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PWP 2015 IRP Update
Energy Roadmap Event

May 13, 2015

Can You Name These PWP Power Sources?

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PWP Power Supplies

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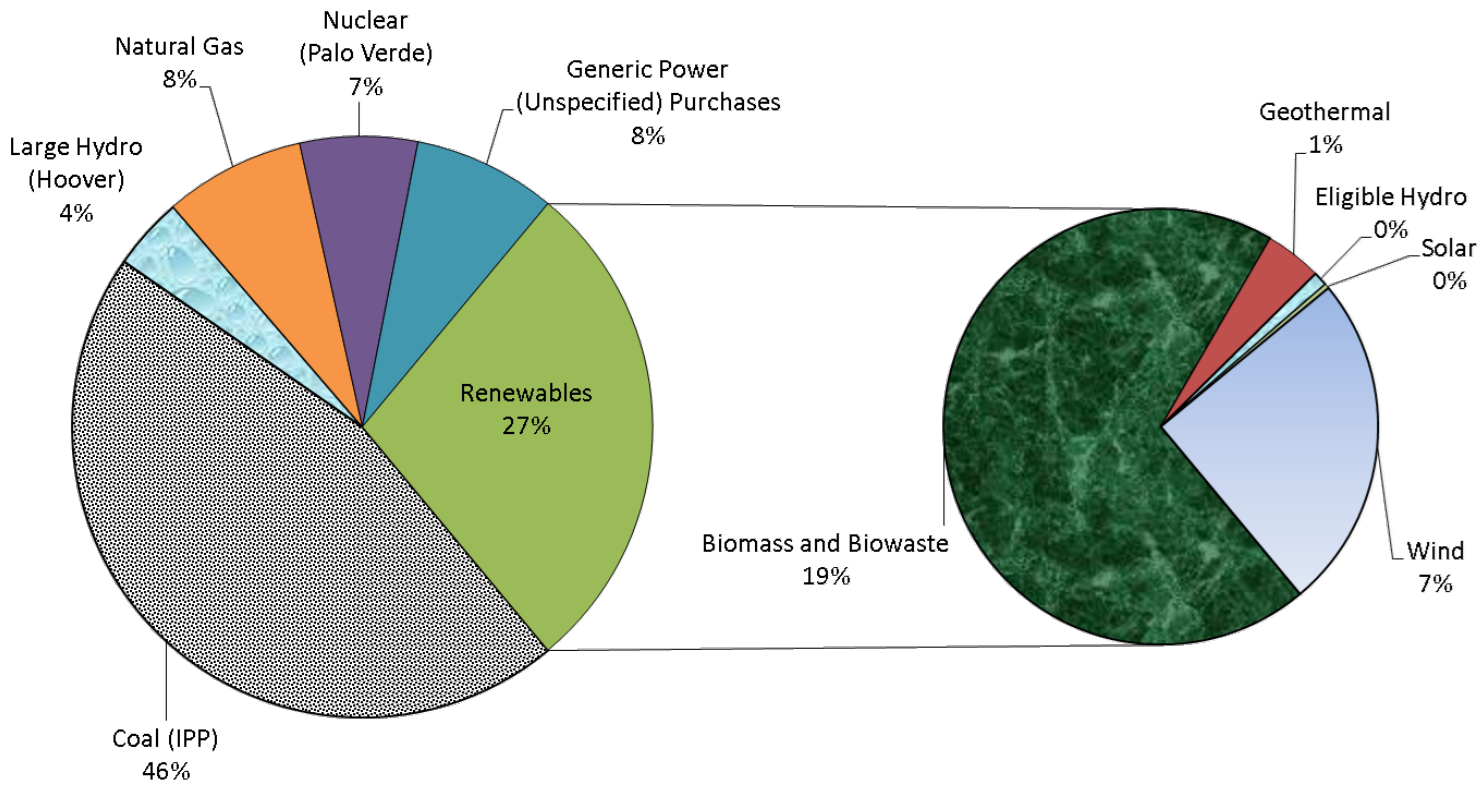

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Energy Integrated Resource Plan (IRP)

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The IRP is a 20 year plan for meeting forecasted energy demand plus reserve capacity through a combination of supply-side and demand-side resources while meeting the objectives of environmental responsibility, reliability and affordable cost.

The IRP evaluates the risks and uncertainties related to regulations, marketplace and technologies based on known information or assumptions.

PWP updates the IRP every 2-3 years.

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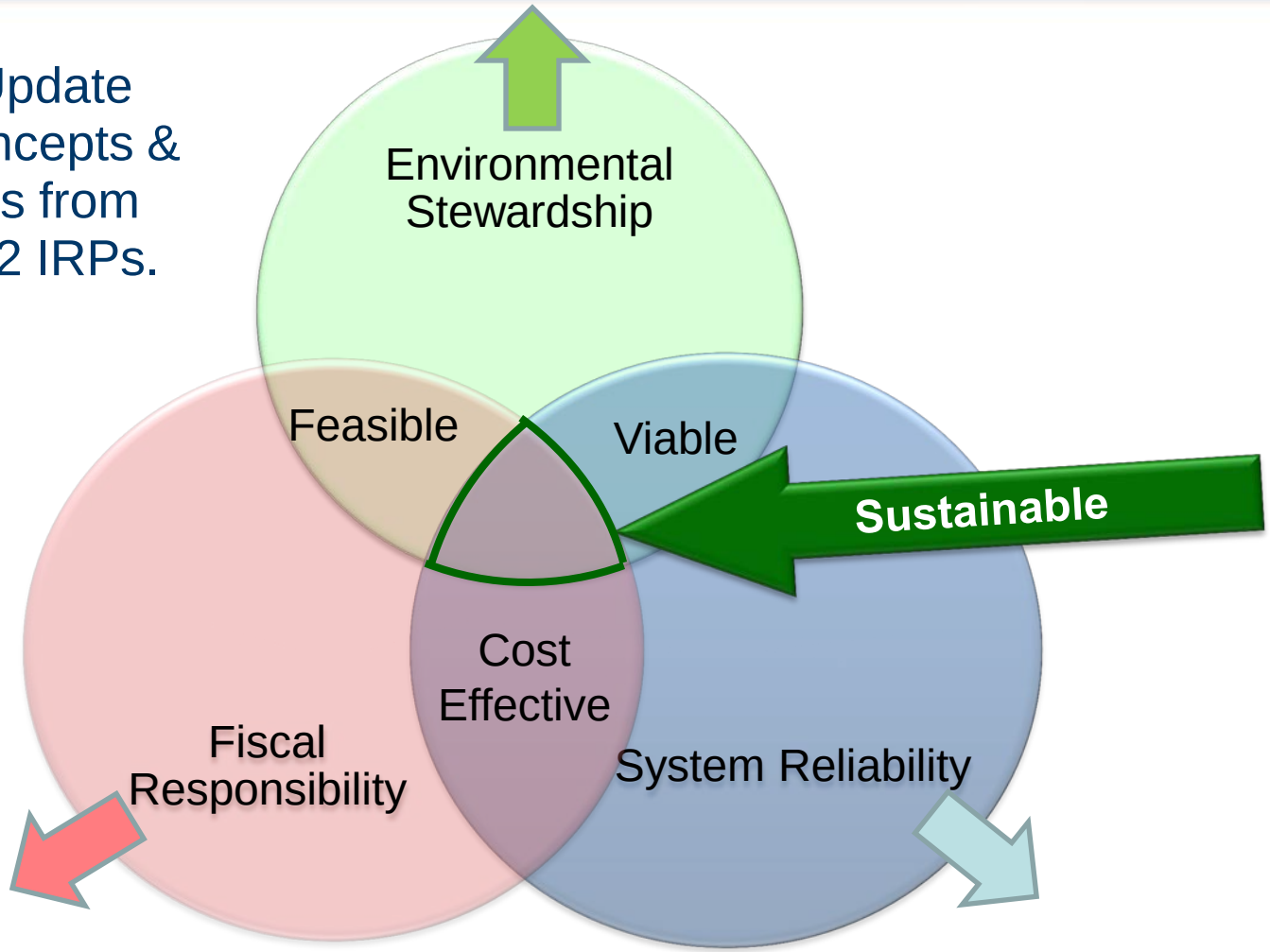
Foundation – Earlier IRPs

This IRP Update builds on concepts & action plans from 2009 & 2012 IRPs.



