



CASE
for Southeast Asia

On behalf of



Federal Ministry for the
Environment, Nature Conservation
and Nuclear Safety

of the Federal Republic of Germany

Priority Dispatch of All RE Plants in WESM

18 March 2022

Clean, Affordable and Secure Energy (CASE) for Southeast Asia



About CASE



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The **Clean, Affordable, and Secure Energy for Southeast Asia (CASE)** aims to support a **narrative change** in the power sector towards an **evidence-based energy transition** that robustly supports the **region's development strategies**.

2 out of 5 outputs:



**Research
and Evidence**

The evidence base for an energy transition in SEA is improved



**Technical
Assistance
(energy)**

The capacities of key energy sector stakeholders to undertake an energy transition are strengthened

CASE Philippines Structure:



INSTITUTE FOR
CLIMATE AND
SUSTAINABLE
CITIES



Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

About CASE



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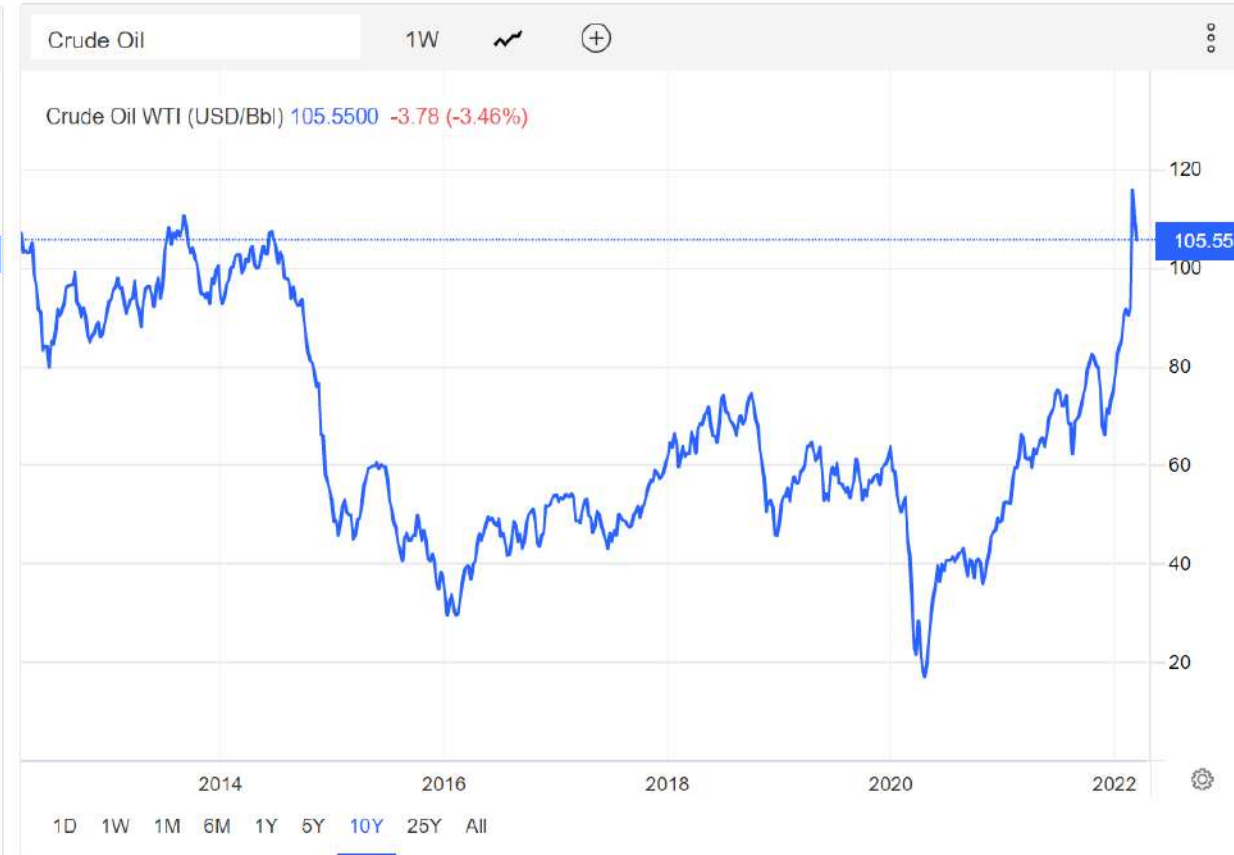
- Maximize the use of available research while **generating new evidence grounded in local context**
- Implement a **joint fact-finding approach** involving expert analysis and dialogue with stakeholders work towards a consensus
- **Build long-term energy scenarios and assess co-benefits with stakeholders using open-source tools** to provide inputs for inclusive national energy planning.
- Provide **capacity building and knowledge sharing** across the region and together with key regional partners

Background



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Coal and Crude Oil index prices have spiked due to international events
as of March 14



Priority Dispatch Policy Objectives



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1. Development and **utilization of indigenous RE resources**, diversifying supply
2. **Reduction** of dependency in **importation of conventional energy resources**
3. **Ensuring energy security** for the Philippines

Study Objectives



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Using simulations, we shall determine the **possible impact in the electricity prices and power supply** if all other RE technologies will be afforded the Priority Dispatch in the electricity market.

Note: Solar, Wind, and Run-of River will retain their must-dispatch status.

