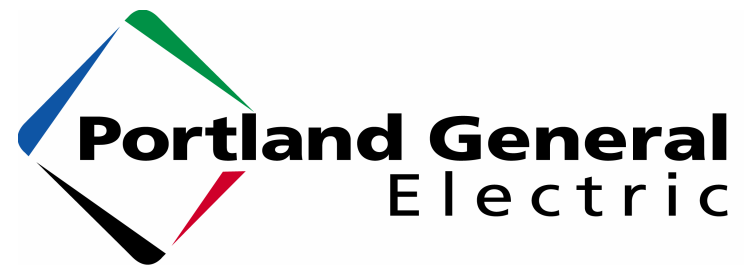


2009 Integrated Resource Plan



Boardman Technical Workshop

August 23, 2010



Boardman Generating Station

Plant Capacity: 585 MW

Location: Approximately 13 miles southwest of Boardman in Morrow County, Oregon

Owners:

- Portland General Electric (65%) – Operator
- Idaho Power Company (10%)
- Power Resources Cooperative (10%)
- Bank of America (15%)

Fuel: Low sulfur sub-bituminous coal

Commercial operation: August 1980 (Site certificate March 1975)

Approximately 110 full-time employees, 30 contractors, 225 seasonal maintenance positions

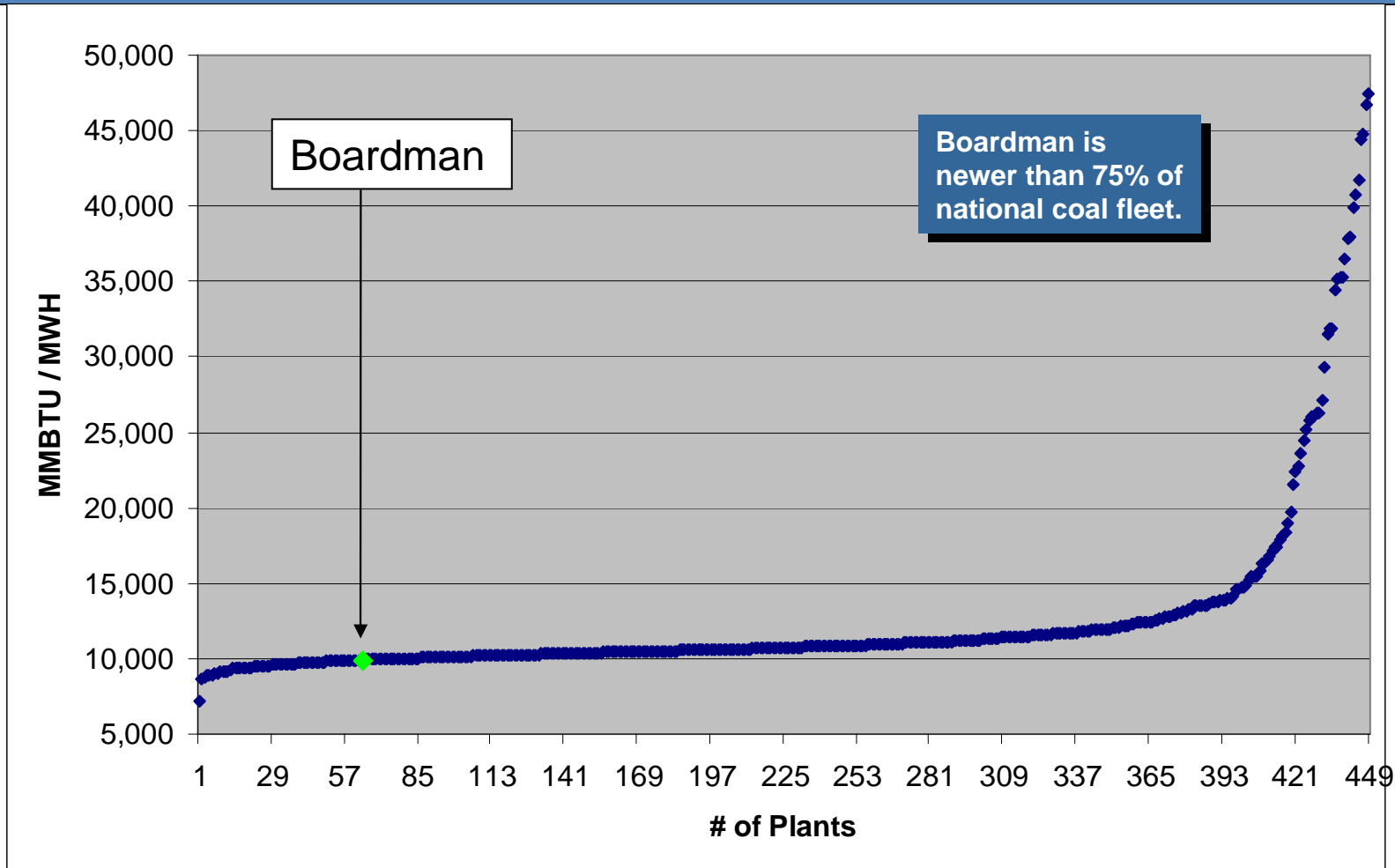
Key element of PGE resource diversity, helping to control costs and assure reliability

Approximately 15% of PGE's power comes from Boardman at prices one-half to two-thirds cheaper to operate than natural gas market prices

Low-cost, baseload resource that creates substantial value for our customers by lowering power costs and therefore prices



US Coal Fleet Heat Rate*

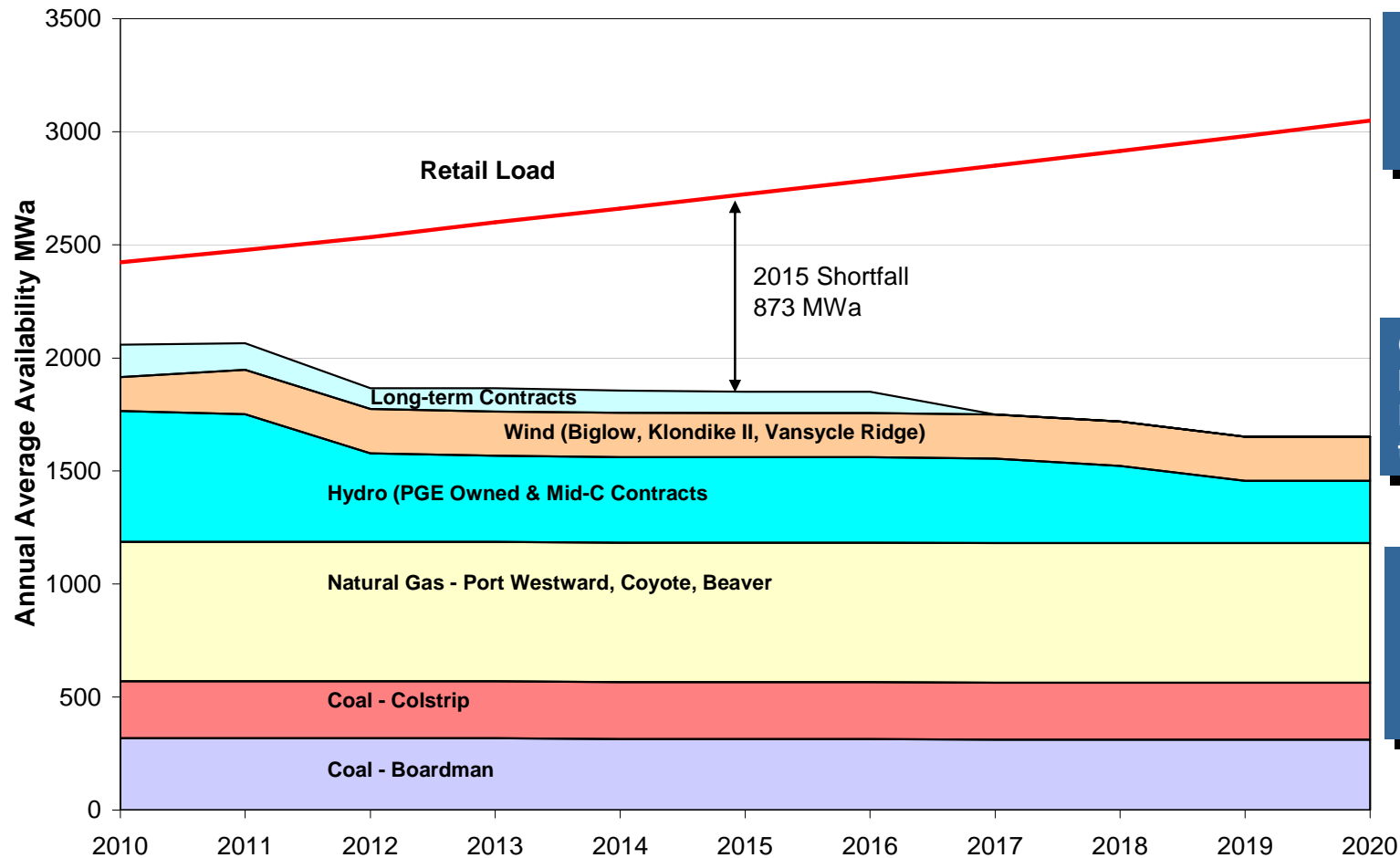


Source: 2000-2007 Average, SNL Financial Database

*Chart shows overall efficiency at 499 of the 533 U.S. coal plant sites where heat rate data is available. Some plant sites operate multiple coal-generating units. There are 1,325 coal-fired units operating in the U.S.; Boardman operates a single unit.

PGE Resource Needs – Energy

Load-Resource Balance 2010-2020



Existing resource need reflects load growth, and expiring long term contracts.

Closing Boardman before 2020 causes large resource deficit to get even bigger

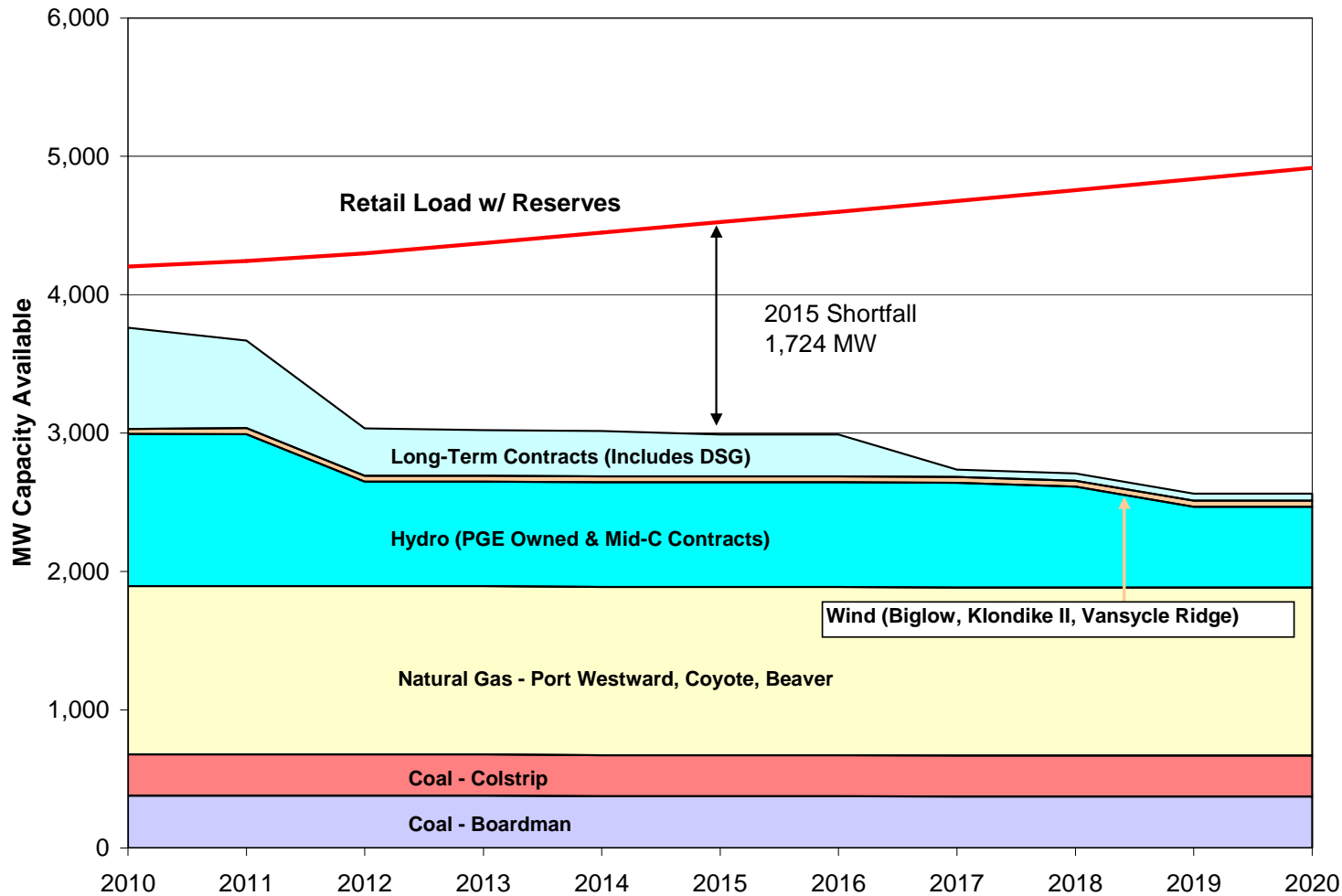
Under 2015 closure scenario, resource deficit equals roughly 45% of total PGE customer demand

Retail load = Net System load – 5-yr opt out (about 30 MWa)



PGE Resource Needs – Capacity

Load-Resource Balance 2010-2020



Existing resource need reflects load growth, and expiring long term contracts.

