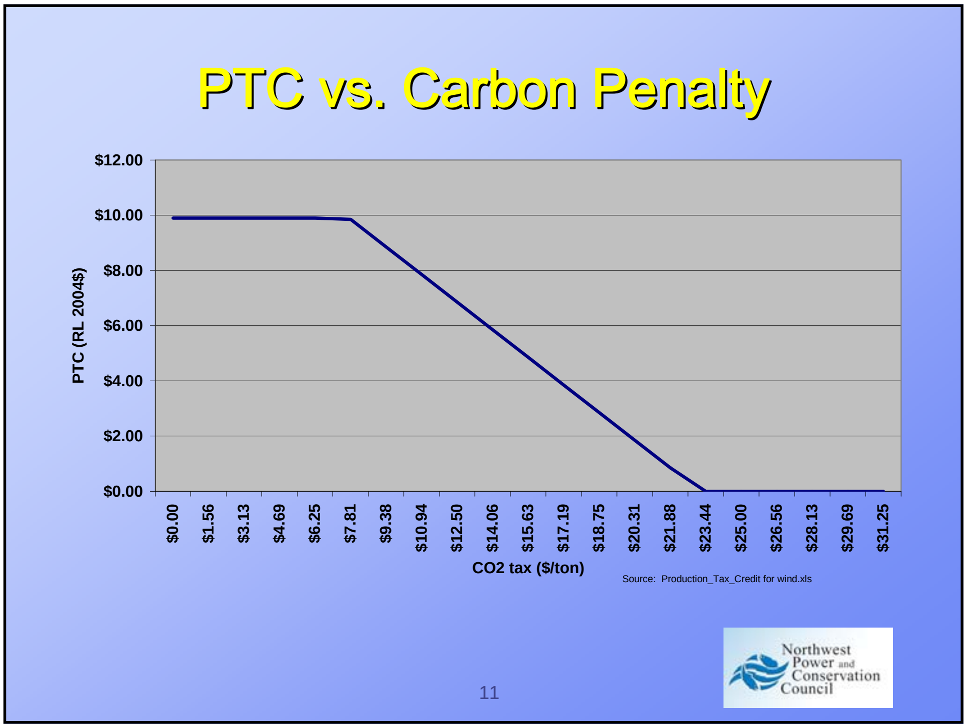
PTC vs. Carbon Penalty
PTC (RL 2004$)
$12.00
$10.00
$8.00
$6.00
$4.00
$2.00
$0.00
$0.00 $1.56 $3.13 $4.69 $6.25 $7.81 $9.38 $10.94 $12.50 $14.06 $15.63 $17.19 $18.75 $20.31 $21.88 $23.44 $25.00 $26.56 $28.13 $29.69 $31.25
CO2 tax ($/ton)
Source: Production_Tax_Credit for wind.xls
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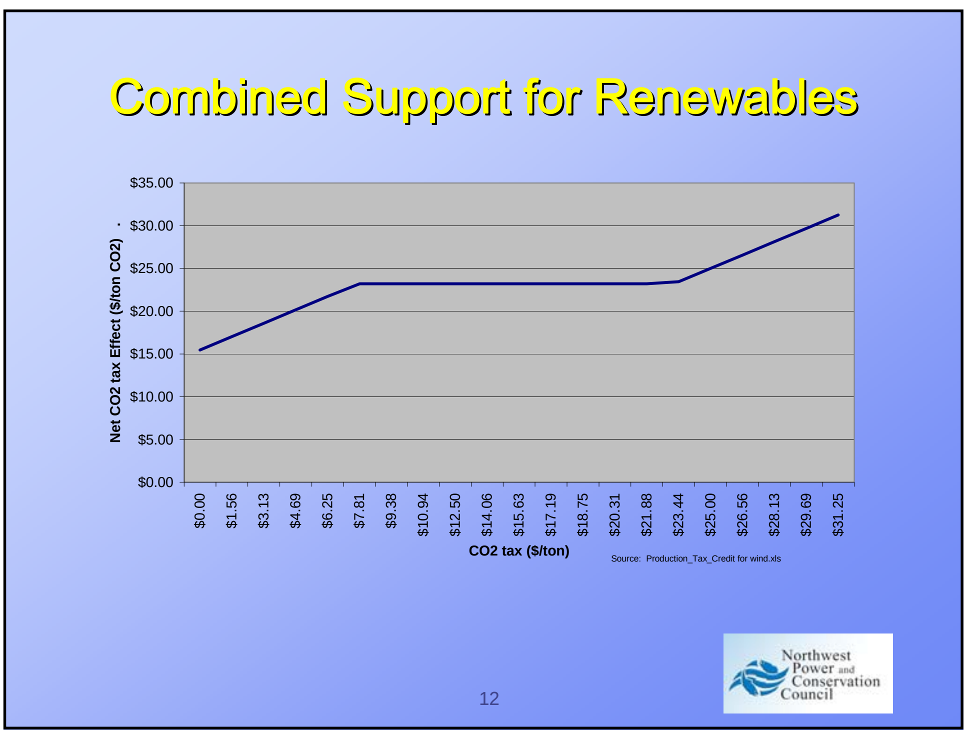
Combined Support for Renewables