Datasets Used



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The findings presented are based on the WESM data, specifically:

1. Generation Bids and Offers
2. Market Clearing Prices and Marginal Plants
3. Market Prices and Schedules
4. Self-Nominations*
5. Merit Order Table*

Old WESM Priority Order



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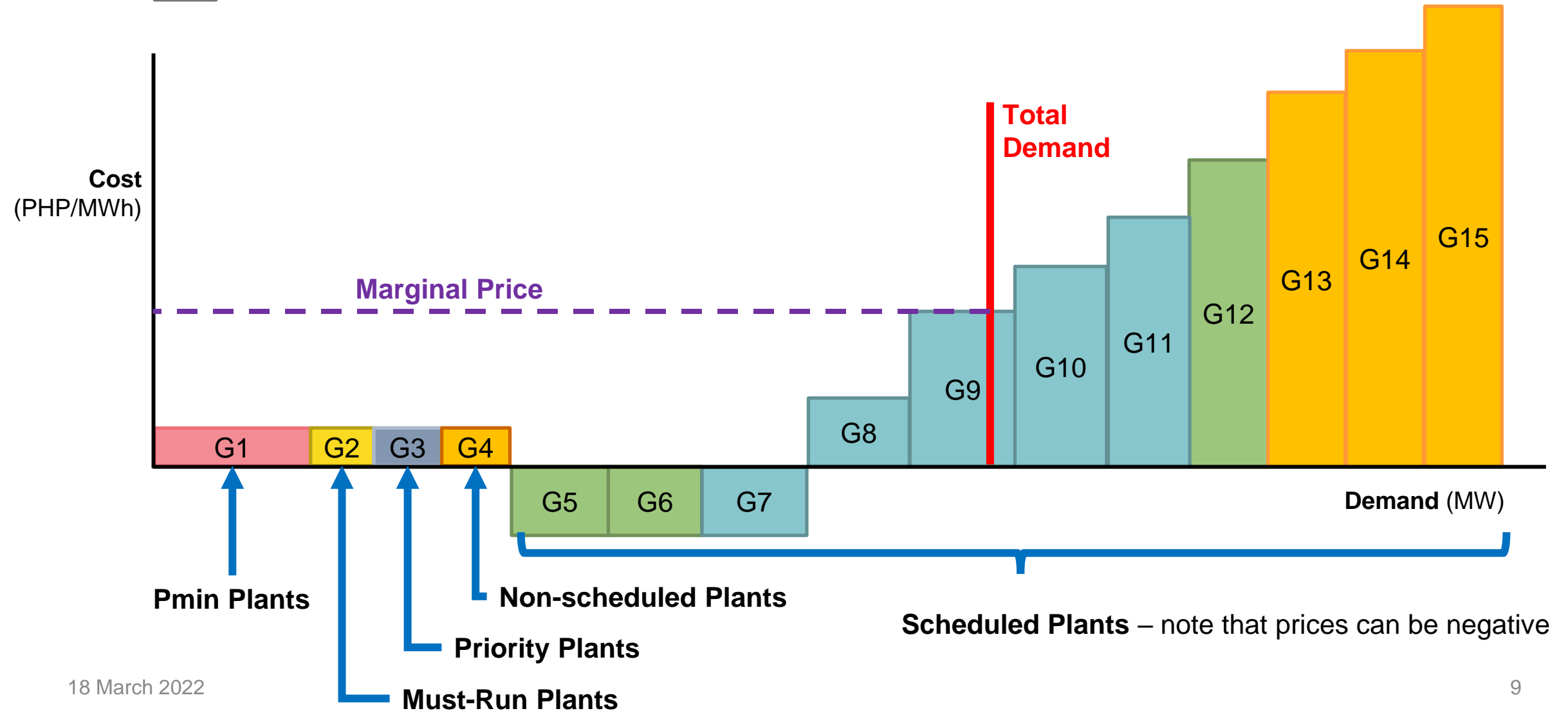
1. **Pmin Plants** – Minimum Stable Power of Baseload Plants
2. **Must-run Plants** - Solar, Wind, and Run-of River Plants
3. **Priority Plants** – Biomass with FIT
4. **Non-scheduled Plants** – Biomass without FIT, Seasonal Plants / Co-generation Plants
5. **Scheduled Plants** – Geothermal, Hydro, Coal, Natural Gas, Oil-Based

Old WESM Merit Order Mechanism



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 = 1 capacity block



Current Enhanced WESM Priority Order



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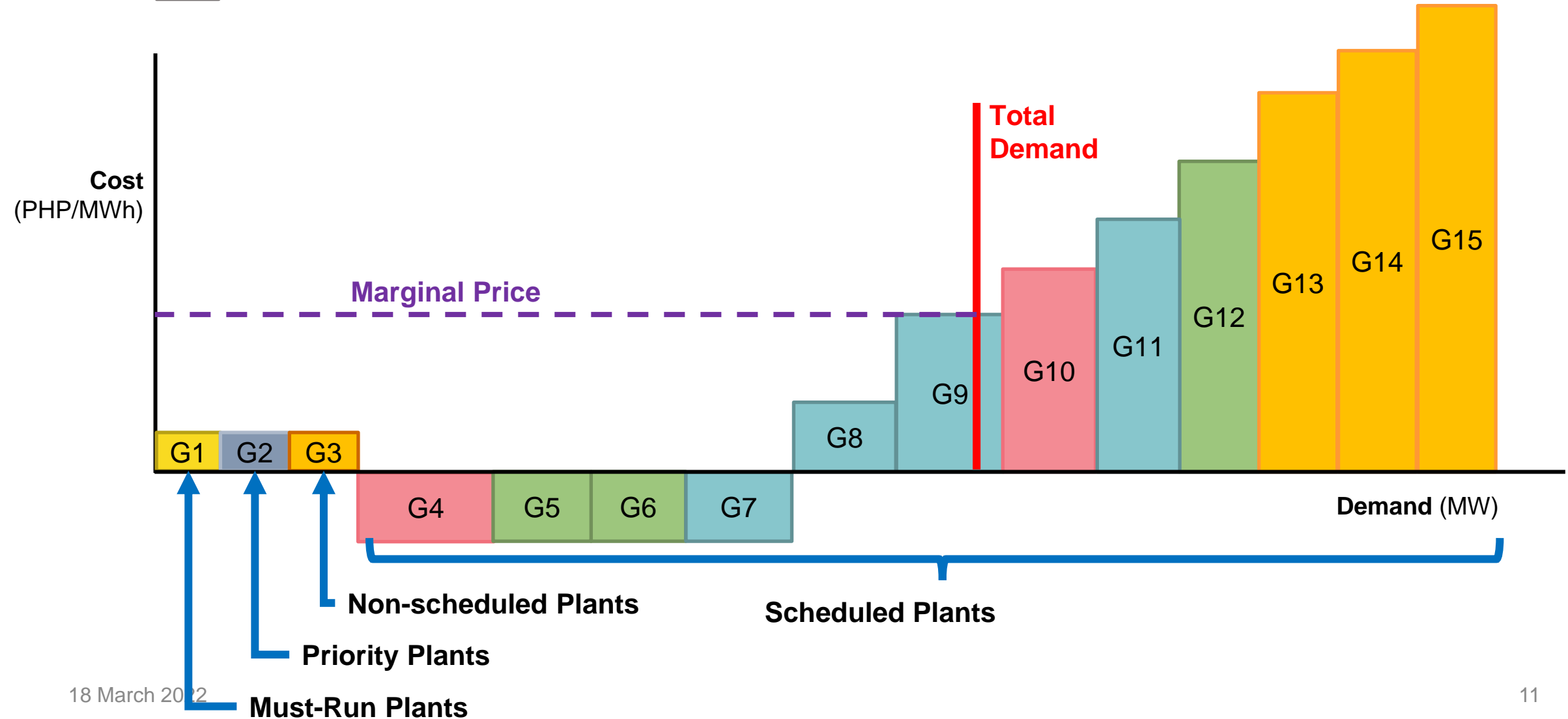
1. **Must-run Plants** - Solar, Wind, and Run-of River Plants
2. **Priority Plants** – Biomass with FIT
3. **Non-scheduled Plants** – Biomass without FIT, Seasonal Plants / Co-generation Plants
4. **Scheduled Plants** – Geothermal, Hydro, Coal, Natural Gas, Oil-Based