Closing Boardman before 2020 causes large capacity deficit to get even bigger

Retail load = Net System load – 5-yr opt out (about 30 MW)



DEQ / EPA - Regional Haze Program

Federal Program

- Regional Haze Rule adopted July 1999
- Objective: Return visibility to natural background level by 2064
- States must submit and periodically update implementation plans

Oregon's Regional Haze Plan

- Identifies pollutants and sources causing haze
- Describes current visibility conditions for national parks/wilderness.
- Contains 10-year projection of visibility (first planning period) and compares to 2018 Milestone
- Explains how Oregon is showing “Reasonable Progress” in improving haze
- Contains a Long-Term Strategy
- Describes DEQ BART Review & DEQ proposal for PGE Boardman

Regulated Haze Emissions

Applicable to Boardman RH BART:

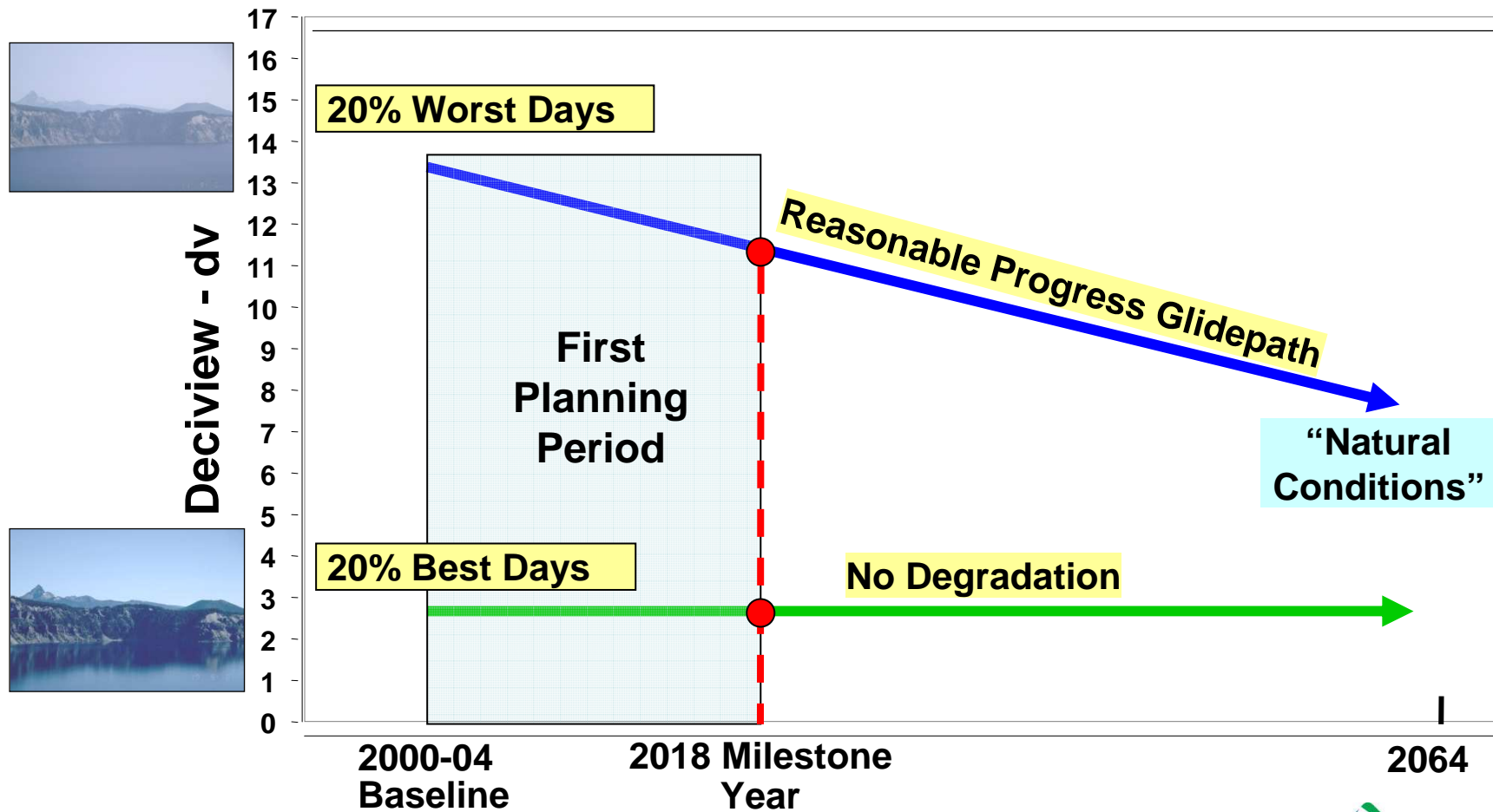
- **Ammonium Sulfate:** SO_2 + ammonia, from combustion of fuels containing sulfur
- **Ammonium Nitrate:** NO_x + ammonia, from high temperature combustion processes
- **Particulate Matter (PM):** Includes fine and course particles in the air. PM_{10} and $\text{PM}_{2.5}$ are particles measured at less than 10 microns and less than 2.5 microns

Not applicable to Boardman RH BART:

- **Organic and Elemental Carbon:** mostly combustion due to fire (wildfire + forest, agricultural, other controlled burning, and woodstoves)
- **Fine Soil:** dust from dirt roads, farmland, bare ground, dust storms

Objective of Regional Haze Plan

Class I Area



BART BASICS

- BART is “Best Available Retrofit Technology”
- BART applies to:
 - Major sources > 250 tons per year of any haze pollutant
 - Construction commenced 1962-1977
 - 26 source categories, including electric generating units & industrial boilers, kraft pulp mills, and refineries
- BART is determined on case-by-case basis



Boardman: Recent Regulatory History

- Jan. 2006:** PGE volunteers Boardman to submit data for DEQ regional haze study
 - Nov. 2007:** PGE proposes BART – Best Available Control Technology – for Boardman
 - Nov. 2008:** DEQ issues proposed regional haze rule requiring BART controls
 - Dec. 2008:** PGE recommends “decision point” plan with off-ramps in 2020 and 2029, reflecting uncertainty of future carbon costs
 - June 2009:** DEQ adopts regional haze rule. Rejects decision point plan but allows possibility of future rule revision
-

DEQ -- Best Available Retrofit Technology (BART I) Requirement:

- NO_x (Low NO_x Burner & Over Fire Air) 0.23 lb/mmBtu by July 1, 2011
- SO₂ (Semi-Dry Scrubber) 0.12 lb/mmBtu by July 1, 2014
- PM (Bag House) 0.012 lb/mmBtu by July 1, 2014

DEQ -- Reasonable Progress (RP) Requirement:

- NO_x (Selective Catalytic Reduction) 0.07 lb/mmBtu by July 1, 2017

DEQ’s regional haze rule effectively left PGE with two options: Close the plant in 2014, or install controls and operate thru 2040+

Boardman: Recent Regulatory History (cont.)

- Sept. 2009:** Despite DEQ rule limitations, stakeholders ask PGE to consider 2020 closure in Integrated Resource Plan
- Nov. 2009:** PGE submits IRP to OPUC, incorporates required BART controls with 2040 operating plan as best option actionable under current rules
- Sept. 2009 - Jan. 2010:** PGE conducts additional cost and risk analysis of Boardman operating scenarios
- Jan. 2010:** PGE announces intent to cease Boardman operations 20 years early
- April 2010:** PGE submits “BART II” proposal to DEQ, files IRP Addendum with OPUC to incorporate 2020 plan
- June 2010:** DEQ informs PGE that they don’t believe BART II will meet EPA requirements
- June 2010:** DEQ proposes their own options for Boardman BART

PGE Proposal -- Best Available Retrofit Technology (BART II):

- NO_x (Low NO_x Burner & Over Fire Air) 0.23 lb/mmBtu by July 1, 2011
- SO₂ Sulfur restriction #1 (Pre combustion controls – Coal) 0.96 lb/mmBtu in 2011
- SO₂ Sulfur restriction #2 (Pre combustion controls – Coal) 0.60 lb/mmBtu in 2014
- Particulate Matter (PM) No change in current PM emissions due to effectiveness of ESP
- Cease operation of the Boardman Plant boiler by December 31, 2020

Under a separate DEQ rule, PGE will be reducing mercury (Hg) at Boardman by 90% by 2012

New DEQ BART Options

- Three new options proposed in addition to BART I *

- DEQ Option 1 (2020)

	<u>Control</u>	<u>Date</u>	<u>Emission</u>
NOX	LNB/MOFA	July 2011	.23 lb/mmBtu
SO ₂	SDFGD	July 2014	.12 lb/mmBtu
NOX	SNCR	July 2014	.19 lb/mmBtu

- Cease coal-fired boiler operations Dec 2020

- DEQ Option 2 (2018)

	<u>Control</u>	<u>Date</u>	<u>Emission</u>
NOX	LNB/MOFA	July 2011	.23 lb/mmBtu
NOX	SNCR	July 2014	.19 lb/mmBtu
SO ₂	DSI	July 2014	.40 lb/mmBtu

- Cease coal-fired boiler operations Dec 2018

- DEQ Option 3 (2015)

	<u>Control</u>	<u>Date</u>	<u>Emission</u>
NOX	LNB/MOFA	July 2011	.23 lb/mmBtu

- Cease coal-fired boiler operations 5 years from when EPA approves State Implementation Plan (SIP)



State of Oregon
Department of
Environmental
Quality

Consideration of DEQ Options

- **DEQ Option 1 (2020) – Is too costly for customers**
 - Investment of \$290 million for SDFGD for six years of operations
 - Results in highest rate impacts over next decade
 - Results in highest overall cost among all Boardman options
- **DEQ Option 2 (2018) – Is not technically feasible**
 - Requires unproven DSI technology with uncertain results
 - DEQ's proposed PM_{2.5} regulation could require further controls at an additional cost of approximately \$100 million
 - Could adversely impact mercury controls
 - Uncertainty not resolved until testing
- **DEQ Option 3 (2015) – Is too risky for customers**
 - Does not provide reasonable transition time for baseload replacement power
 - Higher rate impacts over next decade
 - Higher costs than PGE BART II and III proposals
 - Does not provide reasonable transition time for employees and community
- **DEQ 2040 option (BART I) – Is currently the only workable option for PGE**

PGE's BART III Proposal

- Starts with basic framework from PGE's BART II proposal, adds additional controls to address DEQ concerns.

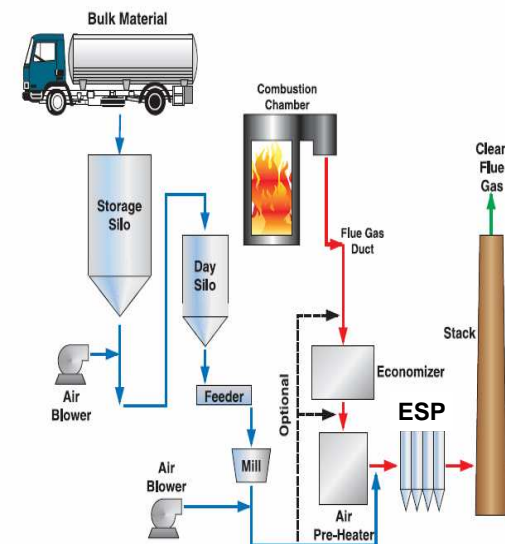
- Controls and emission levels:**

	Control	Date	Emission
NOX	LNB/MOFA	July 2011	.23 lb/mmBtu
NOX	SNCR	July 2014	.19 lb/mmBtu
SO2	DSI/Lower sulfur coal	July 2014	.40 lb/mmBtu*

- PM - No change from current emissions
- December 31, 2020 closure

* Level dependent on DSI testing

Typical Dry Sorbent Injection System



PGE's BART III Proposal

A workable alternative to 2040:

- PGE believes it meets DEQ / EPA regulatory requirements.
- Gives PGE a reasonable timeframe to build or buy cost-effective and reliable replacement resources.
- Reduces adverse social and economic impacts to local community and plant employees.
- Lower combined cost and risk than other potential alternatives.
- Reduces rate impacts to PGE customers over the next decade.
- Performs well on combined cost and risk measures.
- Reduced control technology risk as compared to other DEQ options.

Cost Estimate of Controls Proposed under Various Options

Controls:	Controls Timing and Cost					
	In-Service Year	EPC Contract by:	Overnight Capital Cost (nominal sum)*	Incremental Fixed O&M/Yr.*	Inc. Var. O&M/Yr. @ 85% CF*	Heat Rate Impact (%)
Low NOx Burners / OFA**	July 2011	Spring 2010	\$ 32.8	\$ 0.7	\$ -	Negligible
Mercury Control**	July 2012	Spring 2010	\$ 7.7	\$ 0.4	\$ 5.6	Negligible
Lower-sulfur Coal	July 2014	NA	\$ -	\$ -	\$ 1.5	None
DSI via SBC + Lower-sulfur Coal	July 2014	Summer 2012	\$ 22.6	\$ 0.3	\$ 12.4	0.1
Semi-Dry FGD (Scrubber with Fabric Filter)	July 2014	Spring 2011	\$ 289.9	\$ 2.2	\$ 4.3	1.4
Selective non-Catalytic Reduction	July 2014	Spring 2013	\$ 12.2	\$ 0.3	\$ 3.0	Negligible
Selective Catalytic Reduction	July 2017	Spring 2014	\$ 180.1	\$ 0.4	\$ 2.3	0.7

*(dollars are in millions)

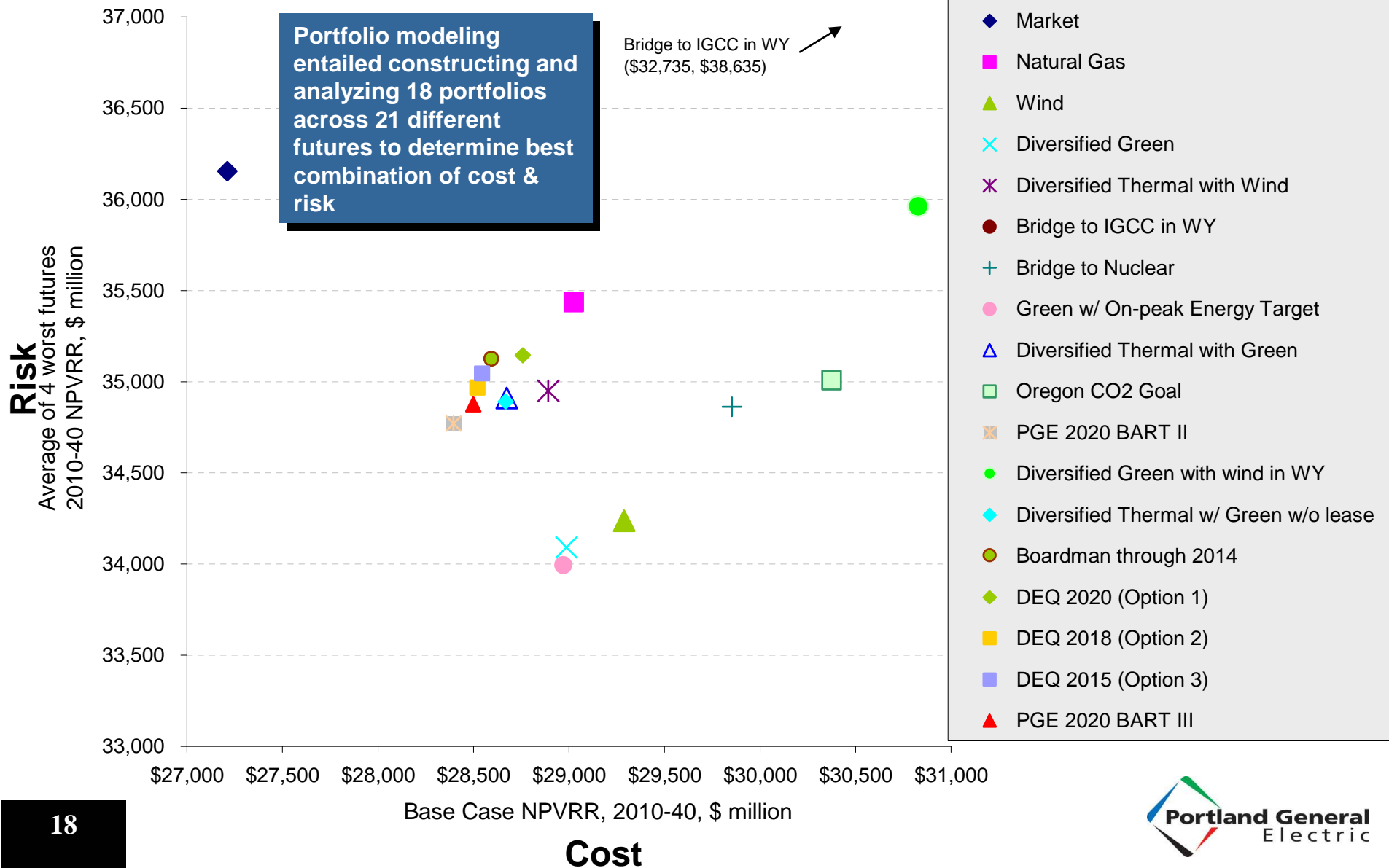
** These controls are common to all options.