Net CO2 tax Effect ($/ton CO2)
$35.00
$30.00
$25.00
$20.00
$15.00
$10.00
$5.00
$0.00
$0.00 $1.56 $3.13 $4.69 $6.25 $7.81 $9.38 $10.94 $12.50 $14.06 $15.63 $17.19 $18.75 $20.31 $21.88 $23.44 $25.00 $26.56 $28.13 $29.69 $31.25
CO2 tax ($/ton)
Source: Production_Tax_Credit for wind.xls
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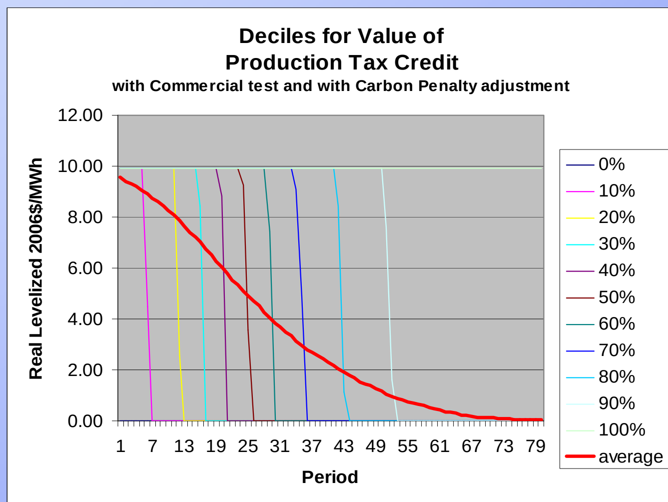
Deciles for PTC over Study Sixth Power Plan