Current Enhanced WESM Merit Order



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 = 1 capacity block



Proposed WESM Priority Order



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1. **Must-run Plants** - Solar, Wind, and Run-of River Plants
2. **Priority Plants – All Geothermal, Biomass, Hydro**
3. **Non-scheduled Plants** – Seasonal Plants / Co-generation Plants
4. **Scheduled Plants** – Coal, Natural Gas, Oil-Based



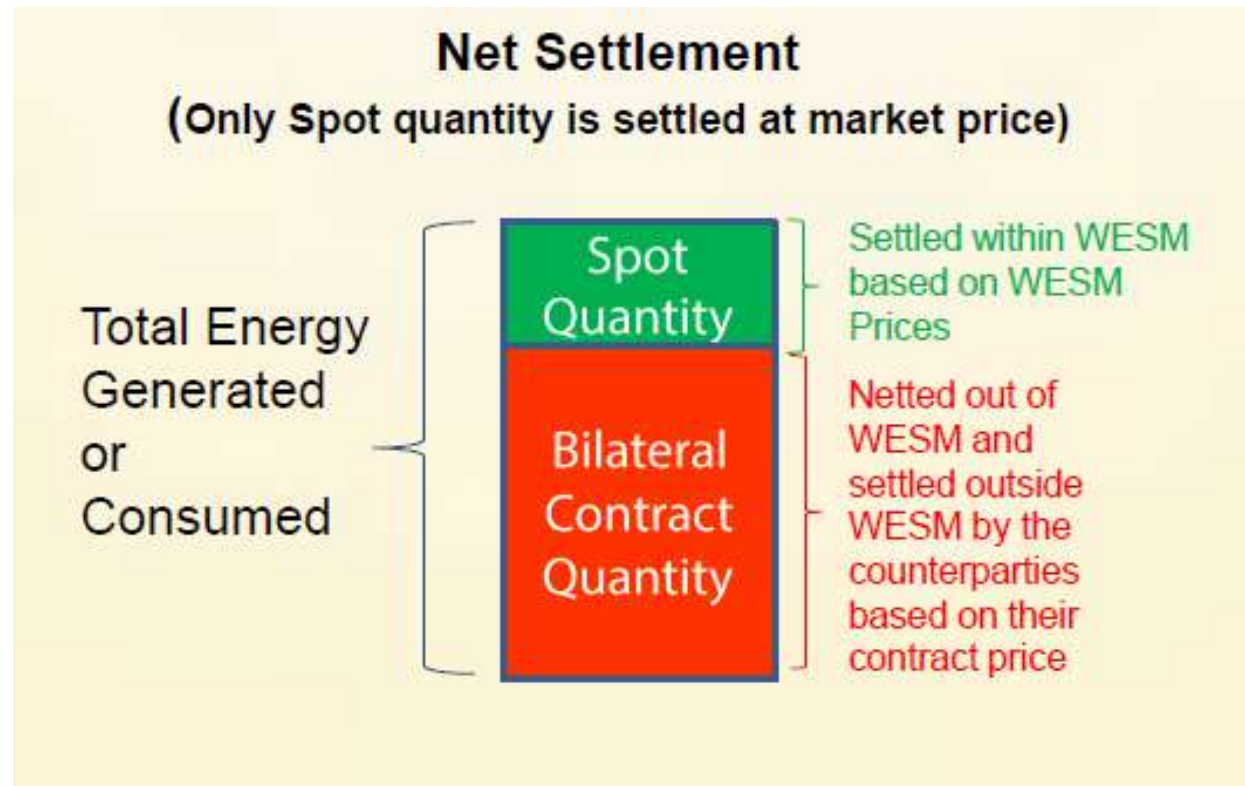
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Generator Bidding Behavior

Philippine Electricity Pricing



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Volatile Prices

Fixed Prices*

*subject to automatic fuel pass-through

Bids of Biomass Plants



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Photo (c) AC Dimatatac/ICSC

Biomass Plants are Self-Nominated Plants

- ~ Priority Dispatch (Biomass with FIT)
- ~ Non-scheduled Dispatch (Biomass without FIT)

It doesn't need to bid in the spot market anymore.