Estimated costs of proposed controls/closure options

Controls/Closure Options*						
Controls	PGE 2020 BART II (Addendum)	DEQ 2015 (DEQ Opt. 3)	DEQ 2018 (DEQ Opt. 2)	PGE 2020 BART III (Proposed)	DEQ 2020 (DEQ Opt. 1)	DEQ 2040 BART I
Low NOx Burners / OFA	X	X	X	X	X	X
Mercury Control	X	X	X	X	X	X
Lower-sulfur Coal	X					
DSI via SBC + Lower-sulfur Coal			X	X		
Semi-Dry FGD (Scrubber with Fabric Filter)					X	X
Selective non-Catalytic Reduction			X	X	X	
Selective Catalytic Reduction						X
Controls Cost Summary	PGE 2020 BART II (Addendum)	DEQ 2015 (DEQ Opt. 3)	DEQ 2018 (DEQ Opt. 2)	PGE 2020 BART III (Proposed)	DEQ 2020 (DEQ Opt. 1)	DEQ 2040 BART I
Overnight Nominal Capital Cost (100% share)	\$ 41	\$ 41	\$ 75	\$ 75	\$ 343	\$ 511
Inc. O&M per Year (Mostly Variable, 100%)	\$ 8	\$ 7	\$ 23	\$ 23	\$ 16	\$ 16

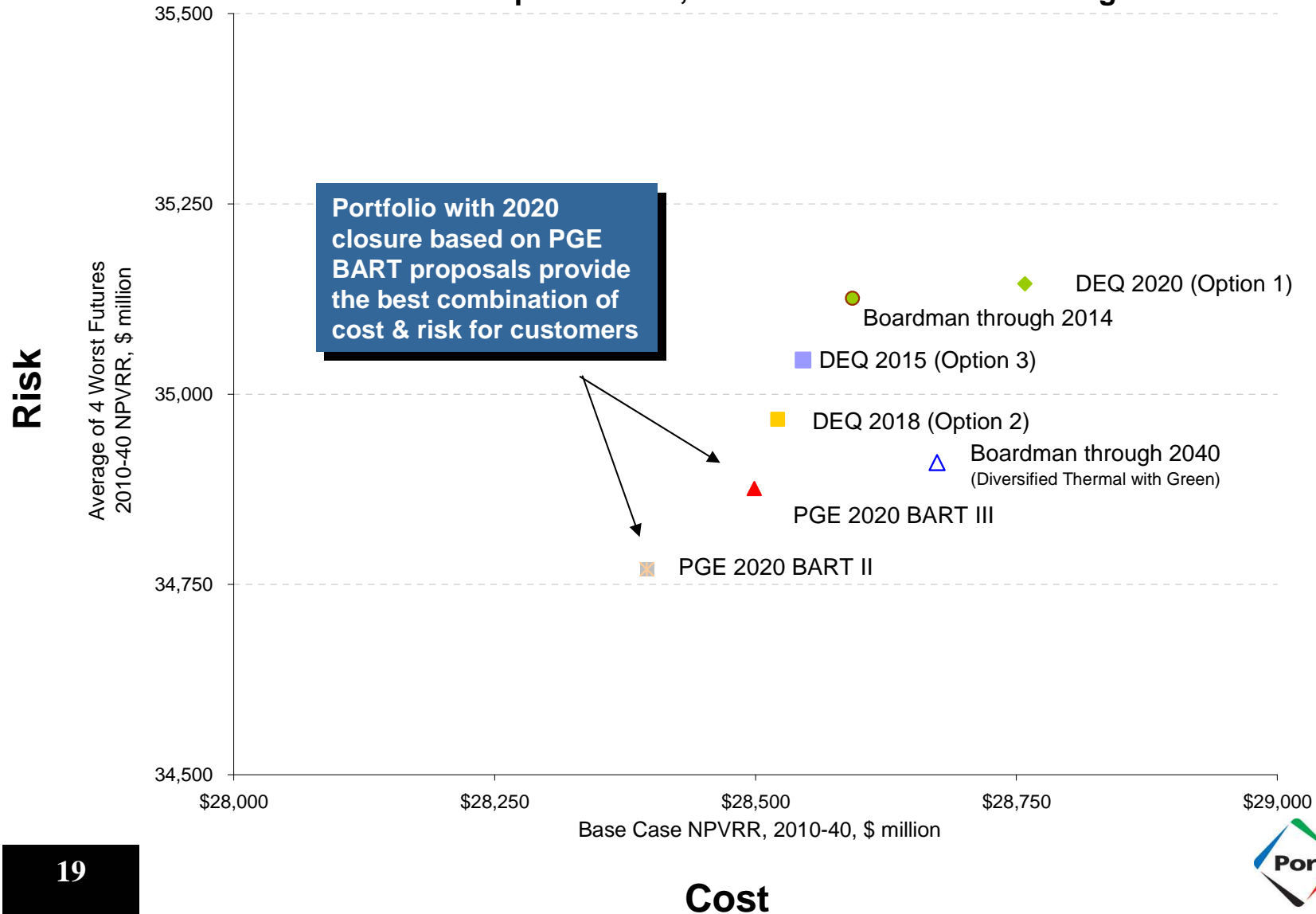
* Dates for IRP analysis purposes are at year-end.

Scenario Analysis: Portfolio Cost vs. Risk



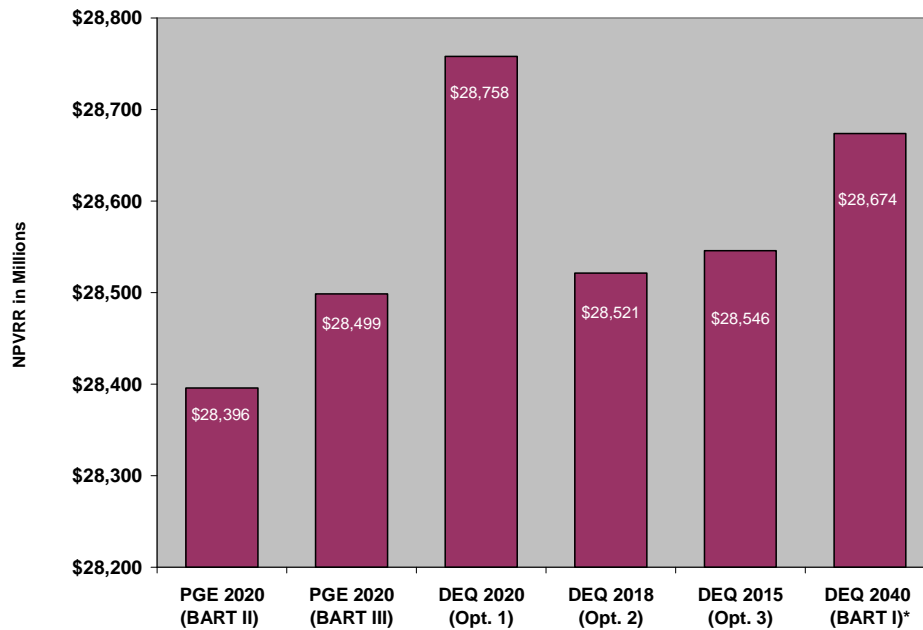
Scenario Analysis: Boardman Highlight

Horizontal axis shows expected cost; vertical axis shows risk of higher cost than expected.



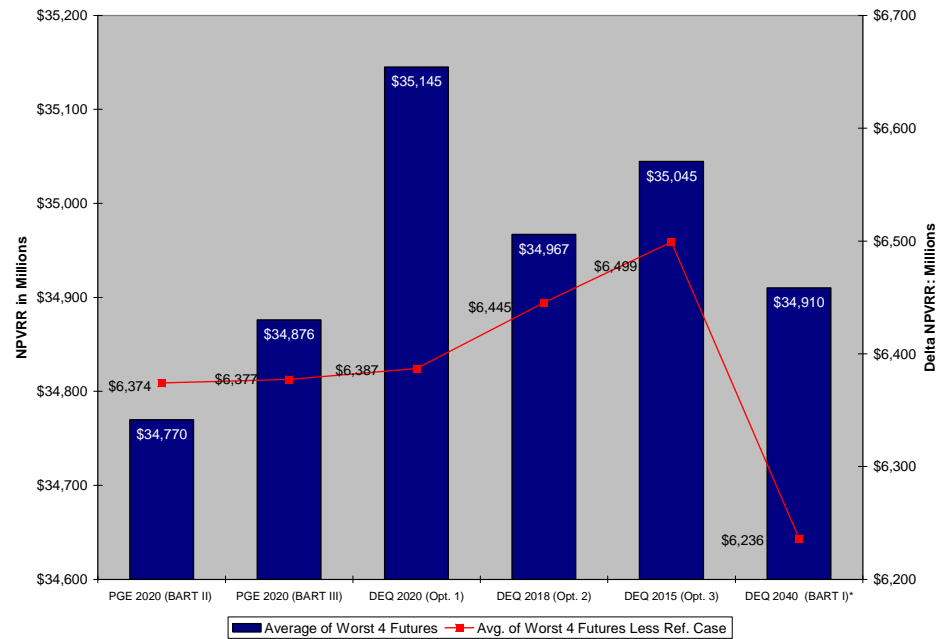
NPVRR (2009\$) – Reference Case Cost & Deterministic Risk Boardman Portfolios

Reference Case



PGE's 2020 BART III portfolio provides lower cost for customers by \$50 MM NPVRR as compared to DEQ 2015 option.

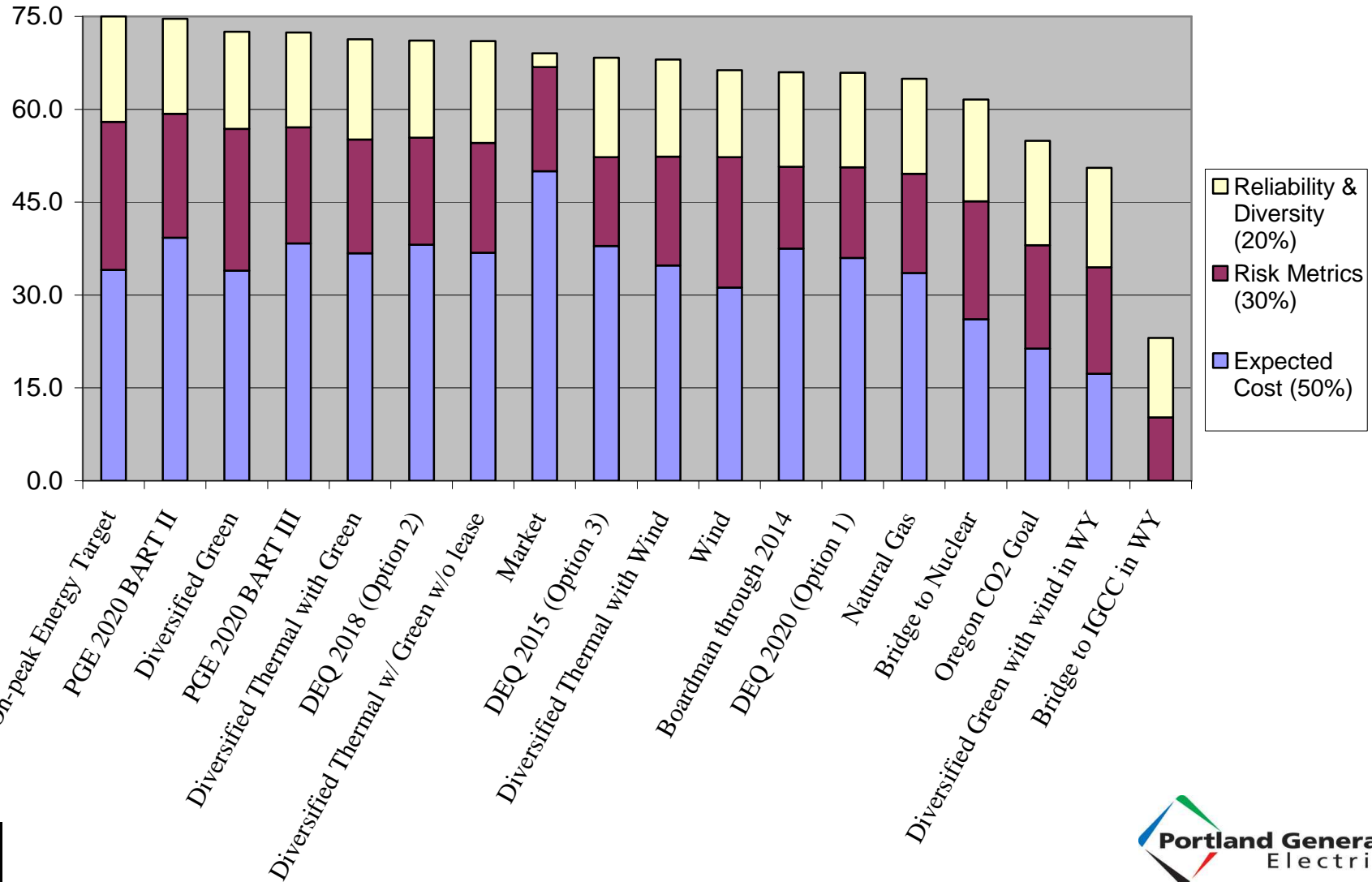
Both 2020 BART III and 2040 BART I cases perform well under deterministic risk measures. DEQ 2015 (Opt. 3) is riskier according to both measures.