Progress Toward 2012 IRP Recommendations

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Recommendation	Target	Status
Renewable Energy: RPS	40% by 2020; Meet/exceed state mandated level of 33% by 2020	On Track; 28% for 2014; Well on our way to 40% by 2020
Renewable Energy: Local Solar	15 MW by 2020; 19 MW by 2024	Approximately 6.2 MW installed
Coal Power Displacement	Reduce coal purchases by at least 35 MW by 2016 (via power sale to non-California public entity buyers)	No willing/qualified buyers; Sales blocked by CARB Resource Shuffling Rules. Able to achieve some reduced output w/economic dispatch + additional carbon premium.
New Local Gas-Fired Generation	Replace Broadway power plant with a comparably sized new combined cycle plant by 2014	GT-5 Under Construction; Commercial Operation expected June 2016
Energy Savings	Incorporate adopted 2010 Energy Efficiency Goals	Adopted 2013 Energy Efficiency Goals: 12,750 MWh, 2.3 MW = ~ 1% per year (energy), 0.7% (demand)
Additional Demand Response	Additional 5 MW by 2012 through incentives and programs	None identified to date. Under review pending development of smart grid strategy.
GHG Emissions Reductions	25% by 2015; 40% by 2020 (from 2008 levels)	19.1% as of 2014
Upgrades of Existing Generation	Continue to maintain and upgrade Glenarm Units 1 and 2 to extend their lives through 2030	Unit 1 complete. Unit 2 still being evaluated. Separate staff recommendation pending.

IRP Terminology

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Portfolios

Groups of Power Supply Resources

1
Stay the Course
(*Preferred Portfolio*)

2
IPP (Coal) Reduction
40% RPS (by 2020)

3
50% Renewable Portfolio Standard (by 2025)

4
70% Renewable Portfolio Standard (by 2030)

5
Carbon (GHG) Neutral (by 2030)

Scenarios

Sets of Market Assumptions

Base Case
B&V Energy Market Perspective

High Gas Prices

Low Gas Prices

"Green" Market Influence
Higher Carbon Pricing

Sensitivities

Basic Model Variations

Higher Energy Efficiency

IPP (Coal) Economic Dispatch
(slightly higher generation than Business As Usual)

IPP Early Retirement in 2025
(original contract expires in 2027)

Why "Stay the Course?"

- **Least Cost**
  - > Of the 5 Short-Listed Portfolios
  - > Does Not Preclude Adopting Any of the Other Portfolios in a Future IRP Update
- **Meets or Exceeds All of PWP's Current Requirements**
  - > Legal, Regulatory, Reliability and Environmental
- **Provides Flexibility**
  - > To Respond to a Number of Variables in Flux Over Next Few Years
- **Achieves a 60% GHG Reduction from 1990 Levels by 2030**
  - > Ahead of California statewide target of 40% under Governor Brown's Executive Order B-30-15

Key Issues/Changes

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- CAISO Reliability Requirements
  - Local & Flexible Resource Adequacy Capacity (“FRAC”)
- Energy Imbalance Market (“EIM”)
- The “Duck Curve”
  - Changing Net Load Profile alters timing of “peak” and “off-peak” loads/prices
  - Over-generation
  - Need for fast-ramping, flexible resources
- Retail Load
  - Increasing penetration of distributed generation (e.g., rooftop solar, microgrids) which reduce load, and EV charging would increase load
  - Change hourly and seasonal shape and load factor
- Cap-and-Trade
  - Will it continue past 2020, or be replaced by federal carbon tax or some other program?
- GHG Emission Levels
  - 1990 levels by 2020 (AB32 – The Global Warming Solutions Act)
  - 80% reduction below 1990 levels by 2050 (Schwarzenegger’s Executive Order S-3-05)
  - 40% reduction below 1990 levels by 2030 (Brown’s Executive Order B-30-15, issued 4-29-15)
- California’s RPS
  - At least 33% by 2020 (AB32)
  - Brown’s “Golden State Standards (aka: the 50/50/50 plan): 50% by 2030
- Renewable Resources and Energy Storage
  - Costs expected to continue to decline
  - Technology still evolving
  - Tax incentives, legislative changes and reliability requirements uncertain
- Intermountain Power Project Contract

Selecting Flexible IRP Portfolios: A Building Block Approach

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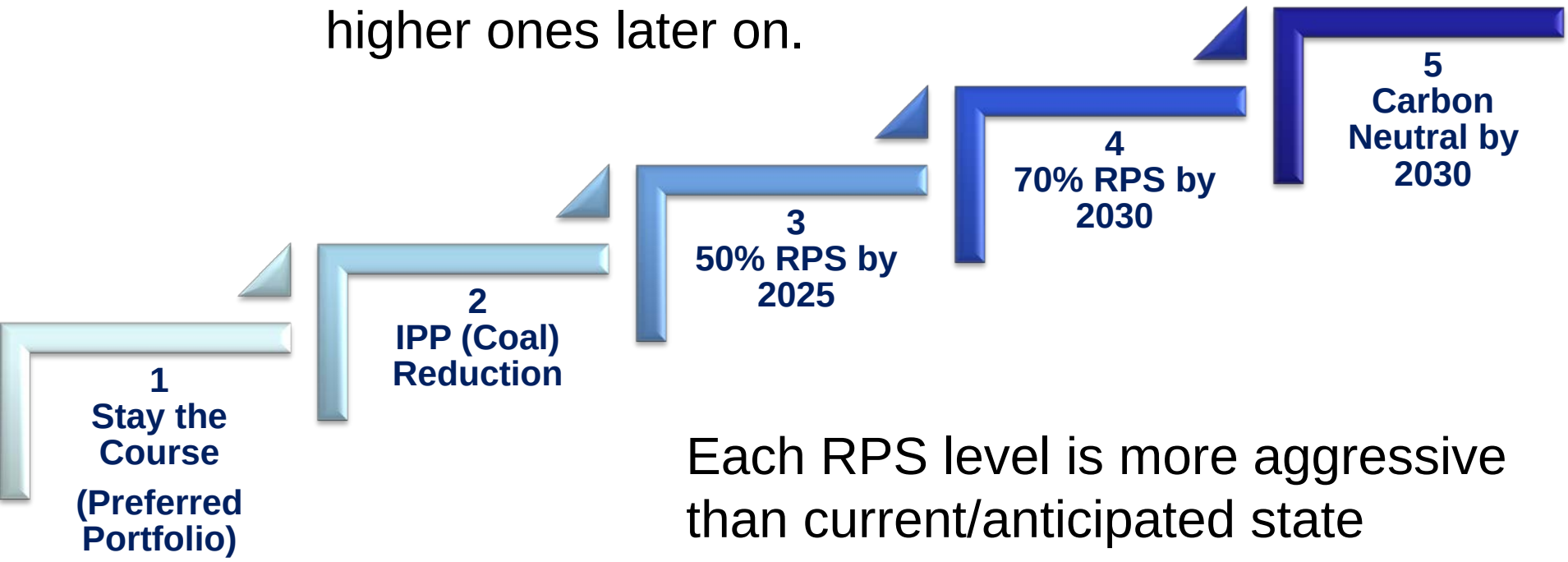
Each Portfolio Step is a subset of the next – the lower steps lay the groundwork for higher ones later on.



Each RPS level is more aggressive than current/anticipated state mandated targets.

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Intermountain Power Project ("IPP")

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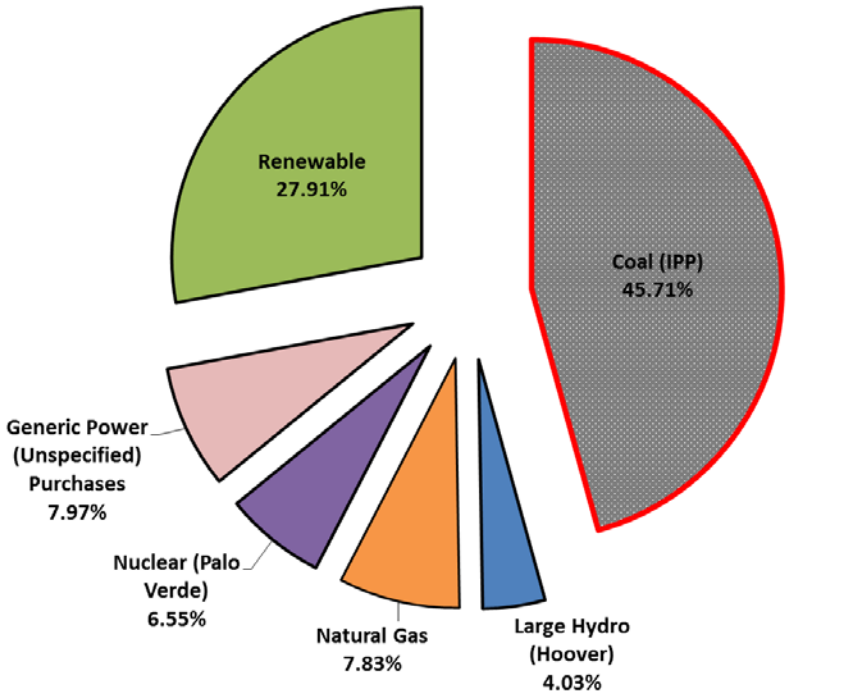
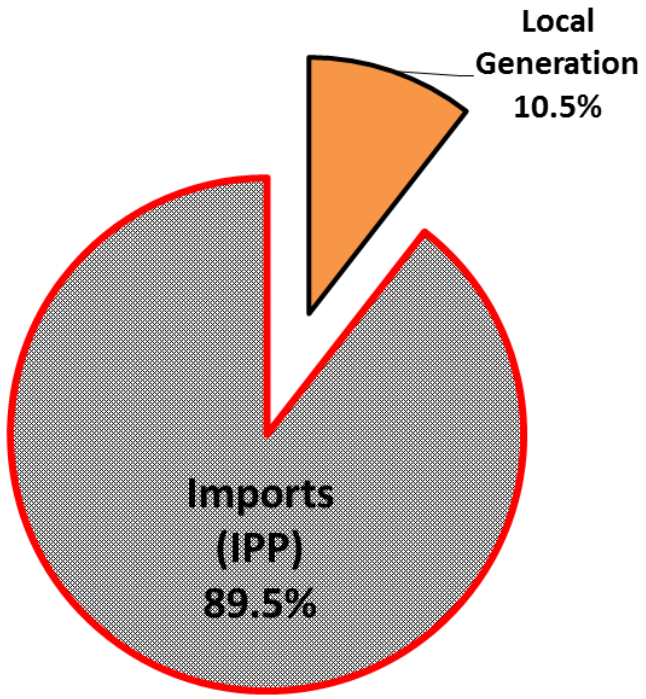