Bids of Geothermal Plants



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Photo (c) ThinkGeoEnergy/Creative Commons

Geothermal Plants are Scheduled Plants

- ~ under Bilateral Contracts
- ~ traded on the WESM

On both cases, these plants **need to bid their capacity** in the spot market dispatch.

Luzon Geothermal Plants Bid Behavior



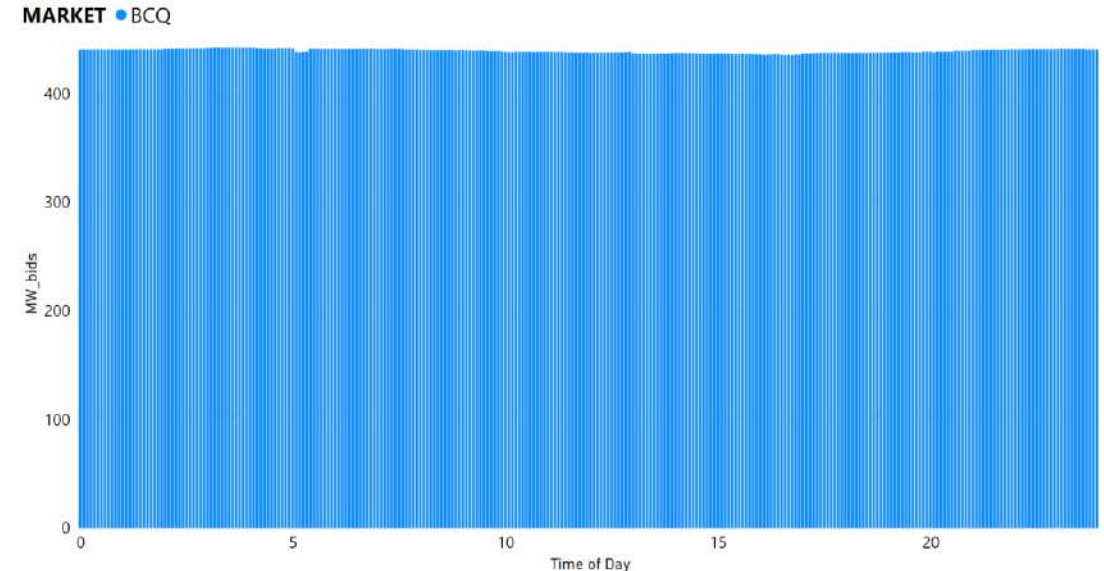
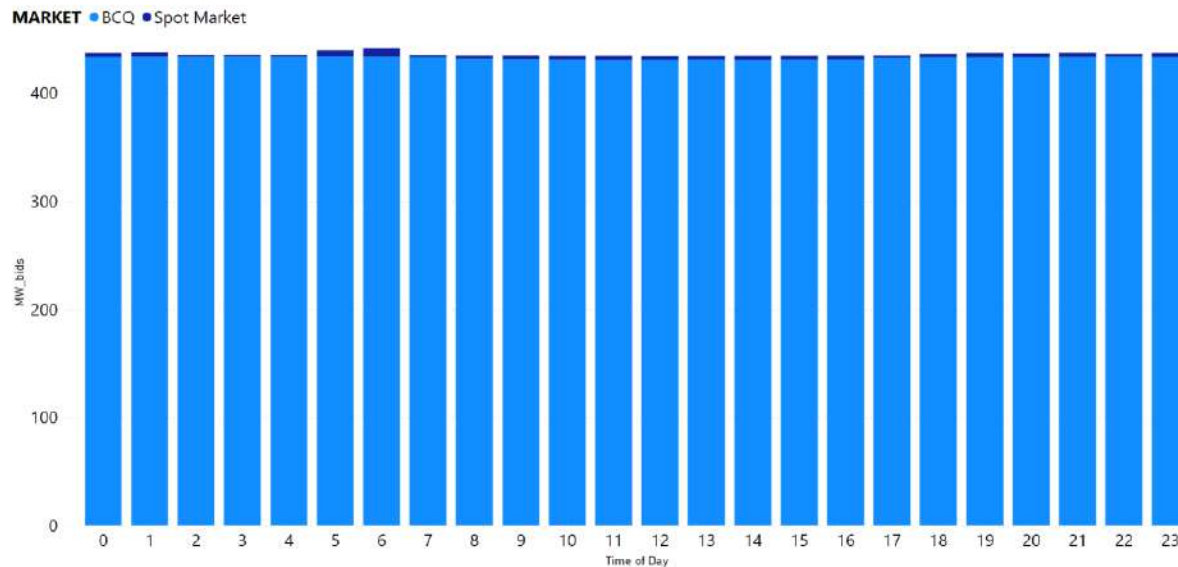
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Hourly Dispatch:

1. Their first bids are **under BCQs**
2. For *Bacman*, their next bids are traded in WESM with **increased prices at increments**

Five Minute Dispatch:

1. All bids are **under BCQs**



Luzon Geothermal Generation Offers



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Previously (in hourly dispatch), Luzon Geothermal Plants participate in WESM trades **in incremental prices.**

Date	Hour : Minute	Plant Unit	Tracker	Bid Quantity (kWh)	Prices (Php x10-3)
2020-01-24	15 : 0	BACMAN_U01	1	30.0	0.00
2020-01-24	15 : 0	BACMAN_U01	2	21.0	0.00
2020-01-24	15 : 0	BACMAN_U01	3	1.0	10212.00
2020-01-24	15 : 0	BACMAN_U01	4	1.0	12779.00
2020-01-24	15 : 0	BACMAN_U01	5	1.0	15346.00
2020-01-24	15 : 0	BACMAN_U01	6	1.0	17913.00
2020-01-24	15 : 0	BACMAN_U01	7	1.0	20480.00
2020-01-24	15 : 0	BACMAN_U01	8	1.0	23047.00
2020-01-24	15 : 0	BACMAN_U01	9	1.0	25614.00
2020-01-24	15 : 0	BACMAN_U01	10	1.0	28181.00
2020-01-24	15 : 0	BACMAN_U01	11	1.0	30748.19