NPVRR = Net present value of revenue requirement
 *2040 is Diversified Thermal with Green Portfolio

Portfolio Scoring Grid

Weighted Scores & Ranked Results

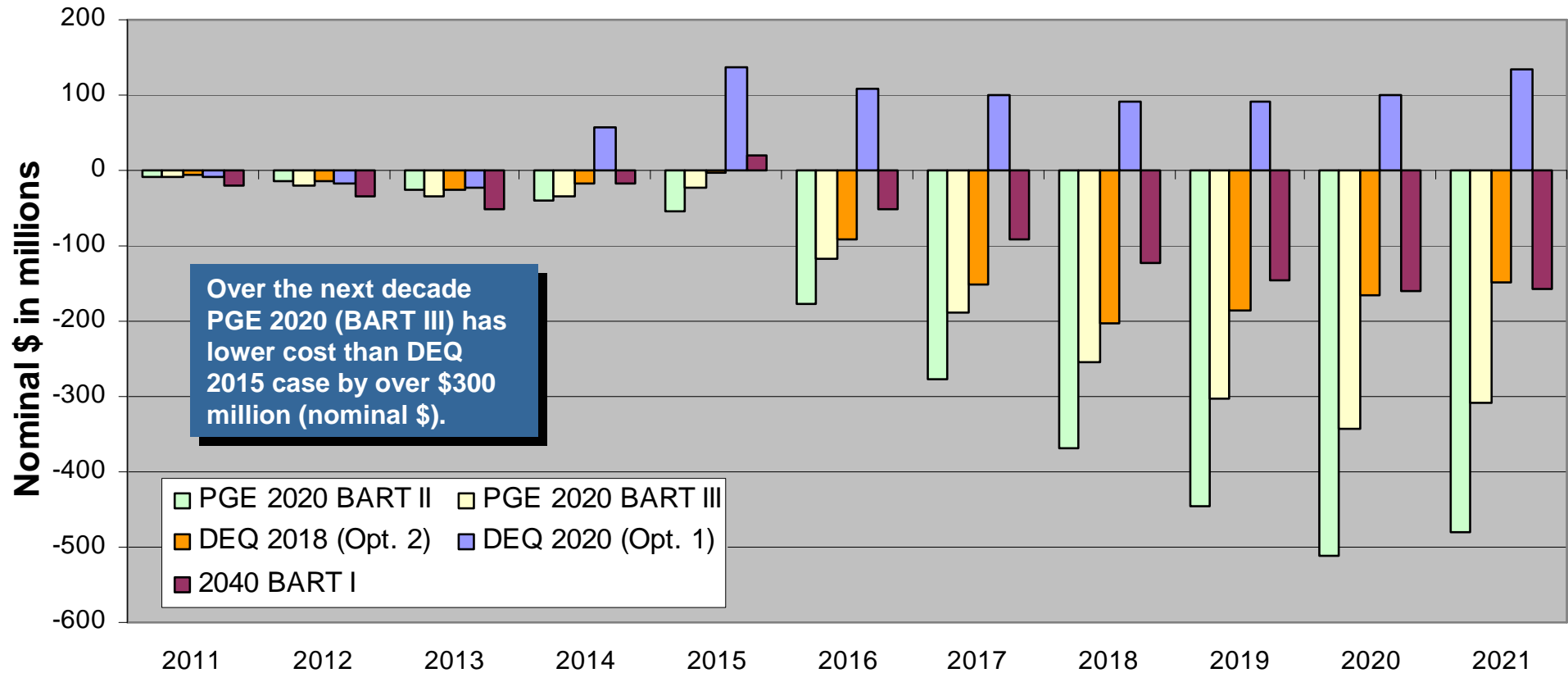


Cost Impacts to 2021

DEQ Options and PGE 2020 BART III (Proposed) vs. DEQ 2015 (Opt. 3)

Cumulative Revenue Requirement Impacts 2011-2021

DEQ and PGE Options Compared to DEQ 2015 (Opt. 3)



* Above comparison based on front-loaded cost recovery in rates

Cumulative Revenue Requirement Impacts

Rate impact vs. 2040 without BART controls						
	Control/closure options					
	PGE 2020 (BART II)	DEQ 2015 (DEQ Opt. 3)	DEQ 2018 (DEQ Opt. 2) + testing	PGE 2020 BART III (Proposed)	DEQ 2020 (DEQ Opt. 1)	DEQ 2040 (BART 1)
Avg. Increase 2011-2021 (%)	1.6%	3.9%	3.2%	2.4%	4.6%	3.2%
Single Highest Year Increase (Year / %)	2021/ 5.4%	2016 / 7.4%	2019 / 6.8%	2021/ 5.4%	2017/ 6.7%	2017/ 5.1%
Cumulative Nominal Impact by 2021 (\$Millions)	\$345	\$824	\$677	\$516	\$958	\$667

Additional Risks

- Maximum Achievable Control Technology (MACT)
 - Could require installation of controls similar to BART I prior to 2020
 - Proposed standards will be issued in March, 2011; final standards in November 2011
 - Affects national coal fleet which generates ~ 50% of US energy consumption
- Sierra Club *et. al.* Litigation
 - Could result in requirement to install controls similar to BART I
 - PGE would need to operate through 2040 to recover costs of controls
 - Liability trial scheduled for June, 2011
 - Remedy trial (if needed) likely in late 2012
- Air Permit
 - Permit delays could require temporary closure of Boardman
 - Permit may not reflect all BART compliance options

Balancing Multiple Objectives & Interests



A Reasonable 2020 Plan - the Best Option for PGE Customers

The PGE 2020 proposal for Boardman is the best option for our customers. The PGE 2020 BART III proposal balances cost and risk, as well as impacts to the environment, the local community and plant employees.

The benefits of a reasonable 2020 plan (PGE BART III) include:

- PGE believes it meets the BART/RH standards.
- Gives PGE a reasonable timeframe to build or buy cost-effective and reliable replacement resources.
- Provides transition time for potential technology advancement, increased availability and cost improvement for replacement supply options.
- Allows Oregon to transition from coal in an orderly and cost-effective manner.
- Reduces adverse social and economic impacts to local community and plant employees.
- Lower combined cost and risk than other potential alternatives.
- Reduces rate impacts to PGE customers over the next decade.
- Sets an important national precedent by eliminating the use of coal at a relatively young baseload plant 20 years ahead of schedule.

2040 Back-up Plan is Next Best Option

The 2040 Alternative (BART I) is the next best option for PGE customers. It is the only other option that is actionable and provides a reasonable balance between cost, risk and environmental impacts.

The 2040 Back-up option:

- Meets BART/RH requirements. Currently approved by DEQ.
- Performs well on combined cost and risk measures. Three out of the top five performing portfolios include Boardman through 2040 with BART I controls. Other two top performing portfolios are PGE BART II and BART III proposals.
- Low execution risk.
- Reduced control technology risk as compared to other DEQ options.
- Lower regulatory and legal risks associated with MACT and Sierra lawsuit.
- Maintains supply diversity and avoids near-term natural gas concentration risk in our portfolio.

Timeline

IRP Schedule

- September 1: Intervenor comments
- September 27: PGE reply comments
- October 11: Staff's proposed order and comments
- October 27: Parties comments on proposed order
- November: Commission Hearing on Acknowledgement of IRP

DEQ Schedule

- September 1: DEQ issues final proposed rule
- September: DEQ Public Meetings
 - Portland – 9/22
 - Eugene – 9/23
 - Medford – 9/27
 - Hermiston – 9/28
 - The Dalles/Hood River – 9/29
- September-October: Public Comment on Rule
- October 1: Public Comment period closes
- November: Final rulemaking package to EQC
- December: DEQ recommends final rule to EQC; EQC vote scheduled

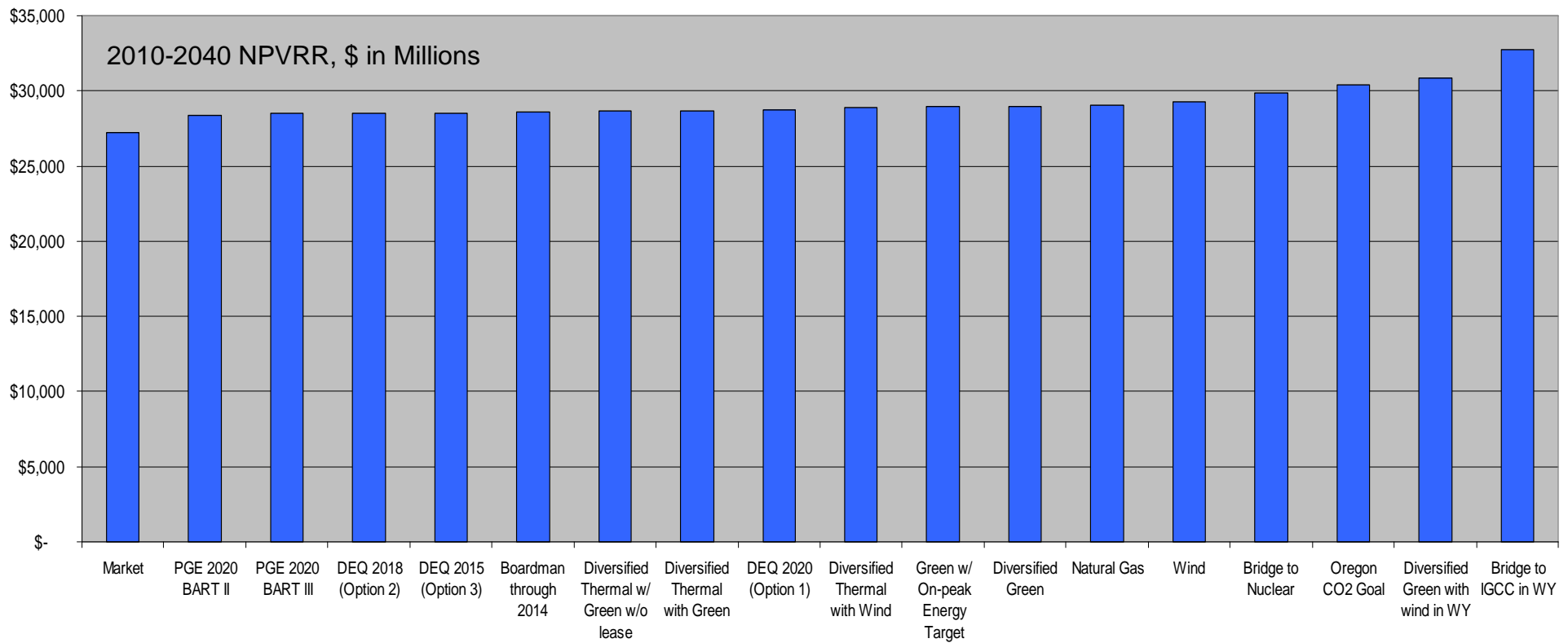
Appendix

IRP Analytical Results – Scoring Grid Backup

Portfolio Analysis

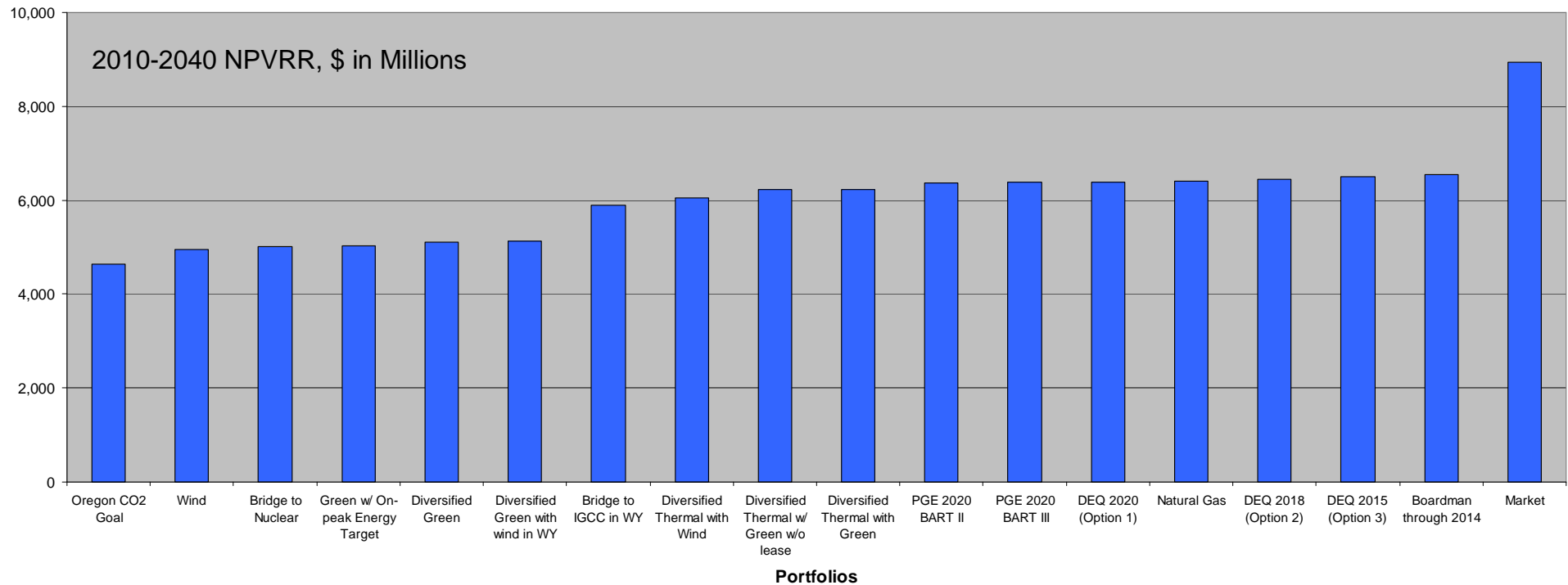
Reference Case

Net Present Value of Revenue Requirements (2009\$)



Portfolio Analysis

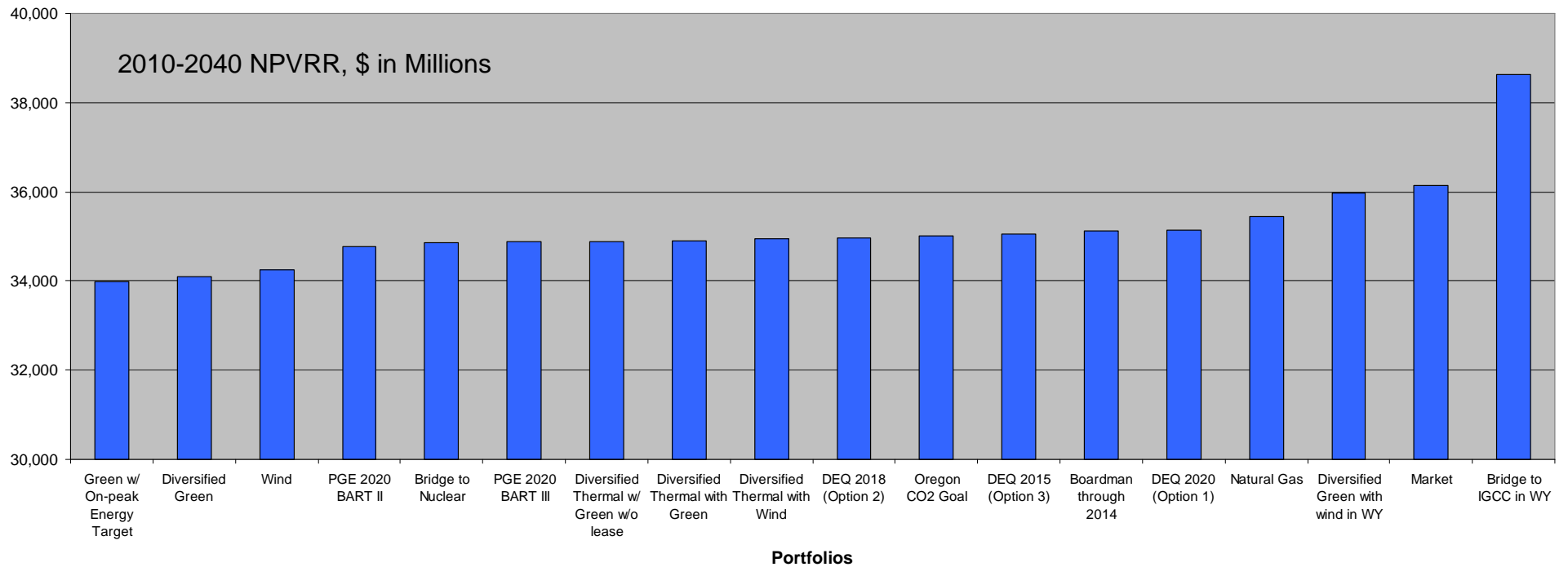
Worst 4 Futures Less Reference Case Net Present Value of Revenue Requirements (2009\$)