IPP Coal As a Percentage of PWP 2014 Generation

IPP is the largest contributor of GHG emissions in the PWP generation portfolio.*



IPP As a Percentage of PWP 2014 GHG Emissions*

** Percentages using current CARB GHG reporting methodology for electric utilities*

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Reducing IPP Generation
(under current contract)

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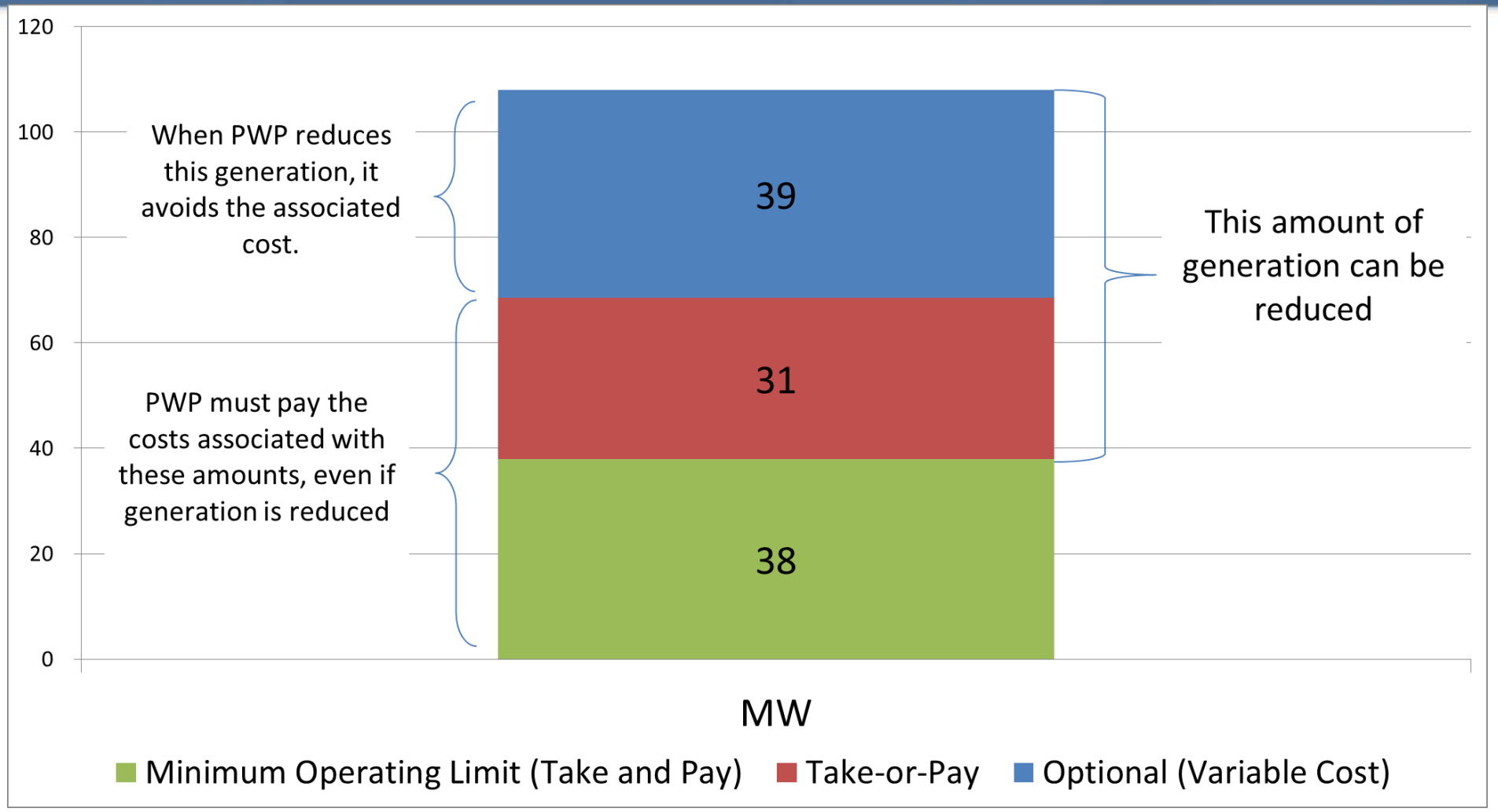

IPP Power Sales Contract ("PSC")

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- Project consists of 2 – 900 MW coal-fired units and associated transmission facilities
- Power purchased by 36 separate public utilities
  - California participants are LADWP, Riverside, Anaheim, Burbank, Glendale, & Pasadena
  - Utah entities have assigned most of their power to California participants
- Current PSC expires June 15, 2027
- Intermountain Power Association ("IPA") proposes to amend and renew the contract
  - California entities cannot sign new coal contracts
  - Amendment would facilitate repowering with smaller natural gas plant and/or alternative
  - Coal fired generation would be repowered with natural gas and/or alternative by 2025 & participants would have option of renewing contracts to participate in repowering
  - Amendment does not require that IPA decommission the coal plant, but if it does, participants will pay decommissioning costs

PWP Carbon Emissions to Date

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Emission Source	2008	2009	2010	2011	2012	2013	2014
Local Generation	82,724	73,355	74,590	80,551	139,828	59,603	64,217
Imports (incl. IPP Coal)	672,321	666,596	629,755	642,935	514,443	536,241	546,314
Magnolia*	38,553	36,285	40,727	19,169	5,723	4,540	12,073
Net Market Purchases*	111,720	106,925	65,898	74,751	97,901	63,304	85,656
Total Emissions/ (2008 Method)	905,317	883,161	810,970	817,406	757,895	663,687	708,261
Reduction from 2008	N/A	2.4%	10.4%	9.7%	16.3%	26.7%	21.8%
Total Emissions/ (Current Method)	**755,045**	**739,951**	**704,345**	**723,486**	**654,271**	**595,844**	**610,531**
Reduction from 2008	**N/A**	**2.0%**	**6.7%**	**4.2%**	**13.3%**	**21.1%**	**19.1%**

*In 2008, Magnolia & Net Market Purchases were included in PWP Emissions. Current Method excludes them because they are counted by other entities (Burbank for Magnolia; Generation owners or first importers for CAISO market purchases). Switching from natural gas to biomethane at Magnolia produces RPS RECs but does not show up as PWP carbon emission reduction under current CARB methodology.