Source: L804b illustrated.xls

Renewable Energy Credits (Green Tags Value)

- Staff decided that REC values would be decoupled from PTC because of world market
- Resources acquired by utilities to meet Renewable Portfolio Standards (RPS) have to retain their RECs
- REC value would therefore apply only to new, discretionary wind development, beyond that required for RPS requirements

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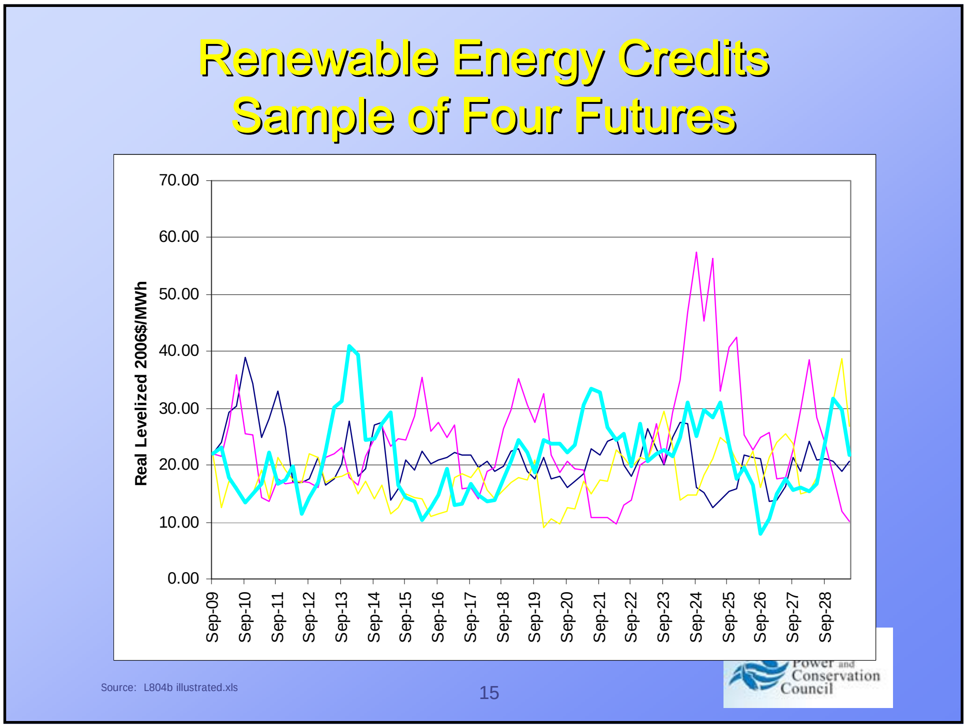
Renewable Energy Credits
Sample of Four Futures
Real Levelized 2006$/MWh
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
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Sep-23
Sep-24
Sep-25
Sep-26
Sep-27
Sep-28
Source: L804b illustrated.xls
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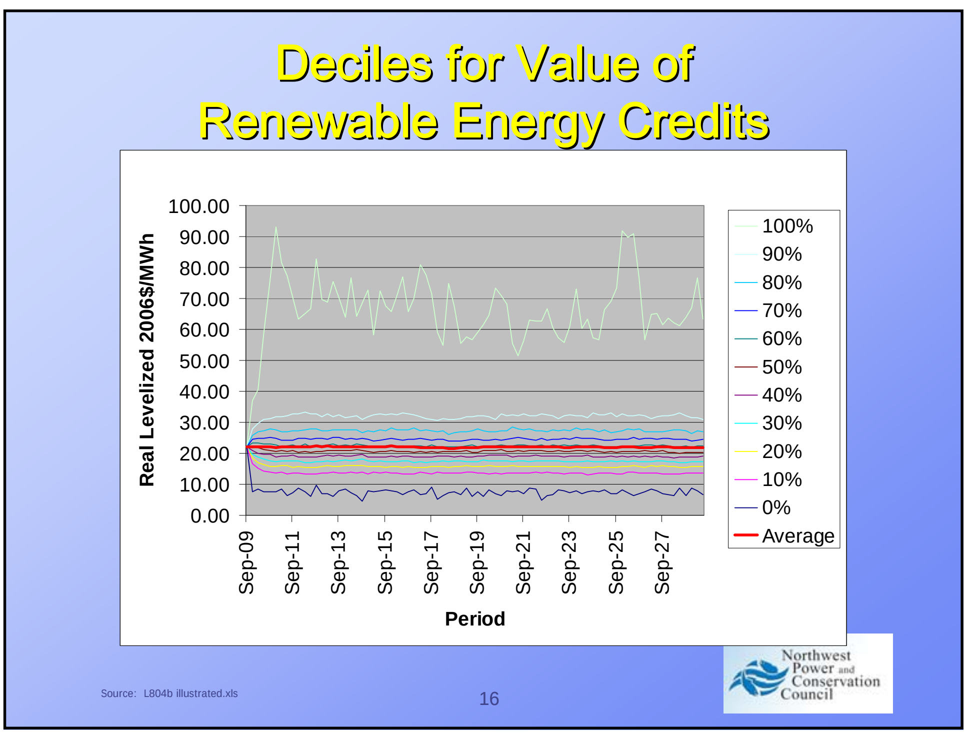
Council