Portfolio Analysis

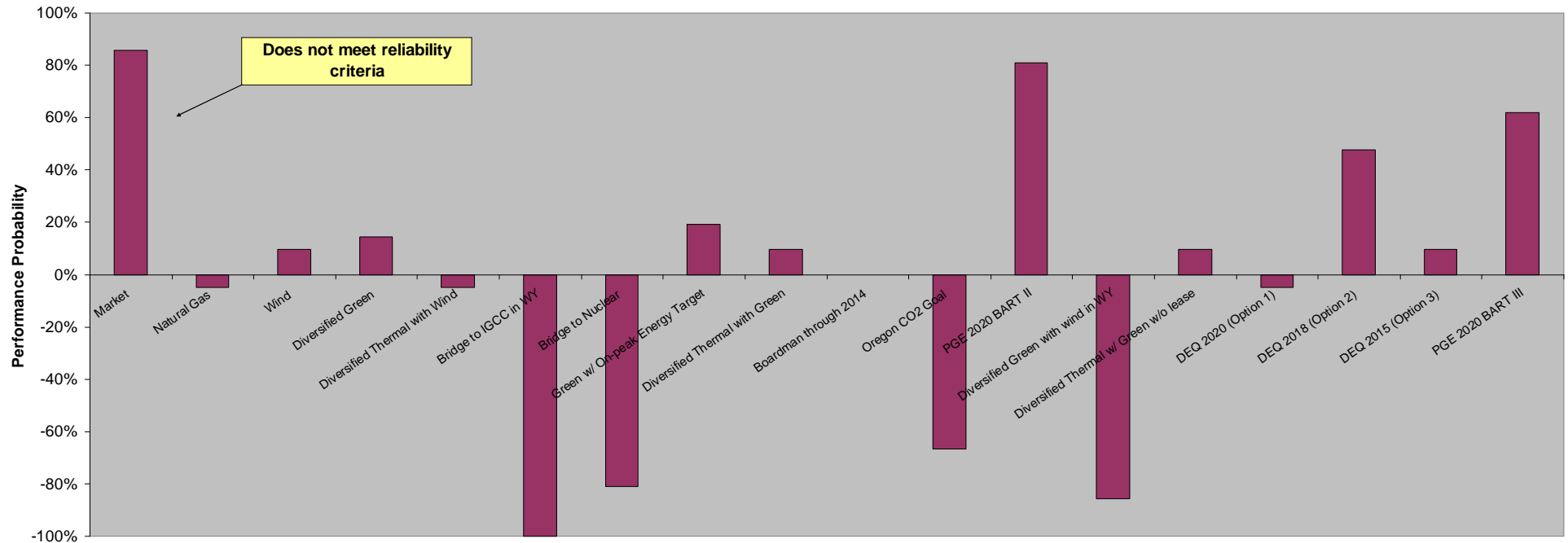
Worst 4 Futures

Net Present Value of Revenue Requirements (2009\$)

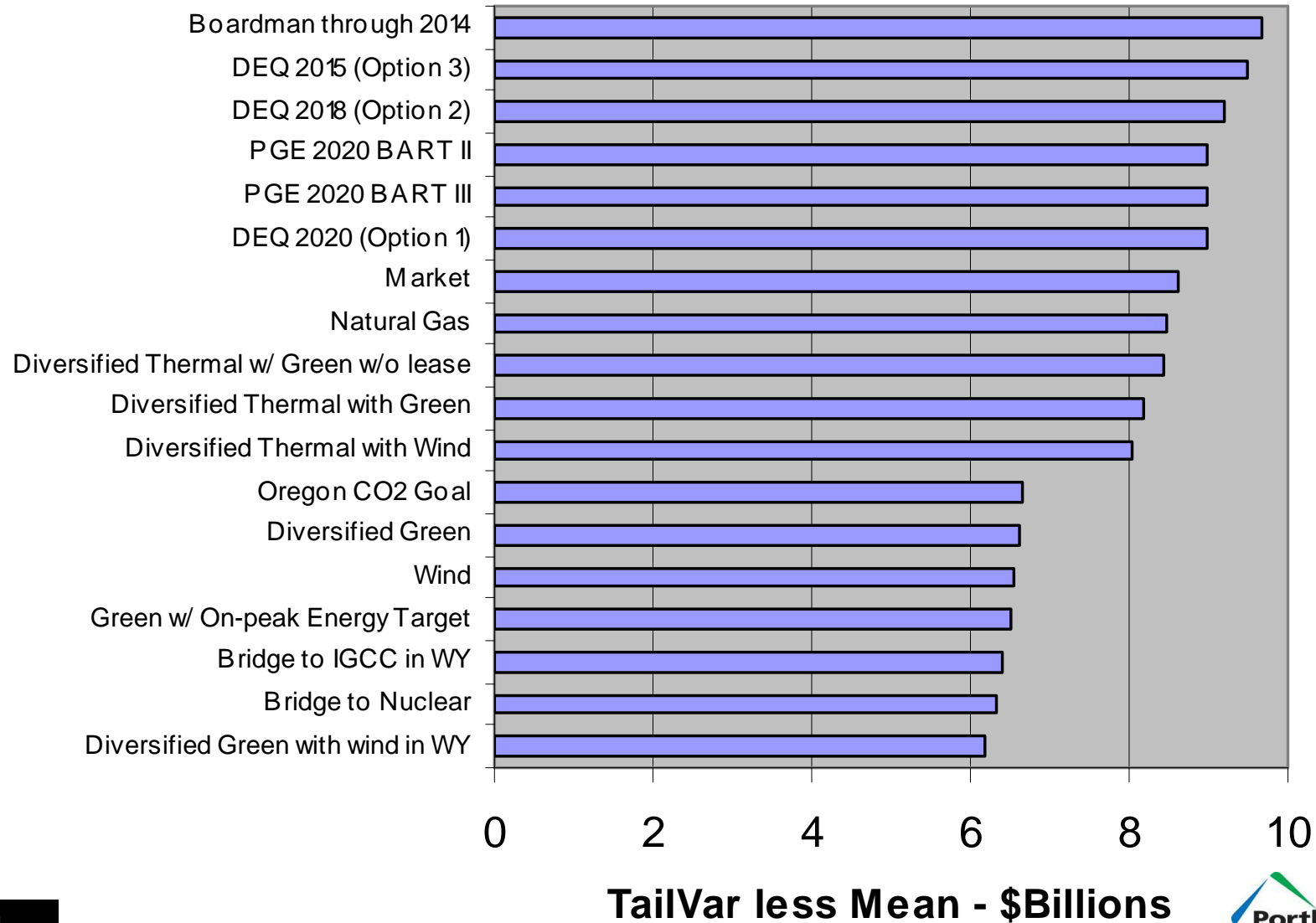


Portfolio Analysis

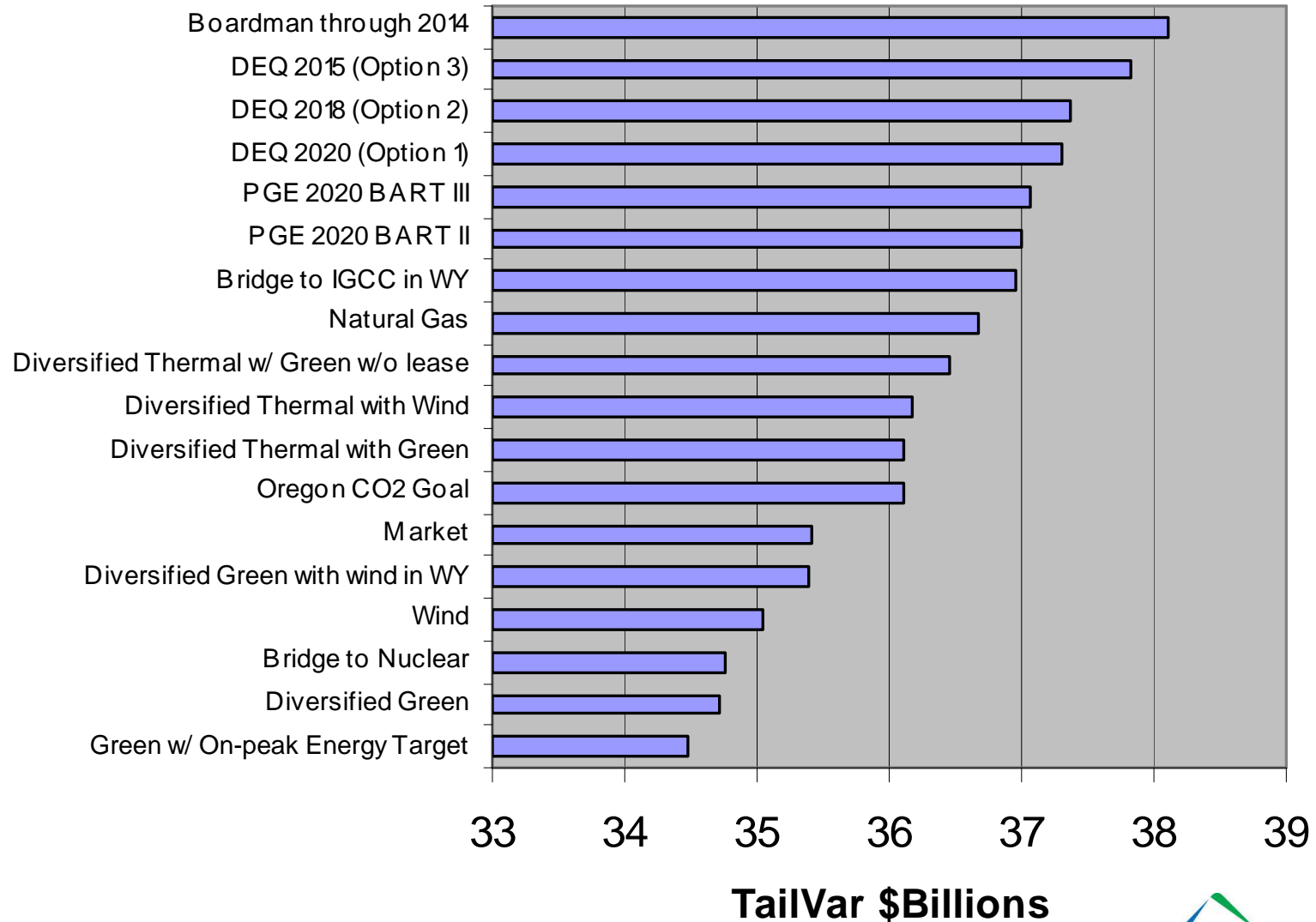
Combined Performance Frequency of Good vs. Bad Outcomes