PWP Carbon Emissions vs. 1990

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1990 PWP Carbon Emissions (MT)	2014 Actual Emissions (MT)	40% Reduction (MT)	60% Reduction (MT)	80% Reduction (MT)
918,622	708,261	551,173	367,488	183,724

Net GHG Emission Reduction Costs

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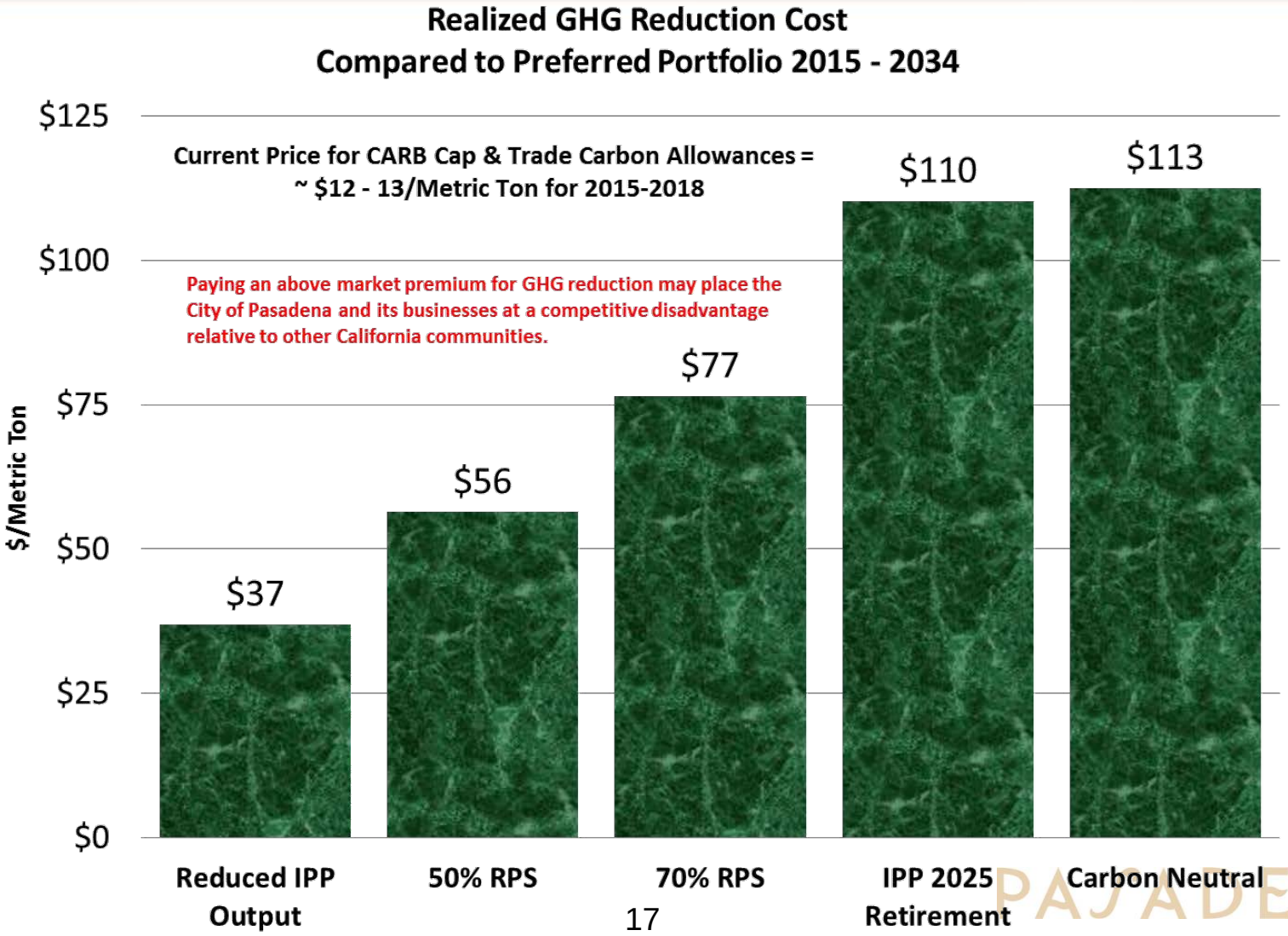

Average New Renewable Technology IRP Cost Assumptions

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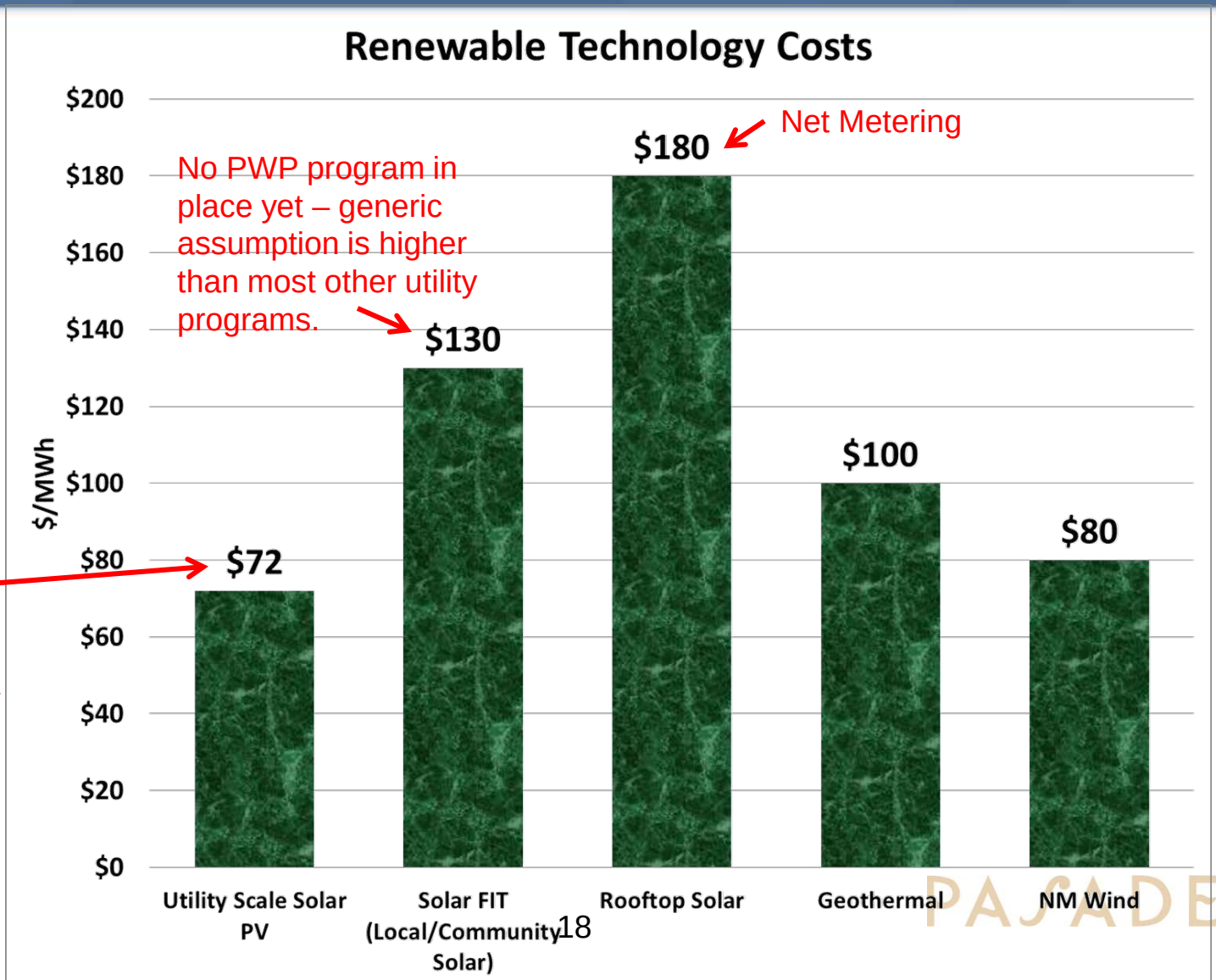

Assumes reduction in federal Investment Tax Credit post 2016. Current solar PV offers are significantly less.

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Average PWP Generation Cost by Resource