Deciles for Value of
Renewable Energy Credits
Real Levelized 2006$/MWh
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Sep-09
Sep-11
Sep-13
Sep-15
Sep-17
Sep-19
Sep-21
Sep-23
Sep-25
Sep-27
Period
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Average
Source: L804b illustrated.xls
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End

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CO2 Penalty Modeling
Fifth Power Plan

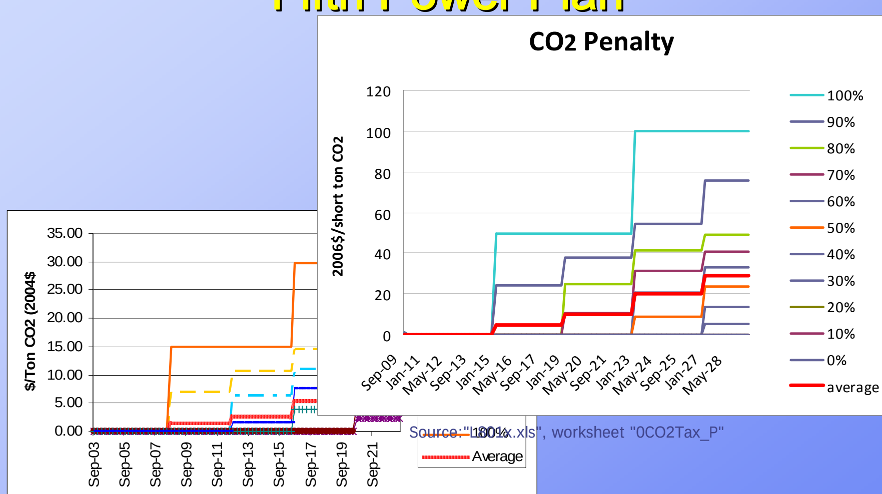

Figure 7-16: Probabilistic Representation of Future Carbon Penalty

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Characterizing Availability in the Fifth Power Plan

- Staff estimated wind would achieve economic competitiveness in 2016. This assumes an electric price of $40/MWh
- Staff assumed the chance of the PTC surviving when wind generation cost fell to $30/MWh in 2034

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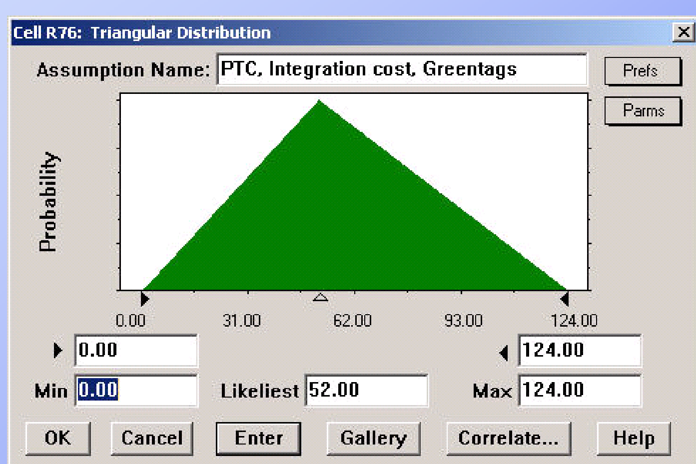
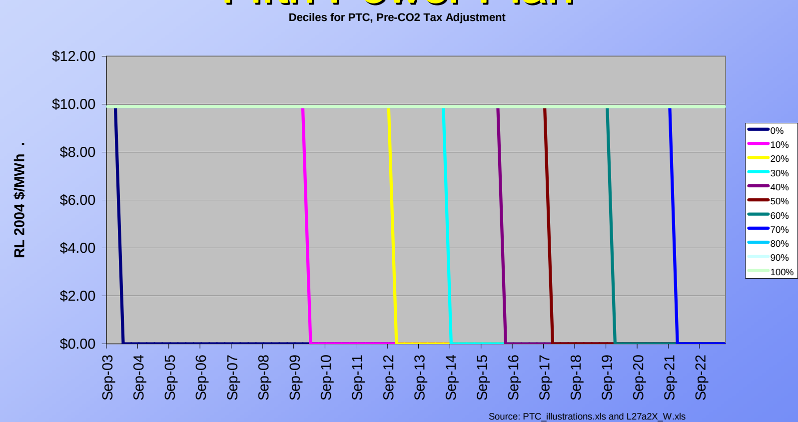
Termination Distribution in the Fifth Power Plan