Stochastic Risk – TailVar 90 less the Mean

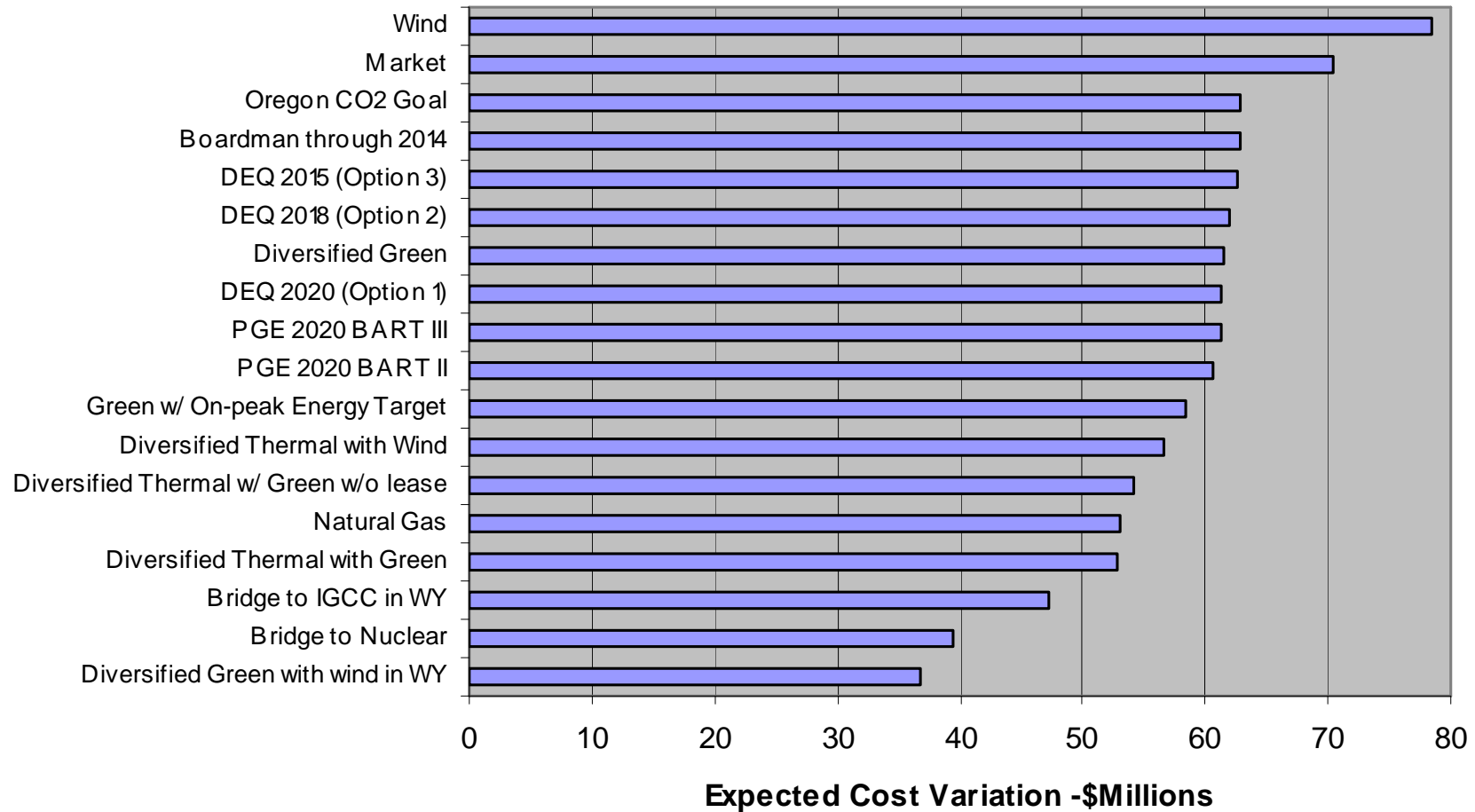


Stochastic Risk – TailVar

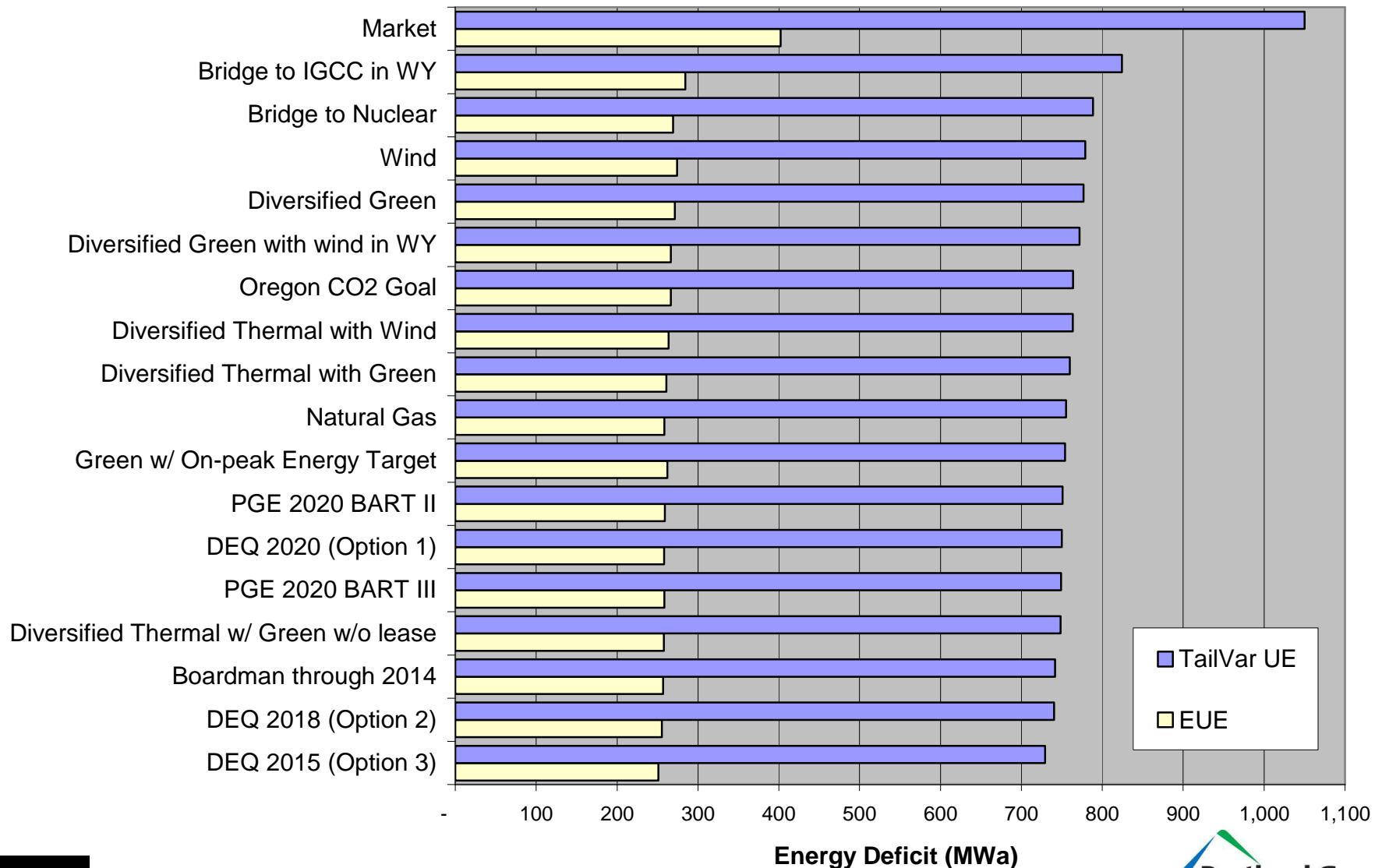


Stochastic Risk – Annual Cost Variance

Year-to-Year Portfolio Average Variance

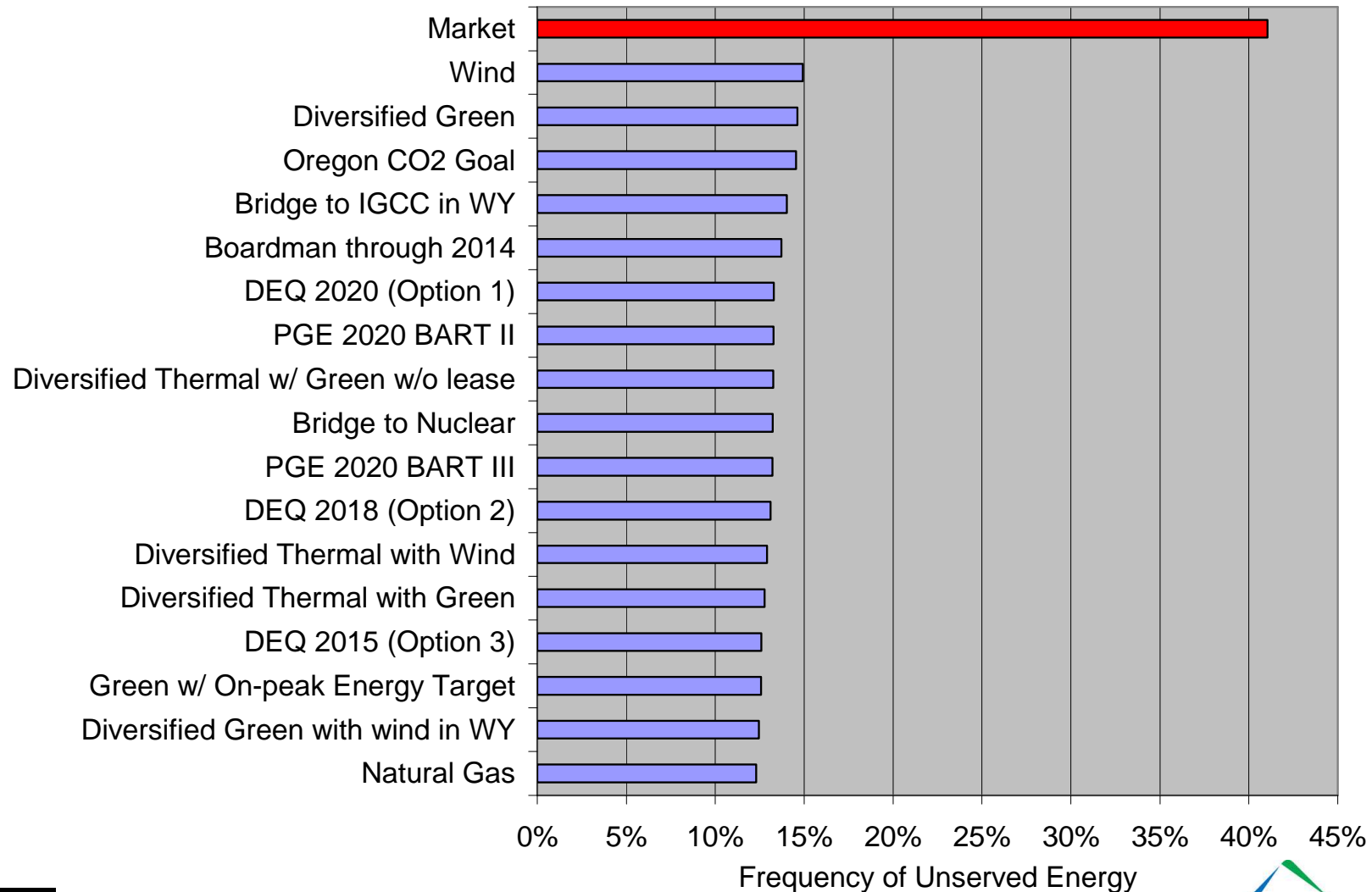


Portfolio Reliability – Unserved Energy 2012-2020 & 2025

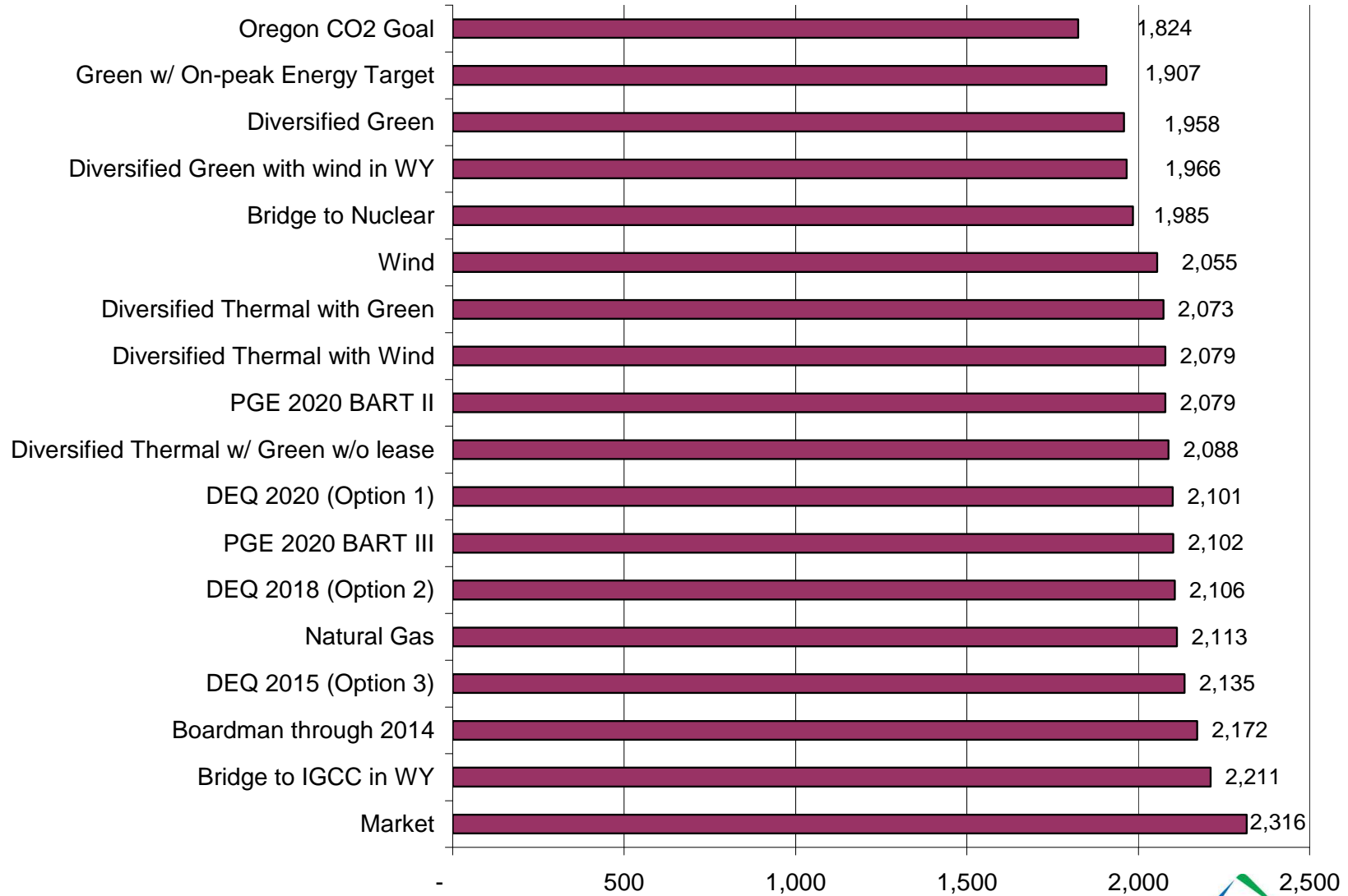


Portfolio Reliability - LOLP

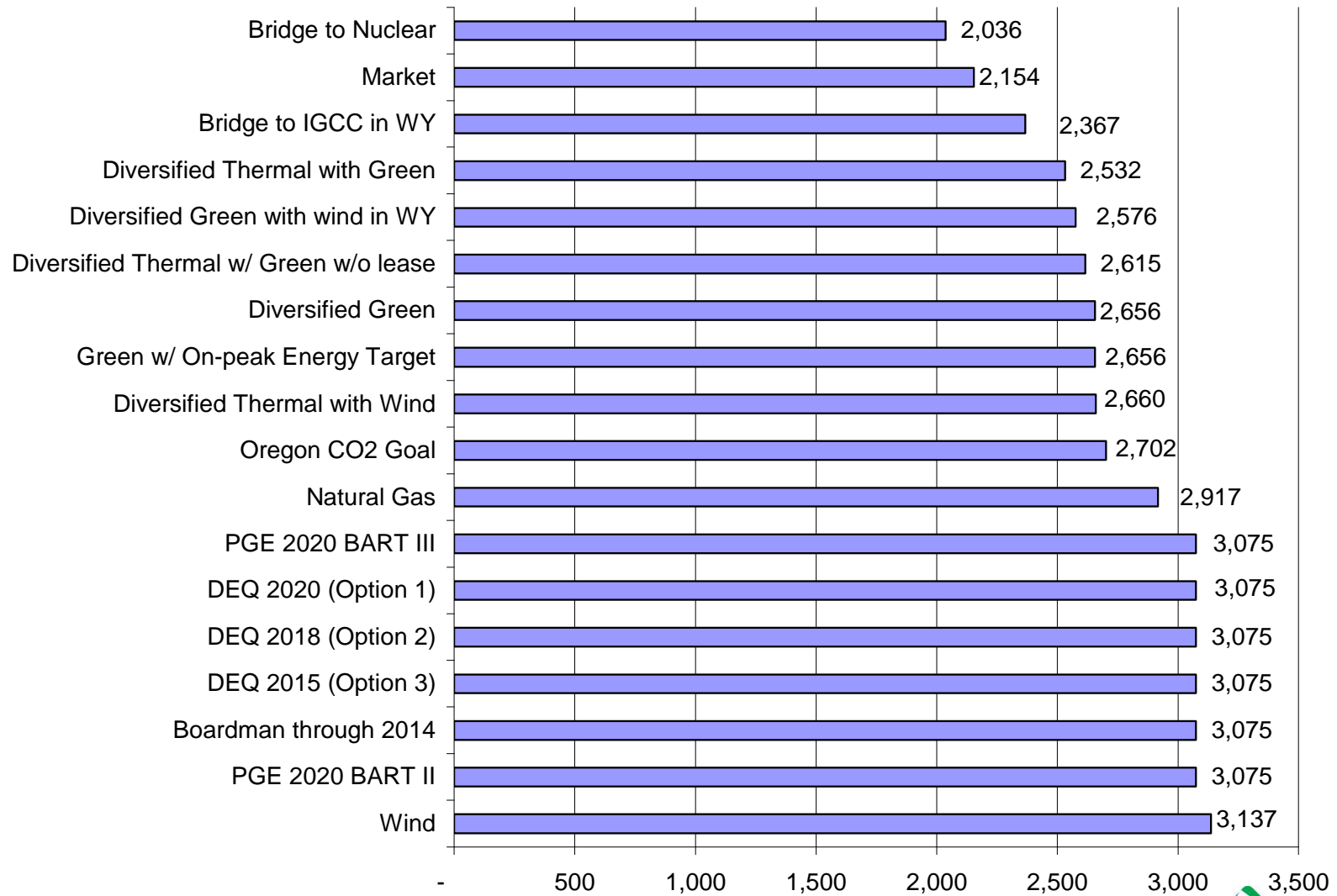
LOLP Performance for 2012-2020, & 2025



HHI – Fuel



HHI – Technology



Portfolio Scoring Grid

Cost & Risk Results Tabulated

1. Portfolio Evaluation Scoring: Raw Performance Metrics		Screening		Deterministic				Stochastic				Reliability & Diversity			
Scoring Consideration		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)
Units		Within Efficient Frontier Zone?	Meets Operating Reserve Req?	Cost: Expected Cost Reference Case	Prob. of Poor Perf.	Prob. of Good Perf.	Risk Durability: Good minus Bad	Risk Magnitude: Avg. Worst 4	Risk Magnitude: Avg. Worst 4 vs. Reference Case	Risk: TailVar	Risk: TailVar less Mean	Risk: Year-to-Year Variation	Reliability: TailVar Unserved Energy 2012-2020	Diversity: Technology HHI	Diversity: Fuel HHI
Units		Y or N	Y or N	\$ NPV	%	%	%	\$ NPV Million	\$ NPV Million	\$ NPV Million	\$ NPV Million	Trillion	MWa	Points	Points
1	Market	Y	N	\$ 27,211	5%	90%	86%	\$ 36,155	\$ 8,943	\$ 35,414	\$ 8,631	70	1050	2154	2316
2	Natural Gas	Y	Y	\$ 29,027	10%	5%	-5%	\$ 35,436	\$ 6,410	\$ 36,675	\$ 8,458	53	755	2917	2113
3	Wind	Y	Y	\$ 29,288	5%	14%	10%	\$ 34,238	\$ 4,949	\$ 35,037	\$ 6,547	78	779	3137	2055
4	Diversified Green	Y	Y	\$ 28,987	0%	14%	14%	\$ 34,091	\$ 5,104	\$ 34,718	\$ 6,624	61	777	2656	1958
5	Diversified Thermal with Wind	Y	Y	\$ 28,891	5%	0%	-5%	\$ 34,949	\$ 6,057	\$ 36,175	\$ 8,025	57	763	2660	2079
6	Bridge to IGCC in WY	N	Y	\$ 32,735	100%	0%	-100%	\$ 38,635	\$ 5,900	\$ 36,950	\$ 6,397	47	824	2367	2211
7	Bridge to Nuclear	Y	Y	\$ 29,853	81%	0%	-81%	\$ 34,863	\$ 5,010	\$ 34,768	\$ 6,311	39	788	2036	1985
8	Green w/ On-peak Energy Target	Y	Y	\$ 28,971	0%	19%	19%	\$ 33,993	\$ 5,023	\$ 34,481	\$ 6,517	58	754	2656	1907
9	Diversified Thermal with Green	Y	Y	\$ 28,674	5%	14%	10%	\$ 34,910	\$ 6,236	\$ 36,116	\$ 8,171	53	760	2532	2073
10	Boardman through 2014	Y	Y	\$ 28,593	10%	10%	0%	\$ 35,126	\$ 6,533	\$ 38,112	\$ 9,689	63	742	3075	2172
11	Oregon CO2 Goal	N	Y	\$ 30,375	81%	14%	-67%	\$ 35,007	\$ 4,632	\$ 36,112	\$ 6,665	63	764	2702	1824
12	PGE 2020 BART II	Y	Y	\$ 28,396	0%	81%	81%	\$ 34,770	\$ 6,374	\$ 36,999	\$ 8,987	61	751	3075	2079
13	Diversified Green with wind in WY	Y	Y	\$ 30,828	86%	0%	-86%	\$ 35,962	\$ 5,134	\$ 35,399	\$ 6,191	37	772	2576	1966
14	Diversified Thermal w/ Green w/o lease	Y	Y	\$ 28,668	0%	10%	10%	\$ 34,891	\$ 6,223	\$ 36,461	\$ 8,432	54	748	2615	2088
15	DEQ 2020 (Option 1)	N	Y	\$ 28,758	5%	0%	-5%	\$ 35,145	\$ 6,387	\$ 37,314	\$ 8,985	61	750	3075	2101