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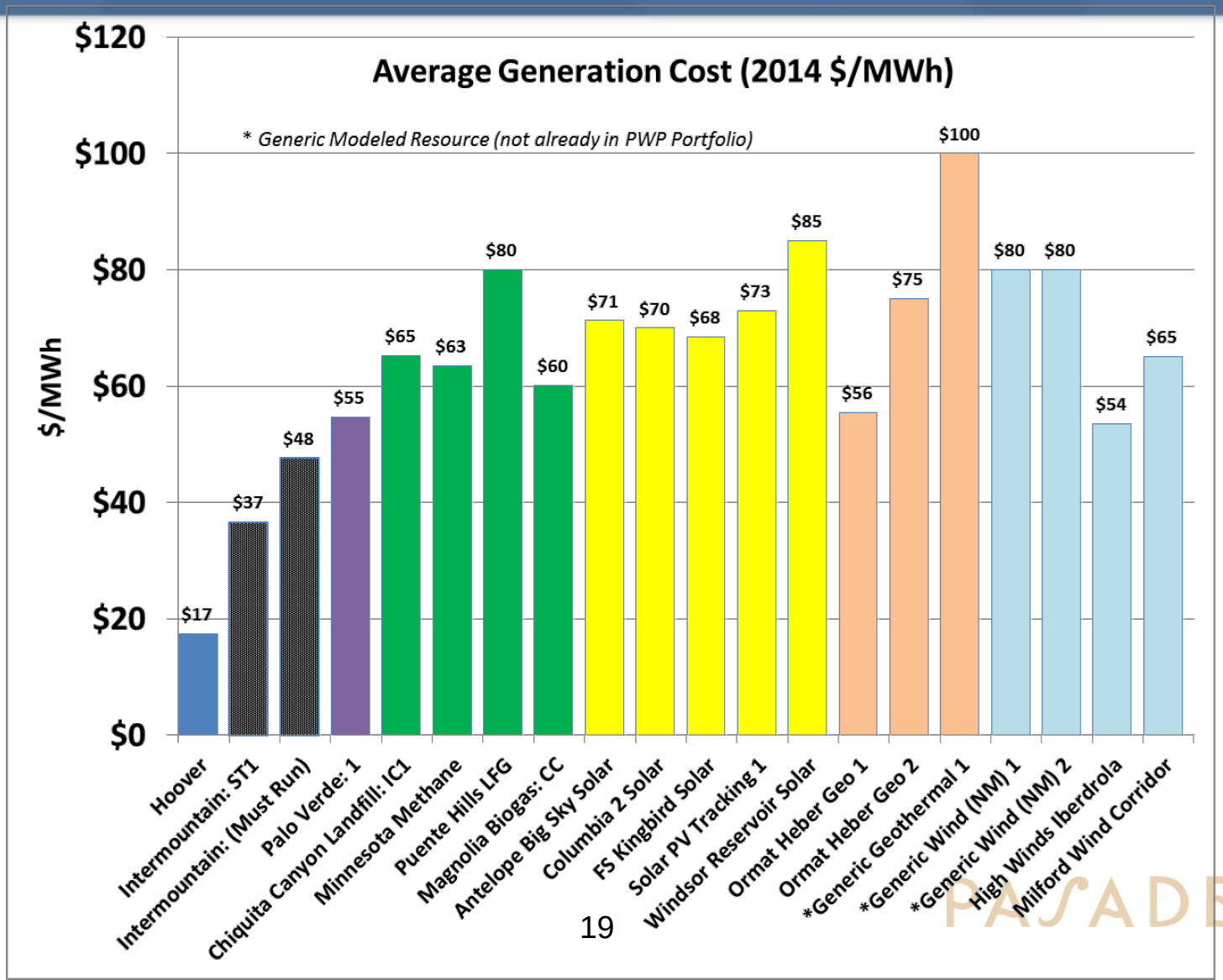

Expected PWP Gas-Fired Generation Cost

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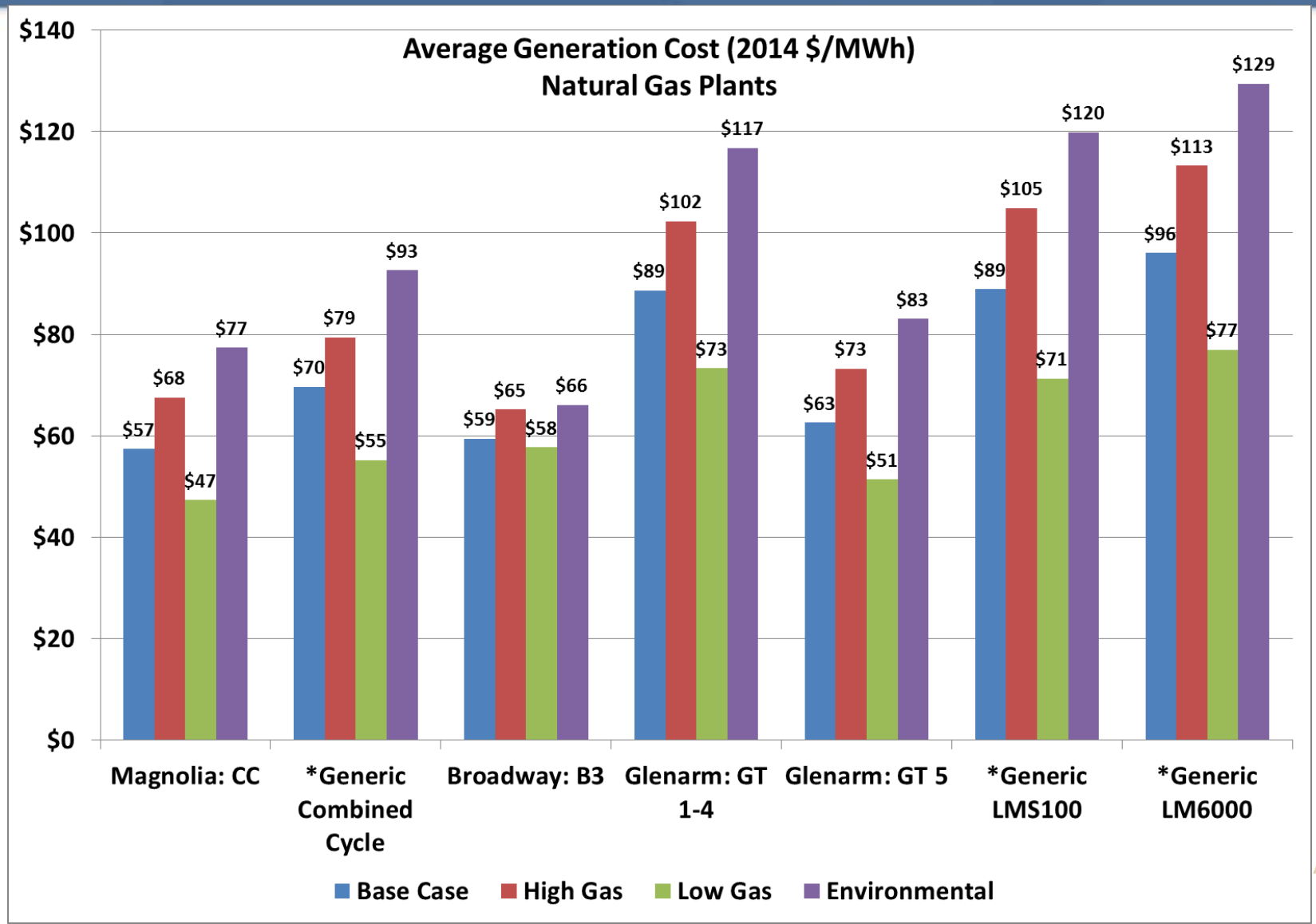

Assumptions – Natural Gas Prices

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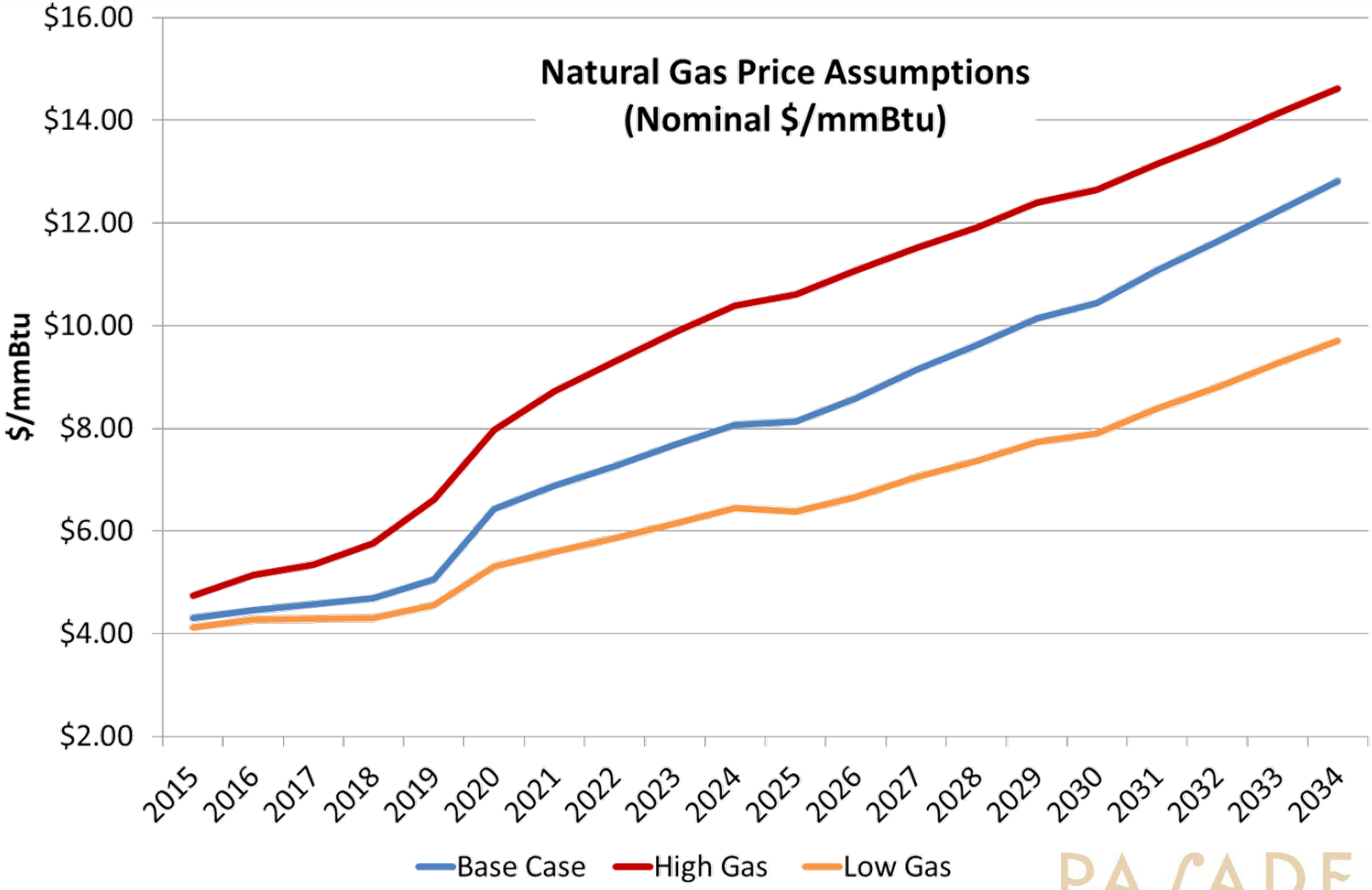