Bilateral Contracts

Prices are determined outside WESM

WESM trades

Incremental pricing ranging from 10 PHP/kWh to 32PHP/kWh

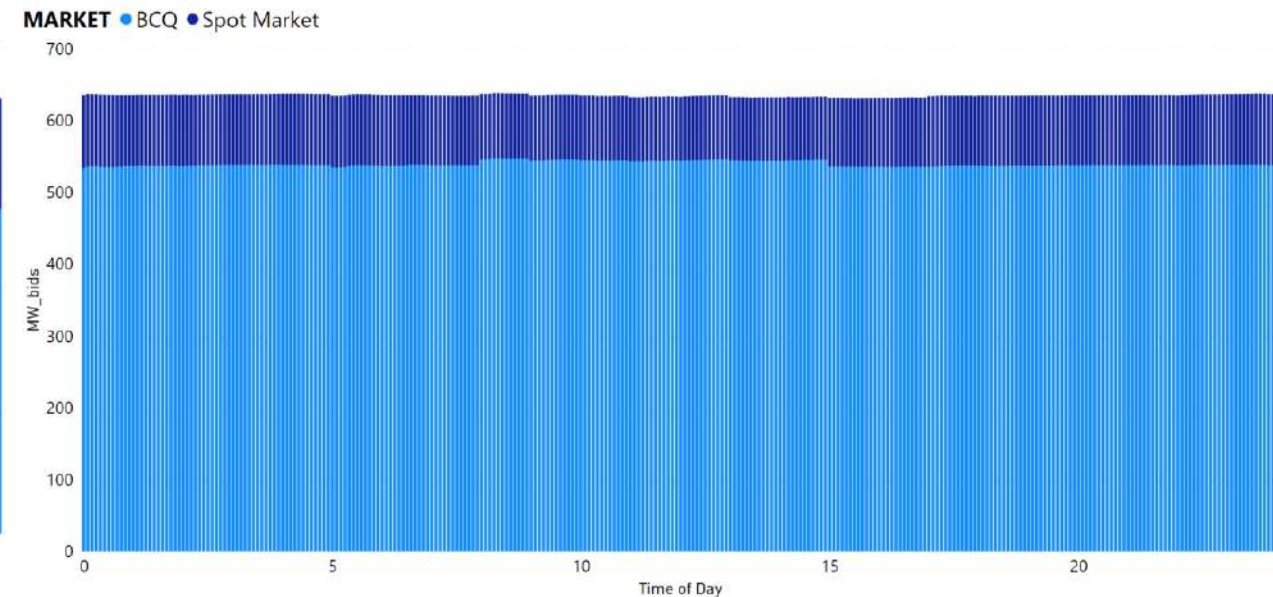
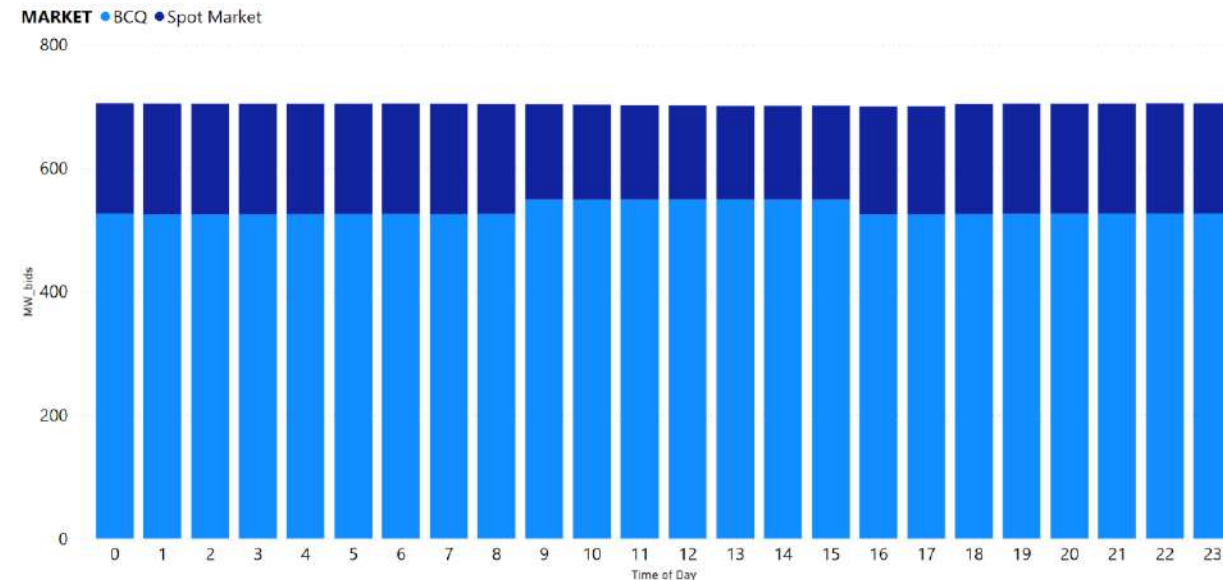
Visayas Geothermal Plants Bid Behavior



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Hourly and Five Minute Dispatch:

1. Their first bids are **under BCQs**
2. Succeeding bids are traded in the **Spot Market**
3. Their Bid quantities during **peak and off-peak** hours are **equivalent**



Visayas Geothermal Generation Offers



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Visayas Geothermal Plants participate in WESM trades in prices lower than the typical market clearing price

Date	Hour : Minute	Plant Unit	Tracker	Bid Quantity (kWh)	Prices (Php x10-3)
2021-02-07	13 : 0	LEYTE_A	1	240.0	0.00
2021-02-07	13 : 0	LEYTE_A	2	10.0	0.00
2021-02-07	13 : 0	LEYTE_A	3	100.0	999.19
2021-02-07	13 : 0	LEYTE_A	4	5.0	1099.19
2021-02-07	13 : 0	LEYTE_A	5	5.0	1199.19
2021-02-07	13 : 0	LEYTE_A	6	5.0	1200.19