16	DEQ 2018 (Option 2)	Y	Y	\$ 28,521	0%	48%	48%	\$ 34,967	\$ 6,445	\$ 37,373	\$ 9,196	62	740	3075	2106
17	DEQ 2015 (Option 3)	Y	Y	\$ 28,546	10%	19%	10%	\$ 35,045	\$ 6,499	\$ 37,815	\$ 9,489	63	729	3075	2135
18	PGE 2020 BART III	Y	Y	\$ 28,499	0%	62%	62%	\$ 34,876	\$ 6,377	\$ 37,056	\$ 8,986	61	749	3075	2102

Performance Range for Scoring Normalization:

Best Performing Portfolio(s)		\$ 27,211	100%	90%	86%	\$ 33,993	\$ 4,632	\$ 34,481	\$ 6,191	37	729.3	2,036	1,824
Best Basis		Min	Max	Max	Max	Min	Min	Min	Min	Min	Min	Min	Min
Worst Performing Portfolio(s)		\$ 32,735	0%	0%	-100%	\$ 38,635	\$ 8,943	\$ 38,112	\$ 9,689	78	1,050.0	3,137	2,316
Spread Best to Worst		\$ 5,524	100%	90%	186%	\$ 4,641	\$ 4,311	\$ 3,631	\$ 3,498	42	320.6	1,101	492
% Difference		20.3%				13.7%	93.1%	10.5%	56.5%	113.9%	44.0%	54.1%	27.0%

Portfolio Scoring Grid

Normalized Scores

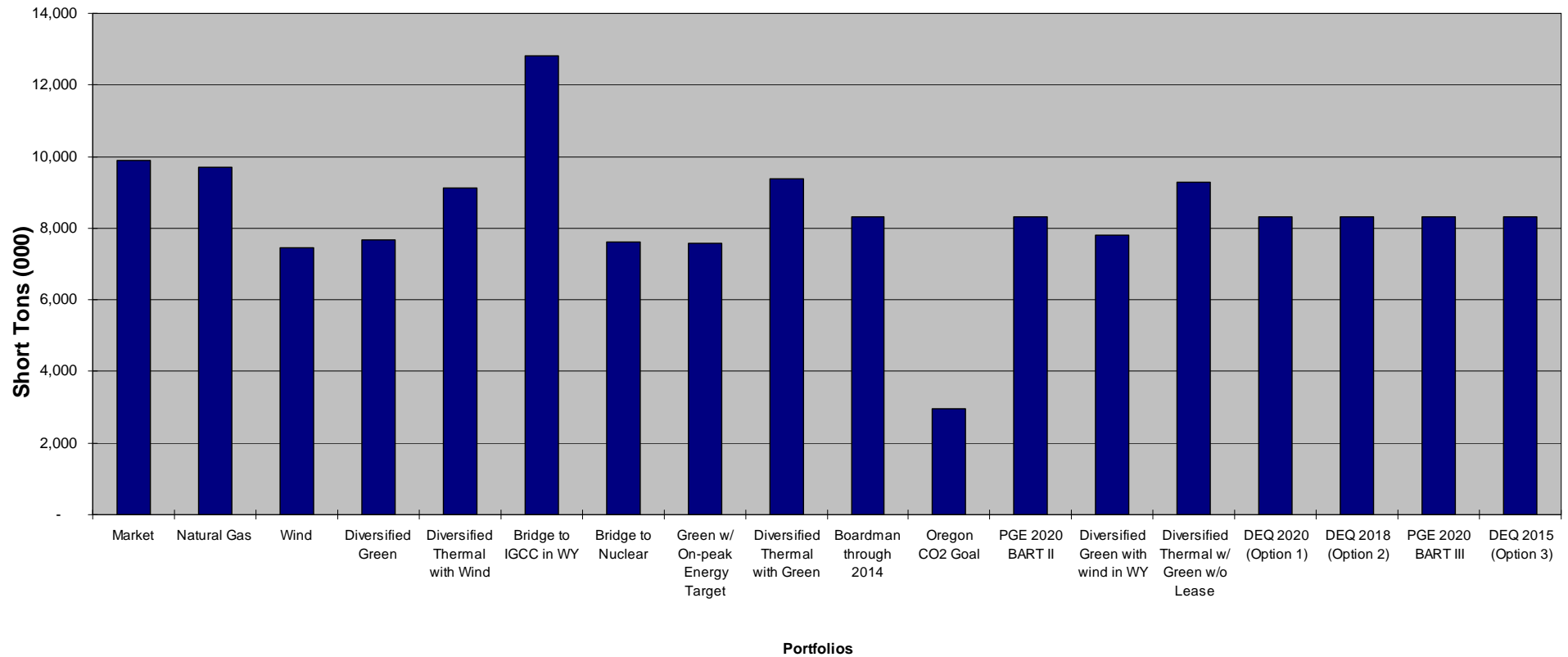
2. Portfolio Evaluation Scoring: Normalized Scores (0 to 100)		Screening		Deterministic			Stochastic			Reliability & Diversity			
		(a)	(b)	(c)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)
Scoring Consideration		Within Efficient Frontier Zone?	Meets Operating Reserve Req?	Cost: Expected Cost	Risk Durability: Good minus Bad	Risk Magnitude: Avg. Worst 4 vs. Reference Case	Risk Magnitude: Avg. Worst 4 vs. Reference Case	Risk: TailVar	Risk: TailVar less Mean	Risk: Year-to-Year Variation	Reliability: Avg. EUE 2012-2020 & 2025	Diversity: Technology HHI	Diversity: Fuel HHI
1	Market	Y	N	100.0	100.0	53.4	0.0	74.3	30.2	19.3	0.0	89.3	0.0
2	Natural Gas	Y	Y	67.1	51.3	68.9	58.8	39.6	35.2	60.8	91.9	20.0	41.3
3	Wind	Y	Y	62.4	59.0	94.7	92.6	84.7	89.8	0.0	84.6	0.0	53.1
4	Diversified Green	Y	Y	67.9	61.5	97.9	89.1	93.5	87.6	40.6	85.2	43.7	72.6
5	Diversified Thermal with Wind	Y	Y	69.6	51.3	79.4	66.9	53.3	47.6	52.3	89.4	43.3	48.2
6	Bridge to IGCC in WY	N	Y	0.0	0.0	0.0	70.6	32.0	94.1	74.7	70.5	69.9	21.3
7	Bridge to Nuclear	Y	Y	52.2	10.3	81.3	91.2	92.1	96.6	93.5	81.6	100.0	67.2
8	Green w/ On-peak Energy Target	Y	Y	68.1	64.1	100.0	90.9	100.0	90.7	47.9	92.4	43.7	83.2
9	Diversified Thermal with Green	Y	Y	73.5	59.0	80.3	62.8	55.0	43.4	61.2	90.5	54.9	49.3
10	Boardman through 2014	Y	Y	75.0	53.8	75.6	55.9	0.0	0.0	37.6	96.1	5.6	29.3
11	Oregon CO2 Goal	N	Y	42.7	17.9	78.2	100.0	55.1	86.5	37.4	89.2	39.5	100.0
12	PGE 2020 BART II	Y	Y	78.6	97.4	83.3	59.6	30.6	20.1	42.9	93.3	5.6	48.0
13	Diversified Green with wind in WY	Y	Y	34.5	7.7	57.6	88.4	74.7	100.0	100.0	86.8	50.9	71.1
14	Diversified Thermal w/ Green w/o lease	Y	Y	73.6	59.0	80.7	63.1	45.5	35.9	58.3	94.1	47.4	46.3
15	DEQ 2020 (Option 1)	N	Y	72.0	51.3	75.2	59.3	22.0	20.1	41.0	93.6	5.6	43.6
16	DEQ 2018 (Option 2)	Y	Y	76.3	79.5	79.0	57.9	20.3	14.1	39.3	96.6	5.6	42.7
17	DEQ 2015 (Option 3)	Y	Y	75.8	59.0	77.4	56.7	8.2	5.7	38.0	100.0	5.6	36.8
18	PGE 2020 BART III	Y	Y	76.7	87.2	81.0	59.5	29.1	20.1	41.2	93.9	5.6	43.4