Assumptions – Electricity Prices

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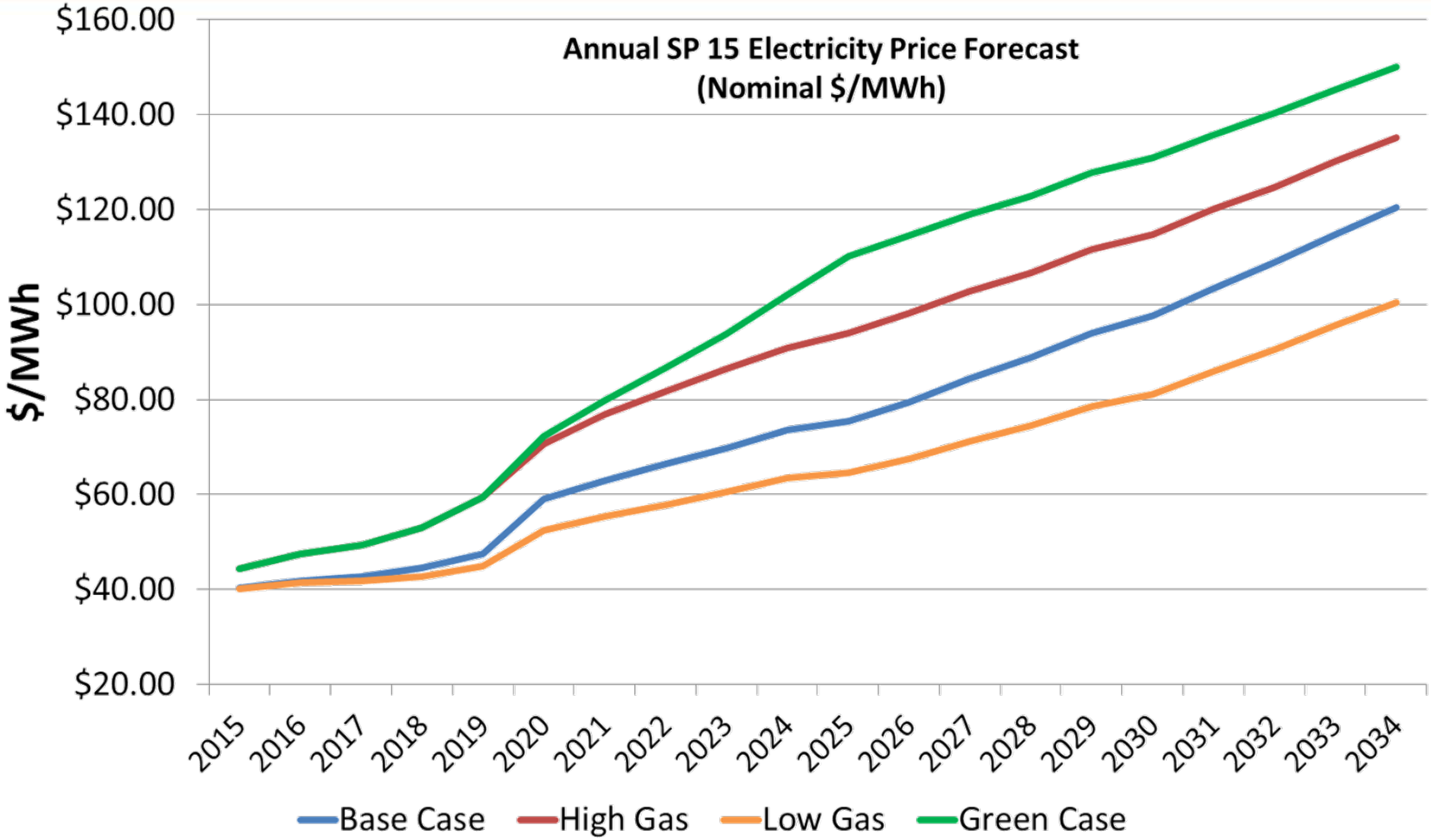

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Assumptions – Carbon Prices

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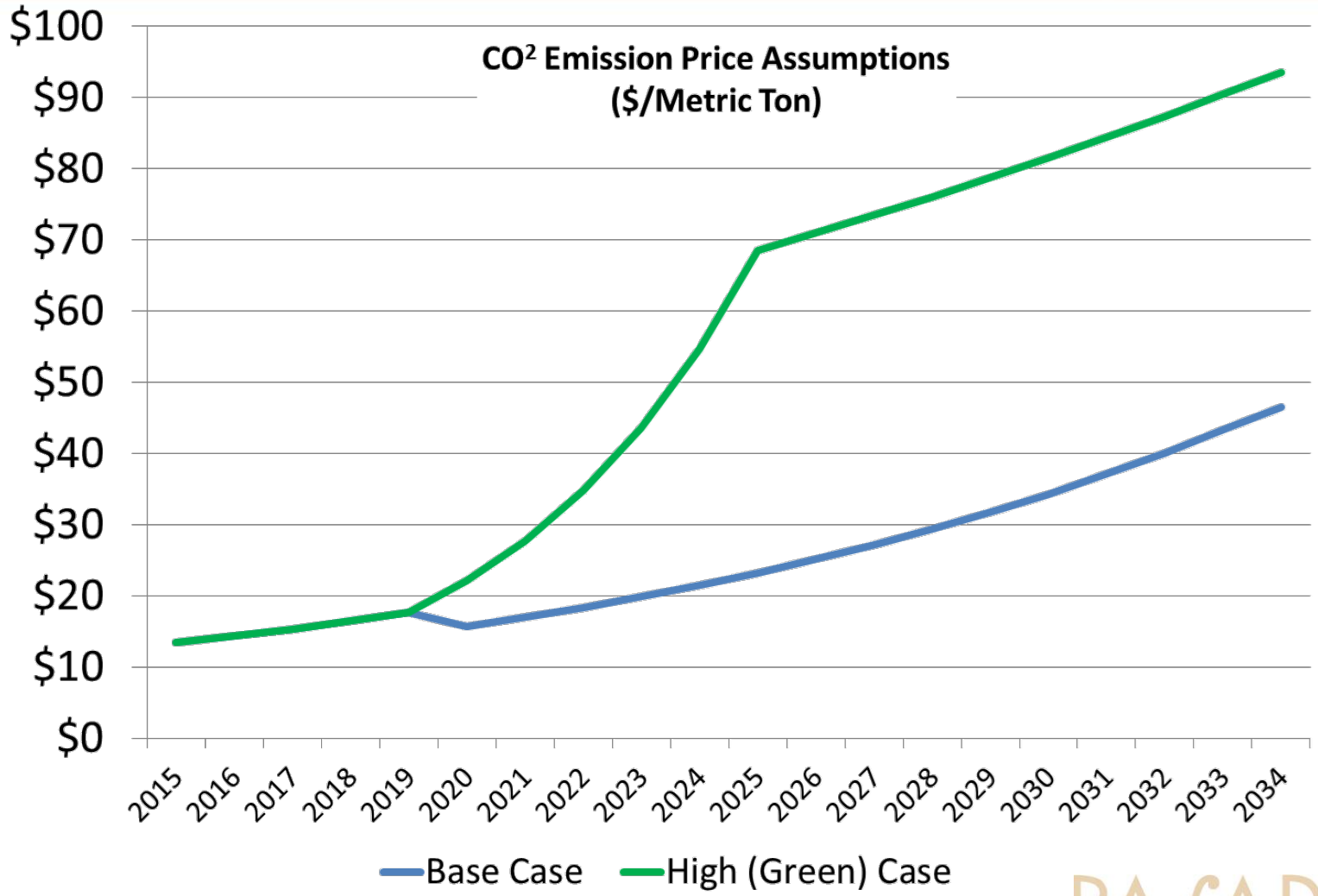