Bilateral Contracts

Prices are determined outside WESM

WESM trades

Incremental pricing ranging from 1 PHP/kWh to 1.2 PHP/kWh

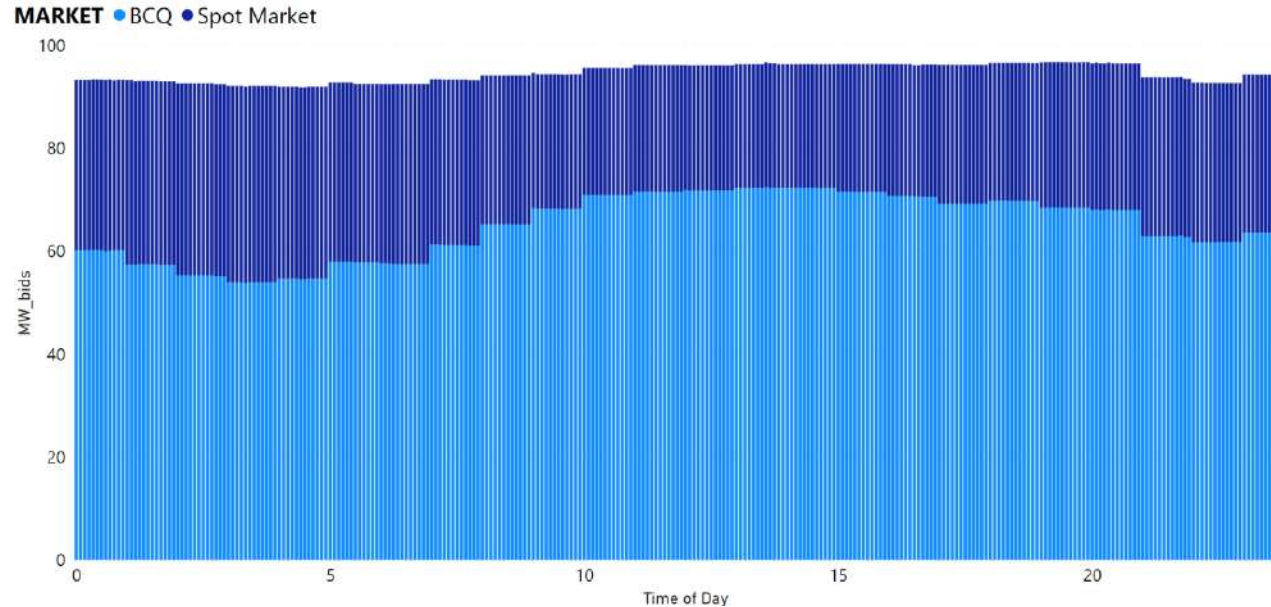
Mindanao Geothermal Bid Behavior



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Five Minute Dispatch:

1. Their first bids are **under BCQs**
2. Succeeding bids are traded in the **Spot Market**
3. Bid quantities during **peak and off-peak** hours are **NOT equivalent**



Note: The WESM is not yet fully operational in Mindanao. Additionally, data only includes 2022.

Mindanao Geothermal Generation Offers



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Mindanao Geothermal Plants participate in WESM trades in **Cap Prices (maximum)**.

Date	Hour : Minute	Plant Unit	Tracker	Bid Quantity (kWh)	Prices (Php x10-3)
2021-10-17	15 : 0	MTAPO_U01	1	0.0	-10000.0
2021-10-17	15 : 0	MTAPO_U01	2	32.0	-10000.0
2021-10-17	15 : 0	MTAPO_U01	3	18.0	32000.0
2021-10-17	15 : 5	MTAPO_U01	1	0.0	-10000.0
2021-10-17	15 : 5	MTAPO_U01	2	32.0	-10000.0
2021-10-17	15 : 5	MTAPO_U01	3	18.0	32000.0
2021-10-17	15 : 10	MTAPO_U01	1	0.0	-10000.0
2021-10-17	15 : 10	MTAPO_U01	2	32.0	-10000.0
2021-10-17	15 : 10	MTAPO_U01	3	18.0	32000.0



Bilateral Contracts

Prices are determined outside WESM



WESM trades

Cap price at 32PHP/kWh

Bids of Hydroelectric Plants



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Hydroelectric Plants are Scheduled Plants

- ~ under Bilateral Contracts
- ~ traded on the WESM

On both cases, these plants **need to bid their capacity** in the spot market dispatch.