Portfolio Scoring Grid

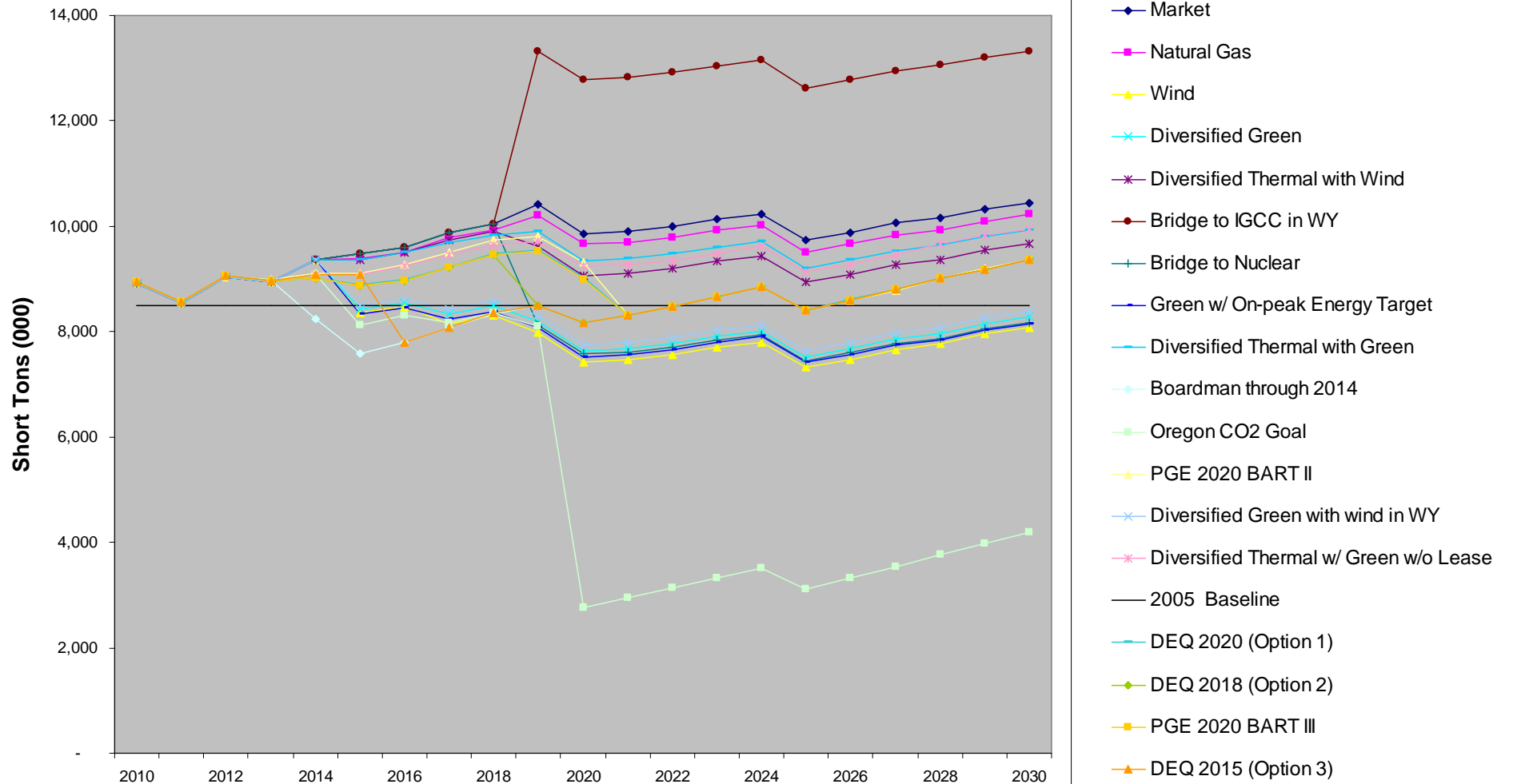
Weighted Scores & Ranked Results

3. Portfolio Evaluation Scoring: Total Weighted Scores		Screening		Deterministic				Stochastic			Reliability & Diversity			(l)	(m)	(n)
Scoring Consideration	(a) Within Efficient Frontier Zone?	(b) Meets Operating Reserve Req?	(c) Cost: Expected Cost	(f) Risk Durability: Good minus Bad	(g) Risk Magnitude: Avg. Worst 4 vs. Reference Case	(h) Risk Magnitude: Avg. Worst 4 vs. Reference Case	(i) Risk: TailVar	(j) Risk: TailVar less Mean	(k) Risk: Year- to-Year Variation	(l) Reliability: Avg. EUE 2012-2020 & 2025	(m) Diversity: Technology HHI	(n) Diversity: Fuel HHI	Weighted Combined Score (0 to 100)	Performance vs. Best (%)	Ordinal Ranking	
Weight			50%	10%	5%	5%	3.3%	3.3%	3.3%	15%	2.5%	2.5%				
1	Market	Y	N	50.0	10.0	2.7	0.0	2.5	1.0	0.6	0.0	2.2	0.0	69.0	92%	8
2	Natural Gas	Y	Y	33.6	5.1	3.4	2.9	1.3	1.2	2.0	13.8	0.5	1.0	64.9	87%	14
3	Wind	Y	Y	31.2	5.9	4.7	4.6	2.8	3.0	0.0	12.7	0.0	1.3	66.3	88%	11
4	Diversified Green	Y	Y	33.9	6.2	4.9	4.5	3.1	2.9	1.4	12.8	1.1	1.8	72.5	97%	3
5	Diversified Thermal with Wind	Y	Y	34.8	5.1	4.0	3.3	1.8	1.6	1.7	13.4	1.1	1.2	68.0	91%	10
6	Bridge to IGCC in WY	N	Y	0.0	0.0	0.0	3.5	1.1	3.1	2.5	10.6	1.7	0.5	23.1	31%	18
7	Bridge to Nuclear	Y	Y	26.1	1.0	4.1	4.6	3.1	3.2	3.1	12.2	2.5	1.7	61.6	82%	15
8	Green w/ On-peak Energy Target	Y	Y	34.1	6.4	5.0	4.5	3.3	3.0	1.6	13.9	1.1	2.1	75.0	100%	1
9	Diversified Thermal with Green	Y	Y	36.8	5.9	4.0	3.1	1.8	1.4	2.0	13.6	1.4	1.2	71.3	95%	5
10	Boardman through 2014	Y	Y	37.5	5.4	3.8	2.8	0.0	0.0	1.3	14.4	0.1	0.7	66.0	88%	12
11	Oregon CO2 Goal	N	Y	21.4	1.8	3.9	5.0	1.8	2.9	1.2	13.4	1.0	2.5	54.9	73%	16
12	PGE 2020 BART II	Y	Y	39.3	9.7	4.2	3.0	1.0	0.7	1.4	14.0	0.1	1.2	74.6	99%	2
13	Diversified Green with wind in WY	Y	Y	17.3	0.8	2.9	4.4	2.5	3.3	3.3	13.0	1.3	1.8	50.6	67%	17
14	Diversified Thermal w/ Green w/o lease	Y	Y	36.8	5.9	4.0	3.2	1.5	1.2	1.9	14.1	1.2	1.2	71.0	95%	7
15	DEQ 2020 (Option 1)	N	Y	36.0	5.1	3.8	3.0	0.7	0.7	1.4	14.0	0.1	1.1	65.9	88%	13
16	DEQ 2018 (Option 2)	Y	Y	38.1	7.9	4.0	2.9	0.7	0.5	1.3	14.5	0.1	1.1	71.1	95%	6
17	DEQ 2015 (Option 3)	Y	Y	37.9	5.9	3.9	2.8	0.3	0.2	1.3	15.0	0.1	0.9	68.3	91%	9
18	PGE 2020 BART III	Y	Y	38.3	8.7	4.0	3.0	1.0	0.7	1.4	14.1	0.1	1.1	72.4	97%	4

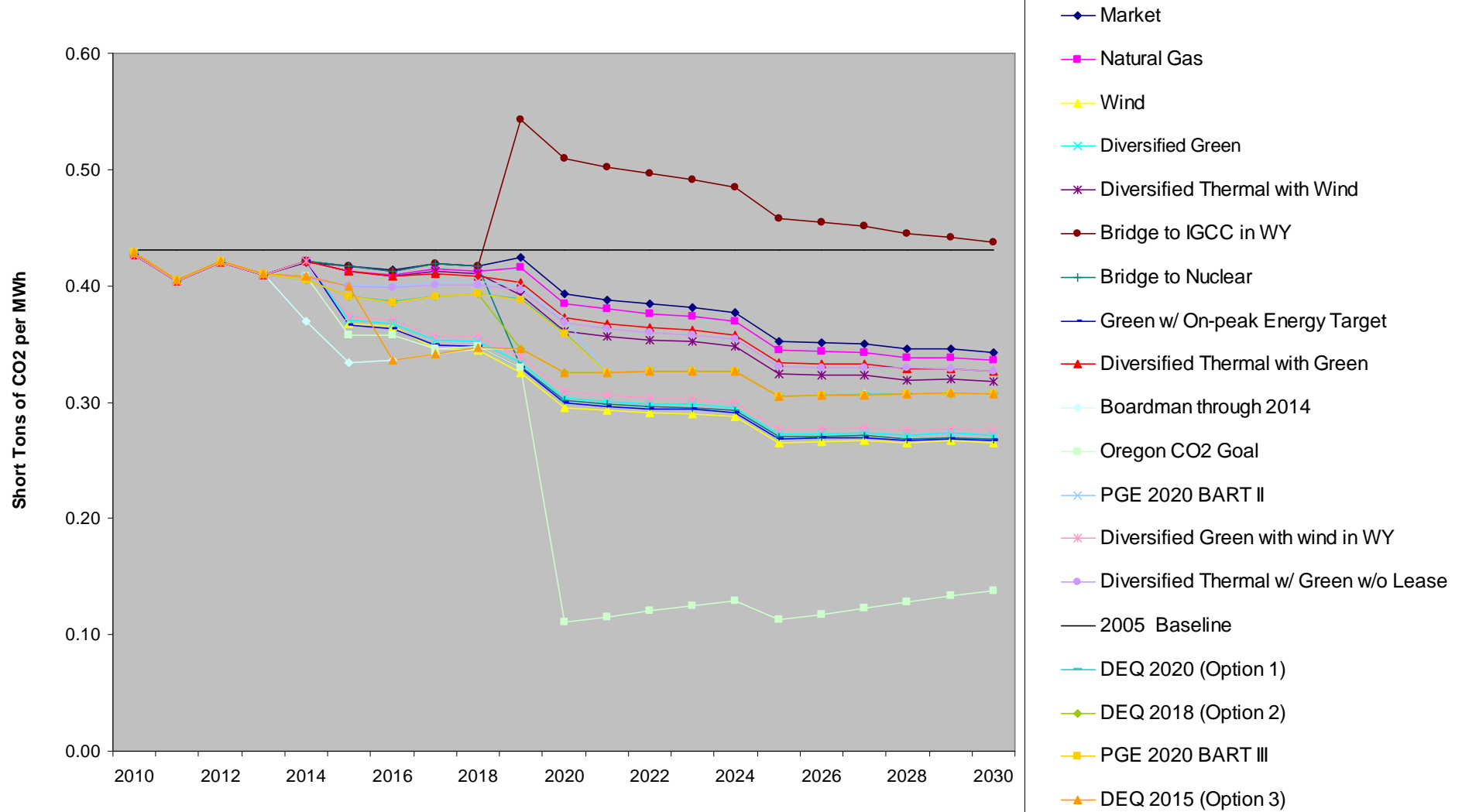
CO₂ Emissions – 2021 Annual Total



CO₂ Emissions – Reference Case 2010-2030



CO₂ Emission Intensity– Reference Case 2010-2030



Portfolio Analysis Results

Net present value of revenue requirements 2010-2040 (\$2009 millions)

Portfolio -->>	1	2	3	4	5	6	7	8	9
	Market	Natural Gas	Wind	Diversified Green	Diversified Thermal with Wind	Bridge to IGCC in WY	Bridge to Nuclear	Green w/ On-peak Energy Target	Diversified Thermal with Green
Reference Case	\$27,211	\$29,027	\$29,288	\$28,987	\$28,891	\$32,735	\$29,853	\$28,971	\$28,674
High Gas	\$34,213	\$35,970	\$34,181	\$34,067	\$35,312	\$37,642	\$34,707	\$34,011	\$35,310
Low Gas	\$23,524	\$25,099	\$26,597	\$26,201	\$25,342	\$29,986	\$27,260	\$26,087	\$25,012
CO2 \$45 per ton	\$29,302	\$30,956	\$30,866	\$30,618	\$30,760	\$35,144	\$31,289	\$30,528	\$30,606
CO2 \$65 per ton	\$32,183	\$33,520	\$32,980	\$32,809	\$33,264	\$38,270	\$33,234	\$32,576	\$33,200
No CO2	\$23,024	\$24,945	\$25,998	\$25,595	\$25,004	\$27,757	\$26,956	\$25,626	\$24,672
CO2 \$20 per ton	\$25,825	\$27,707	\$28,222	\$27,885	\$27,626	\$31,106	\$28,909	\$27,900	\$27,368
High Capital Costs	\$27,419	\$29,340	\$30,062	\$29,710	\$29,314	\$33,749	\$34,063	\$29,665	\$29,046
High PGE Load Growth	\$30,410	\$32,225	\$32,487	\$32,186	\$32,090	\$35,934	\$33,052	\$32,170	\$31,873
Low PGE load growth	\$24,867	\$26,682	\$26,944	\$26,642	\$26,547	\$30,390	\$27,508	\$26,626	\$26,329
High Electricity Prices	\$39,882	\$25,266	\$21,997	\$24,158	\$26,348	\$32,046	\$28,547	\$22,576	\$27,853
Low Electricity Prices	\$19,054	\$21,452	\$23,716	\$23,110	\$21,748	\$26,010	\$24,748	\$23,396	\$21,201
No Incentives	\$27,678	\$29,493	\$30,841	\$30,658	\$29,698	\$33,205	\$30,322	\$30,642	\$29,356
50 percent incentives	\$27,445	\$29,260	\$30,065	\$29,823	\$29,295	\$32,970	\$30,088	\$29,807	\$29,015
Low Coal-High Gas-\$65 CO2	\$38,340	\$40,028	\$37,302	\$37,302	\$39,129	\$42,693	\$37,447	\$37,218	\$39,257
CO2 Start 1 year later	\$26,951	\$28,775	\$29,064	\$28,759	\$28,645	\$32,455	\$29,631	\$28,747	\$28,424
CO2 Start 1 year earlier	\$27,477	\$29,289	\$29,522	\$29,224	\$29,147	\$33,024	\$30,087	\$29,206	\$28,933
CO2 \$12 per ton	\$24,738	\$26,648	\$27,372	\$27,009	\$26,618	\$29,801	\$28,162	\$27,036	\$26,330
Aggressive EE	\$26,600	\$28,416	\$28,677	\$28,376	\$28,281	\$32,124	\$29,242	\$28,360	\$28,063
Major Resources 1 Year Earlier	\$27,209	\$29,144	\$29,518	\$29,160	\$29,021	\$33,025	\$29,893	\$29,132	\$28,775
Major Resources 1 Year Later	\$27,212	\$28,916	\$29,083	\$28,831	\$28,771	\$32,474	\$29,673	\$28,826	\$28,577

Portfolio Analysis Results – cont.

Net present value of revenue requirements 2010-2040 (\$2009 millions)

Portfolio -->>	10	11	12	13	14	15	16	17	18
	Boardman through 2014	Oregon CO2 Goal	PGE 2020 BART II	Diversified Green with wind in WY	Diversified Thermal w/ Green w/o lease	DEQ 2020 (Option 1)	DEQ 2018 (Option 2)	DEQ 2015 (Option 3)	PGE 2020 BART III
Reference Case	28,593	\$30,375	\$28,396	\$30,828	\$28,668	\$28,758	\$28,521	\$28,546	\$28,499
High Gas	\$36,175	\$35,006	\$35,551	\$35,946	\$35,231	\$35,971	\$35,856	\$36,036	\$35,694
Low Gas	\$24,517	\$28,141	\$24,532	\$28,002	\$24,958	\$24,845	\$24,560	\$24,524	\$24,590
CO2 \$45 per ton	\$30,293	\$31,150	\$30,152	\$32,468	\$30,575	\$30,517	\$30,274	\$30,266	\$30,261
CO2 \$65 per ton	\$32,596	\$32,296	\$32,544	\$34,658	\$33,142	\$32,884	\$32,628	\$32,584	\$32,622
No CO2	\$25,281	\$29,107	\$24,952	\$27,414	\$24,755	\$25,321	\$25,113	\$25,205	\$25,062
CO2 \$20 per ton	\$27,470	\$29,917	\$27,227	\$29,717	\$27,369	\$27,594	\$27,374	\$27,419	\$27,338
High Capital Costs	\$29,002	\$34,993	\$28,796	\$31,735	\$29,053	\$29,158	\$28,925	\$28,953	\$28,898
High PGE Load Growth	\$31,792	\$33,574	\$31,595	\$34,026	\$31,867	\$31,956	\$31,719	\$31,743	\$31,696
Low PGE load growth	\$26,248	\$28,030	\$26,051	\$28,483	\$26,323	\$26,415	\$26,178	\$26,202	\$26,155
High Electricity Prices	\$26,400	\$23,541	\$25,554	\$26,141	\$27,477	\$25,930	\$25,860	\$26,130	\$25,654
Low Electricity Prices	\$21,109	\$26,914	\$21,120	\$24,822	\$21,147	\$21,399	\$21,122	\$21,115	\$21,143
No Incentives	\$29,275	\$32,046	\$29,078	\$32,488	\$29,350	\$29,440	\$29,203	\$29,228	\$29,181
50 percent incentives	\$28,934	\$31,211	\$28,737	\$31,658	\$29,009	\$29,099	\$28,863	\$28,887	\$28,840
Low Coal-High Gas-\$65 CO2	\$39,942	\$36,455	\$39,389	\$39,217	\$39,323	\$39,769	\$39,664	\$39,815	\$39,491
CO2 Start 1 year later	\$28,367	\$30,206	\$28,162	\$30,597	\$28,423	\$28,518	\$28,291	\$28,321	\$28,265
CO2 Start 1 year earlier	\$28,832	\$30,560	\$28,642	\$31,066	\$28,923	\$29,003	\$28,766	\$28,787	\$28,746
CO2 \$12 per ton	\$26,588	\$29,574	\$26,309	\$28,835	\$26,340	\$26,693	\$26,472	\$26,525	\$26,429
Aggressive EE	\$27,982	\$29,764	\$27,785	\$30,217	\$28,057	\$28,148	\$27,911	\$27,935	\$27,888
Major Resources 1 Year Earlier	\$28,741	\$30,707	\$28,493	\$31,102	\$28,781	\$28,856	\$28,664	\$28,642	\$28,597
Major Resources 1 Year Later	\$28,453	\$30,079	\$28,268	\$30,574	\$28,562	\$28,662	\$28,392	\$28,462	\$28,409