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Financial Terms

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- **Future Value/Present Value***: Money now is more valuable than money later on. If you have $1,000 and could get 10% interest on your money, $1,000 x 10% = $100 in a year. Your $1,000 now would have a *future value* of $1,100 by next year. $1,100 next year has a *present value* of $1,000 now.
  - The formula for Present Value is: $PV = FV / (1+r)^n$, where:
    PV is Present Value
    FV is Future Value
    r is the interest rate (as a decimal)
    n is the number of years
- **Levelized Cost**: The equal payments determined by taking the Present Value (adjusted for the cost of inflation or interest on money) today of a series of future payment obligations and dividing by the number of future payments in the period. It is different than the average or median payment.
  - For example: a series of ten annual payments starting with $1,000, and escalating at 3.5% per year would have a levelized payment of $1,162. The average payment would be $1,173. The median payment would be $1,168.
- **Discount Rate**: The risk-adjusted cost of borrowing money, used to determine the Present Value of a series of future cash flows. PWP has used a discount rate of 3.5% for its analysis in this IRP update.

* Pierce, Rod. "Present Value (PV)" Math Is Fun. Ed. Rod Pierce. 2 Aug 2014. 31 Mar 2015 <http://www.mathsisfun.com/money/present-value.html>

What Portion of PWP Costs Are We Addressing in the IRP?

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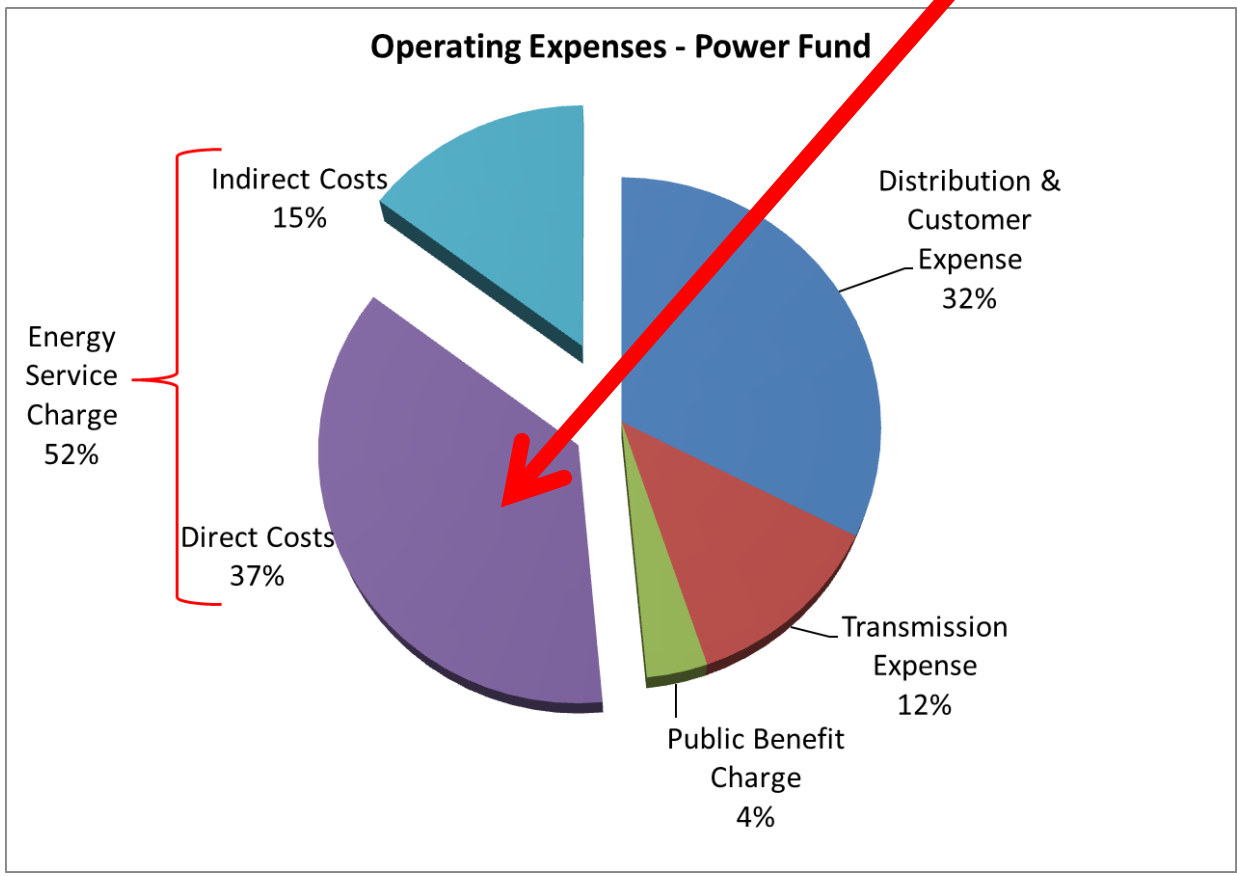
The IRP Modeling addresses <u>only</u> the **Direct Cost** component of the **Energy Service Charge**.

Analyses of the economic impact of various alternatives under the IRP on customer rates/bills assume that ***all other components of the power bill and rate structure remain unchanged from FY2017.***

It is reasonable to assume that there will be increases in these other components as well over the next 20 years.* It is very difficult to accurately predict all components of rates over a 20 year horizon.



** For example, the CAISO is forecasting significant increases in its transmission access charge.*

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Portfolio Cost Comparison

($2015)

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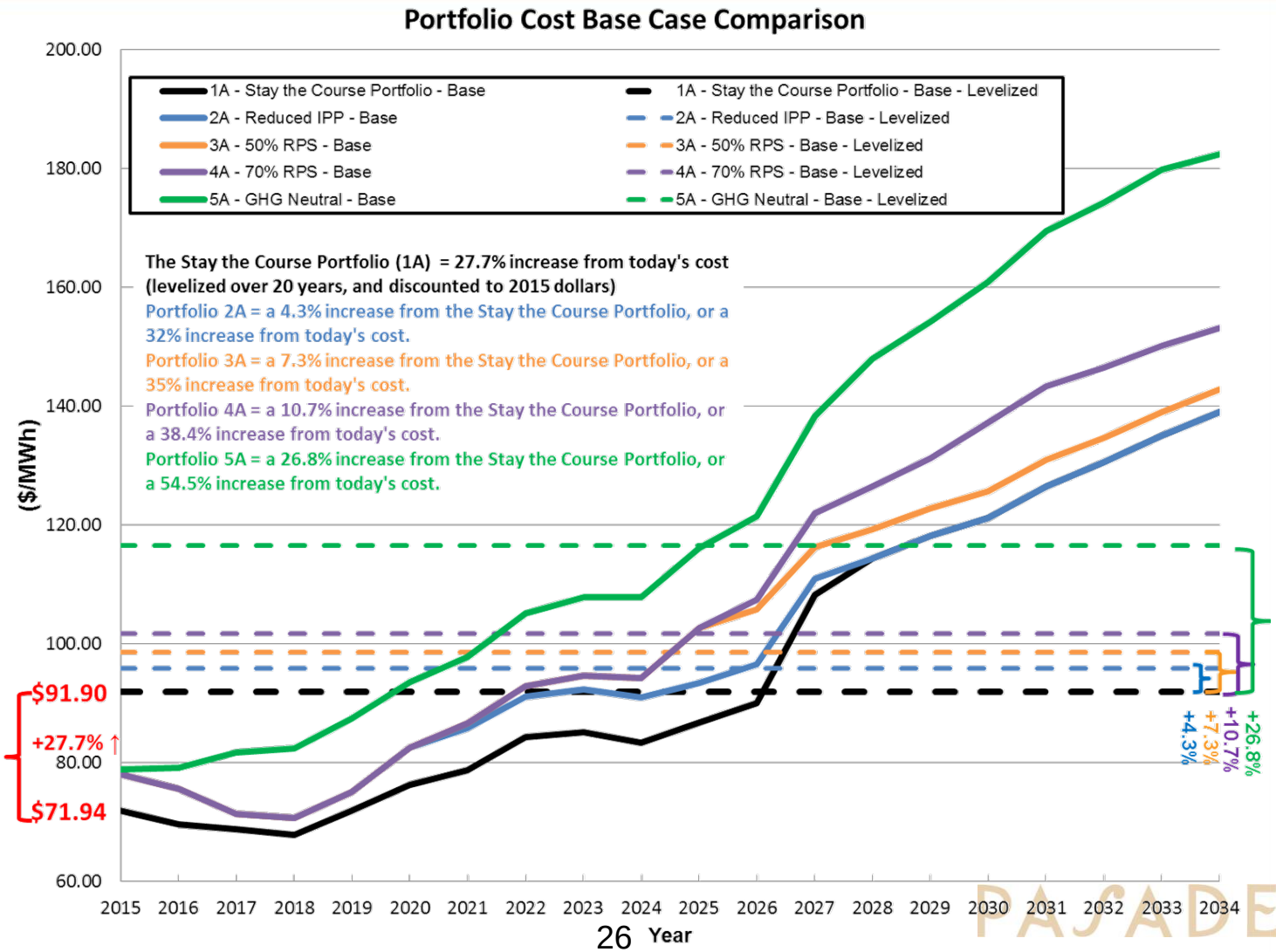