Photo (c) AC Dimatatac/ICSC

Luzon Hydro-electric Plants Bid Behavior

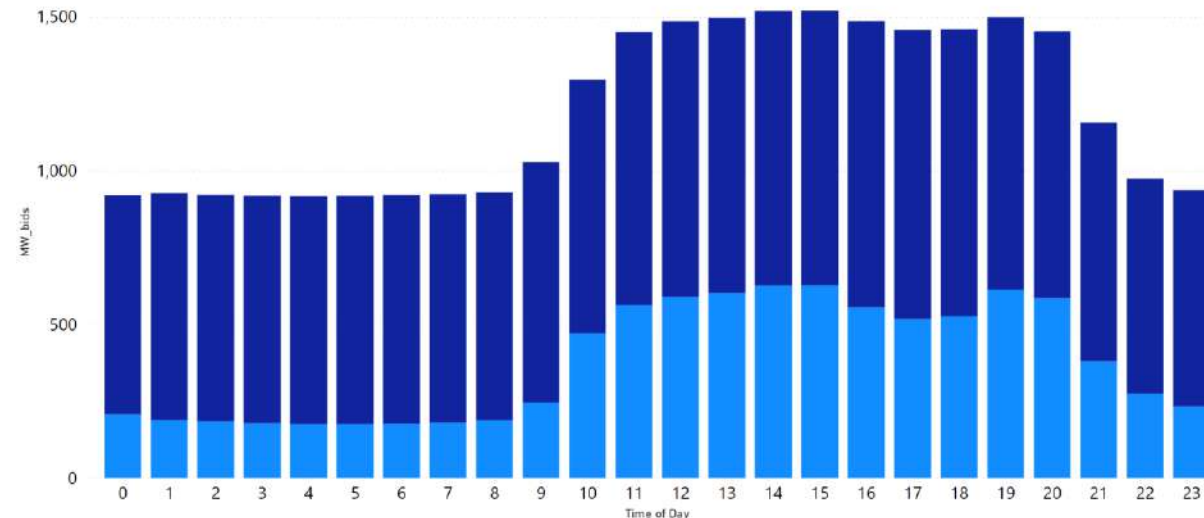


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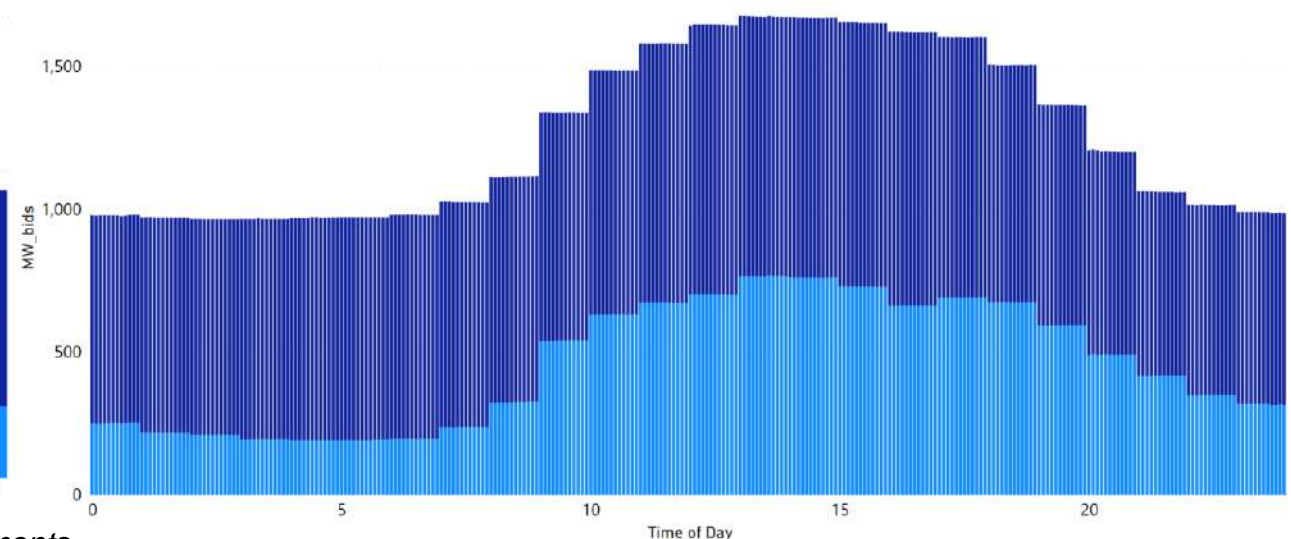
Hourly and Five Minute Dispatch:

1. Their first bids are **under BCQs**
2. Succeeding bids are traded in the **Spot Market**
3. Bid quantities during **peak and off-peak** hours are **NOT equivalent**

MARKET BCQ Spot Market



MARKET BCQ Spot Market



**Note that BCQ quantities can include contracts for energy or reserve requirements.*

Luzon Hydro-electric Generation Offers



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Luzon Hydro-electric Plants participate in WESM trades in **prices higher than the typical market clearing price**

Date	Hour : Minute	Plant Unit	Tracker	Bid Quantity (kWh)	Prices (Php x10-3)
2021-08-02	10 : 0	MAGAT_U02	1	0.0	0.0
2021-08-02	10 : 0	MAGAT_U02	2	27.0	0.0
2021-08-02	10 : 0	MAGAT_U02	3	9.0	10886.0
2021-08-02	10 : 0	MAGAT_U02	4	27.0	11999.0
2021-08-02	10 : 5	MAGAT_U02	1	0.0	0.0
2021-08-02	10 : 5	MAGAT_U02	2	27.0	0.0
2021-08-02	10 : 5	MAGAT_U02	3	9.0	10886.0
2021-08-02	10 : 5	MAGAT_U02	4	27.0	11999.0