20

Deciles for PTC over Study
Carbon Penalty Only
Fifth Power Plan



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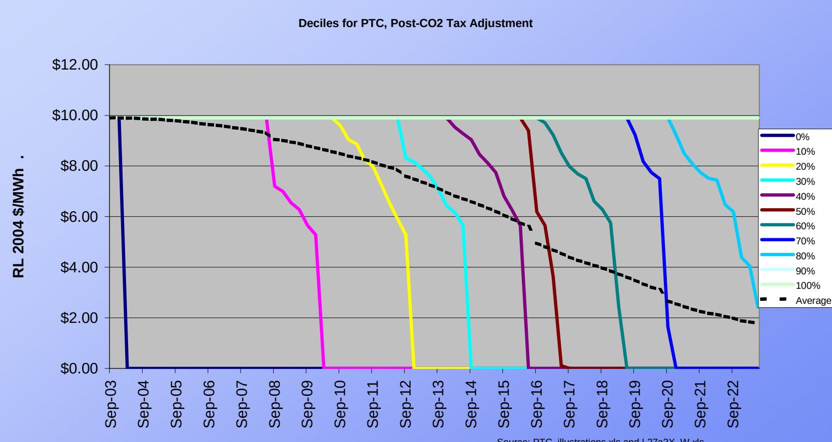
Deciles for PTC over Study
Fifth Power Plan