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Portfolio Cost Comparison

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PORTFOLIO	Expected Increase from Starting (Today's) Cost to 20-Year Levelized	Increase from Status Quo (2008) or Stay the Course (2015)	Total Portfolio Cost Increase
2008 IRP ($2008)	28%	6%	34%
1A – Stay the Course ($2015)	27.7%	N/A	27.7%
2A – Reduce IPP ($2015)	27.7%	4.3%	32.0%
3A – 50% RPS ($2015)	27.7%	7.3%	35.0%
4A – 70% RPS ($2015)	27.7%	10.7%	38.4%
5A – GHG Neutral ($2015)	27.7%	26.8%	54.5%

Estimated Impact of Direct Electricity Cost Only – Monthly Residential Bill (by Usage)

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Assumes no changes to other cost components or rate structure from FY 2017 approved rates

Portfolio	Portfolio Name	500 kWh	1000 kWh
Current Annual Average Monthly Bill – As of March 2015		$84.95	$189.78
20-Year Levelized (2015$)			
1	Stay the Course (*Preferred Portfolio*) Economic IPP Dispatch + carbon premium 40% RPS by 2020	$96.31	$216.03
2	Reduced IPP Output Reduce IPP to Min starting in 2015 40% RPS by 2020	$100.77	$224.93
3	Blended – 50% RPS Reduce IPP to Min starting in 2015 50% RPS by 2025 (Solar/Wind/Base Mix)	$102.01	$227.42
4	Blended – 70% RPS Reduce IPP to Min starting in 2015 50% RPS by 2025 & 70% by 2030 (Solar/Wind/Base Mix)	$103.47	$230.34
5	Carbon (GHG) Neutral Starting in 2015: Reduce IPP to Min, no power market purchases, natural gas plants burn 100% biomethane. 50% RPS by 2025 & 100% Carbon-Free by 2030 (e.g., 88% Renewable and 12% existing large hydro/nuclear)	$110.24	$243.88

Estimated Impact of Direct Electricity Cost Changes on Monthly General Service Bill (by Usage)

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Assumes no changes to other cost components or rate structure from FY 2017 approved rates

Portfolio	Portfolio Name	2,000 kWh	10,000 kWh	50,000 kWh	100,000 kWh
Current Annual Average Monthly Bill – As of March 2015		$327	$1,664	7,563	14,875
20-Year Levelized (2015$)					
1	Stay the Course (*Preferred Portfolio*) Economic IPP Dispatch + carbon premium 40% RPS by 2020	$372	$1,898	$8,630	$16,965
2	Reduced IPP Output Reduce IPP to Min starting in 2015 40% RPS by 2020	$390	$1,988	$9,081	$17,847
3	Blended – 50% RPS Reduce IPP to Min starting in 2015 50% RPS by 2025 (Solar/Wind/Base Mix)	$395	$2,014	$9,208	$18,093
4	Blended – 70% RPS Reduce IPP to Min starting in 2015 50% RPS by 2025 & 70% by 2030 (Solar/Wind/Base Mix)	$401	$2,043	$9,355	$18,382
5	Carbon (GHG) Neutral Starting in 2015: Reduce IPP to Min, no power market purchases, natural gas plants burn 100% biomethane. 50% RPS by 2025 & 100% Carbon-Free by 2030 (e.g., 88% Renewable and 12% existing large hydro/nuclear)	$427	$2,181	$10,042	$19,722

Preferred Portfolio: Stay the Course = 60% GHG Reduction by 2030

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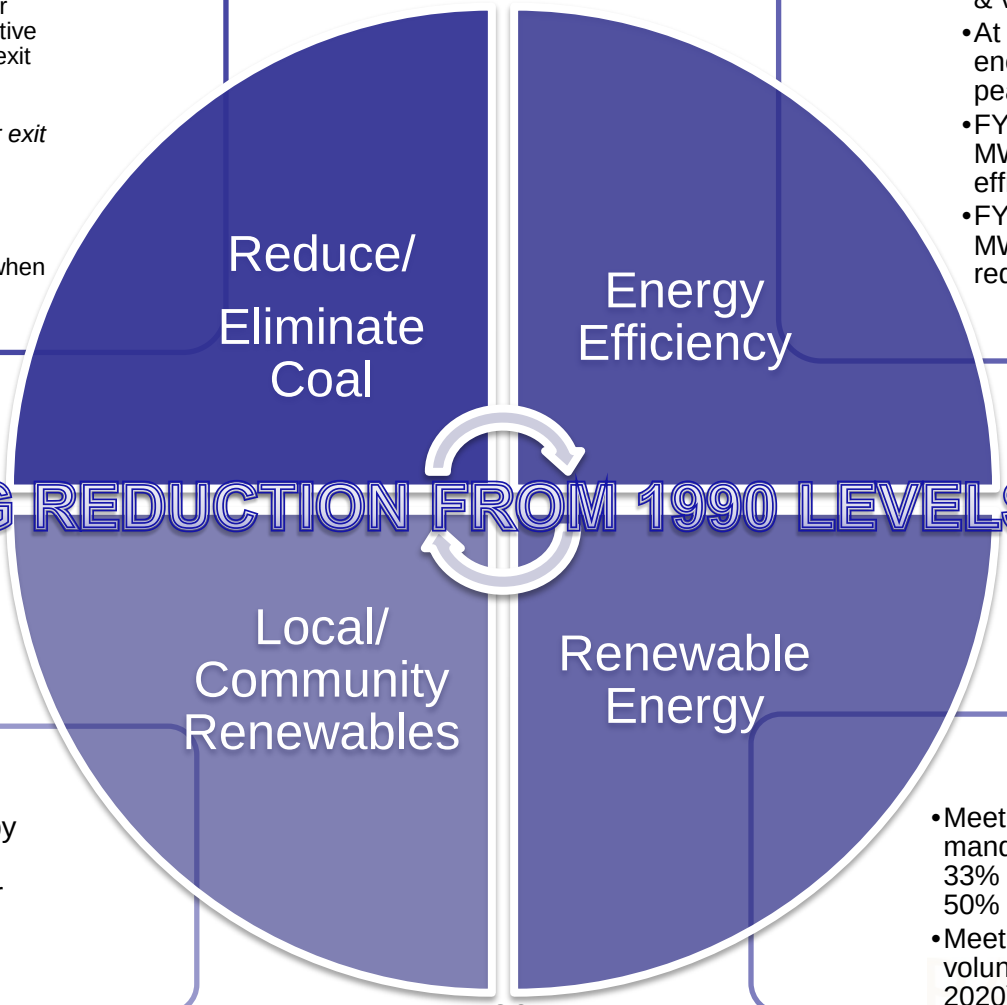
- Exit IPP coal generation no later than 2027.
- Discussions underway for IPP natural gas or alternative repowering & 2025 early exit from coal.
  - *Must have option to reduce participation or exit repowered project in 2019.*
  - *Must preserve IPP transmission rights.*
- Reduce IPP generation when operationally and economically practicable.

- Acquire all cost- effective & viable energy efficiency.
- At least 1% of annual net energy load + 0.7% of avg. peak demand.
- FY2015 – 2023: 12,750 MWh/year energy efficiency
- FY2015 – 2023: 2.3 MW/year demand reduction



60 % GHG REDUCTION FROM 1990 LEVELS BY 2030[1]

- Establish Feed-In Tariff by 2016
- Launch Community Solar Program by 2016

- Meet or exceed California mandatory target (at least 33% by 2020 – proposed 50% by 2030).
- Meet or exceed Pasadena voluntary target (40% by 2020).

[1] ***Statewide targets are 40% reduction by 2030 & 80% by 2050 from from 1990 levels.***