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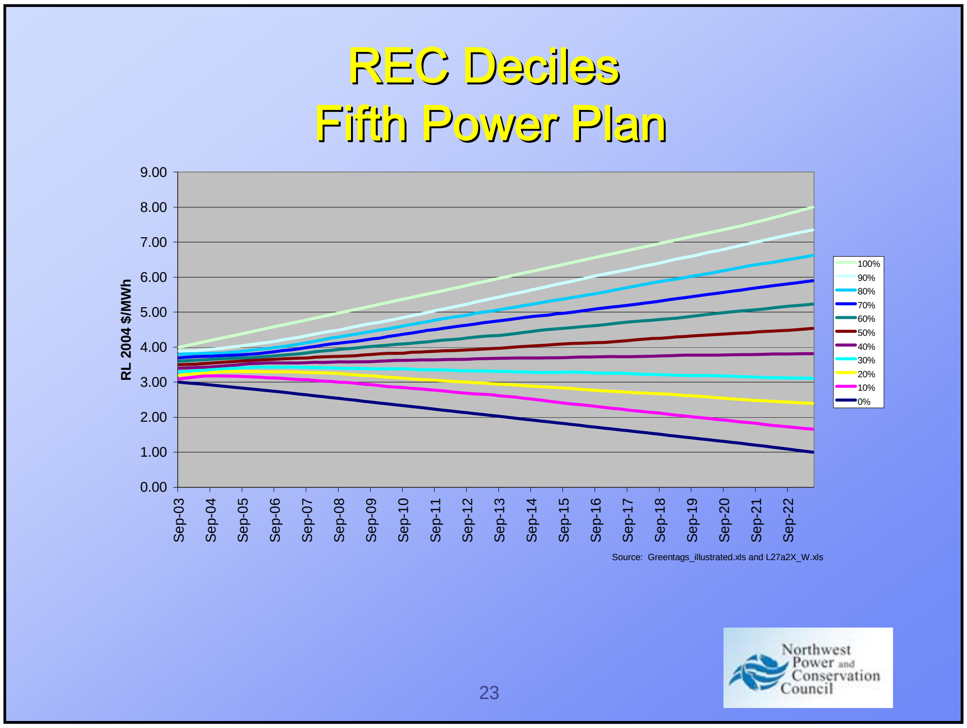
REC Deciles
Fifth Power Plan
RL 2004 $/MWh
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
Sep-22
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Source: Greentags_illustrated.xls and L27a2X_W.xls
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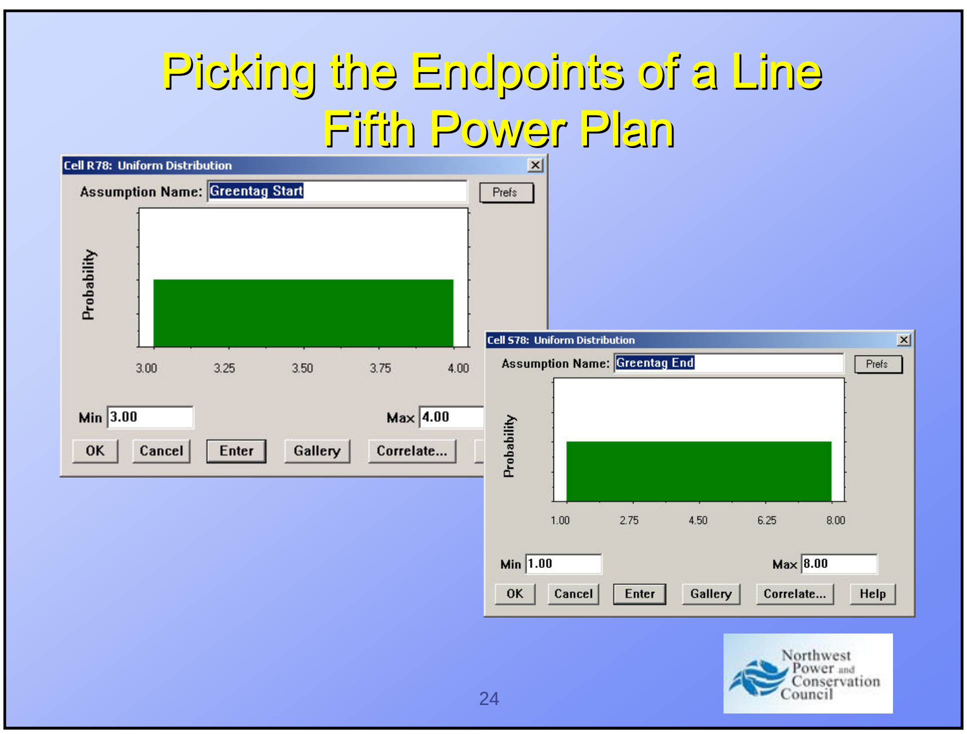
Picking the Endpoints of a Line
Fifth Power Plan
Cell R78: Uniform Distribution
Assumption Name: Greentag Start
Prefs
Probability
3.00
3.25
3.50
3.75
4.00
Min 3.00
Max 4.00
OK
Cancel
Enter
Gallery
Correlate...
Cell S78: Uniform Distribution
Assumption Name: Greentag End
Prefs
Probability
1.00
2.75
4.50
6.25
8.00
Min 1.00
Max 8.00
OK
Cancel
Enter
Gallery
Correlate...
Help
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