Bilateral Contracts

Prices are determined outside WESM



WESM trades

Priced higher than the typical market clearing prices

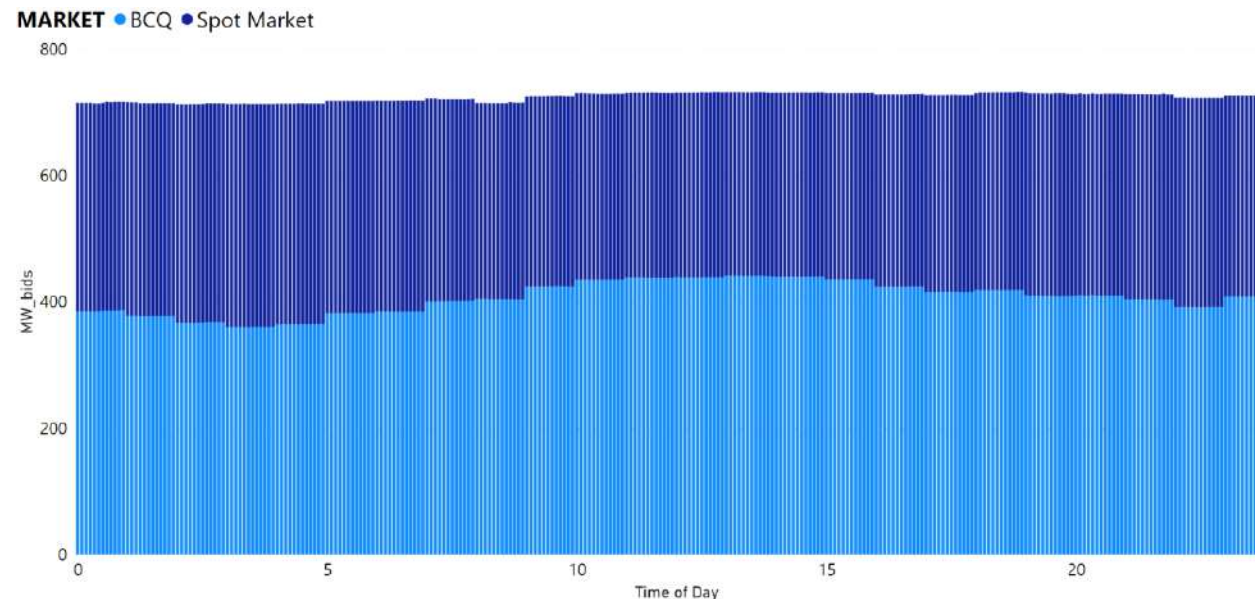
Mindanao Hydro Bid Behavior



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Five Minute Dispatch:

1. First bids are **under BCQs**
2. Succeeding bids are traded in the **Spot Market**
3. Bid quantities during **peak and off-peak** hours are **NOT equivalent**



Note: The WESM is not yet fully operational in Mindanao. Additionally, data only includes 2022.

Mindanao Hydro Generation Offers



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Mindanao Hydro-electric Plants participate in WESM trades in **Cap Prices (maximum)**.

DATE	HOUR	MINUTE	RESOURCE_NAME	TRACKER	BID_QUANTITIES	PRICES
2022-01-12	10	0	AGUS1_U01	1	0.0	-10000.0
2022-01-12	10	0	AGUS1_U01	2	12.0	-10000.0
2022-01-12	10	0	AGUS1_U01	3	8.0	0.0
2022-01-12	10	0	AGUS1_U01	4	15.0	32000.0
2022-01-12	10	5	AGUS1_U01	1	0.0	-10000.0
2022-01-12	10	5	AGUS1_U01	2	12.0	-10000.0
2022-01-12	10	5	AGUS1_U01	3	8.0	0.0
2022-01-12	10	5	AGUS1_U01	4	15.0	32000.0



Bilateral Contracts

Prices are determined outside WESM



WESM trades

Cap price at 32PHP/kWh



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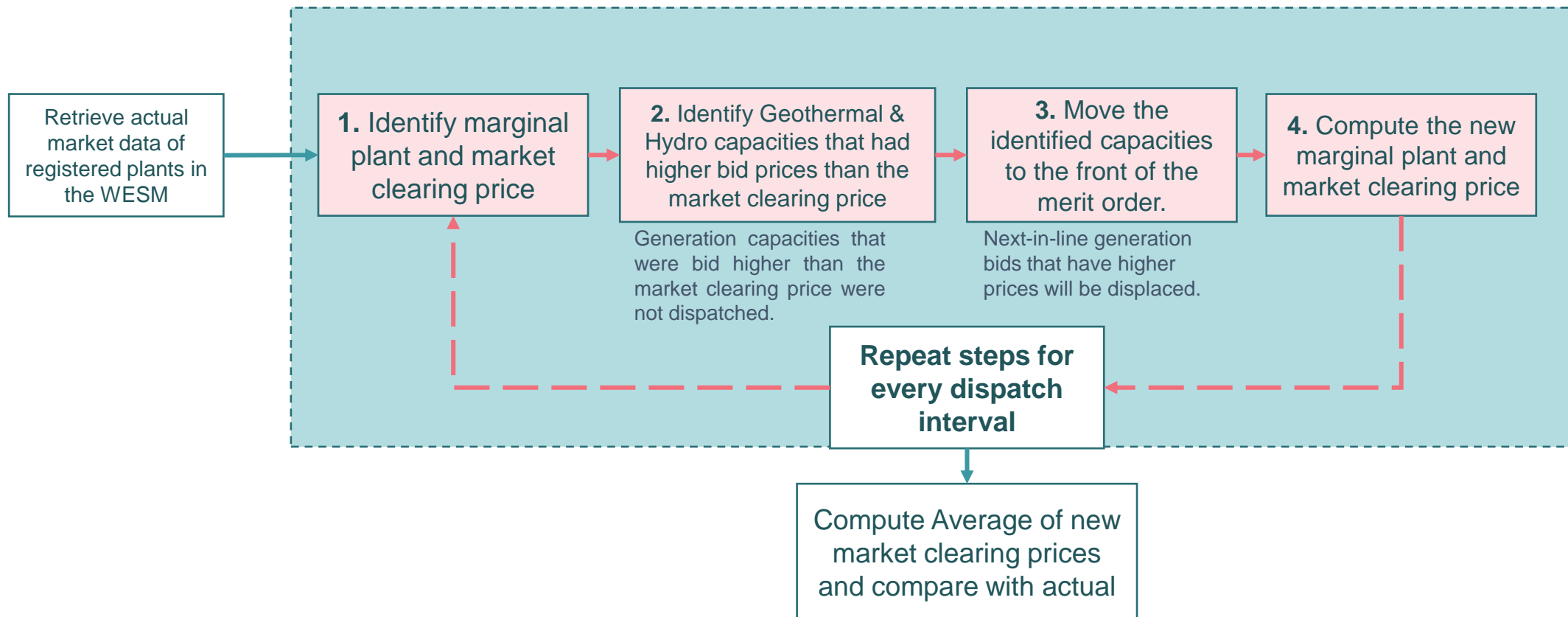
Methodology

Methodology



Simulating Priority Dispatch condition:

Geothermal, Hydroelectric Bids in the market are prioritized or moved to the front of the merit order



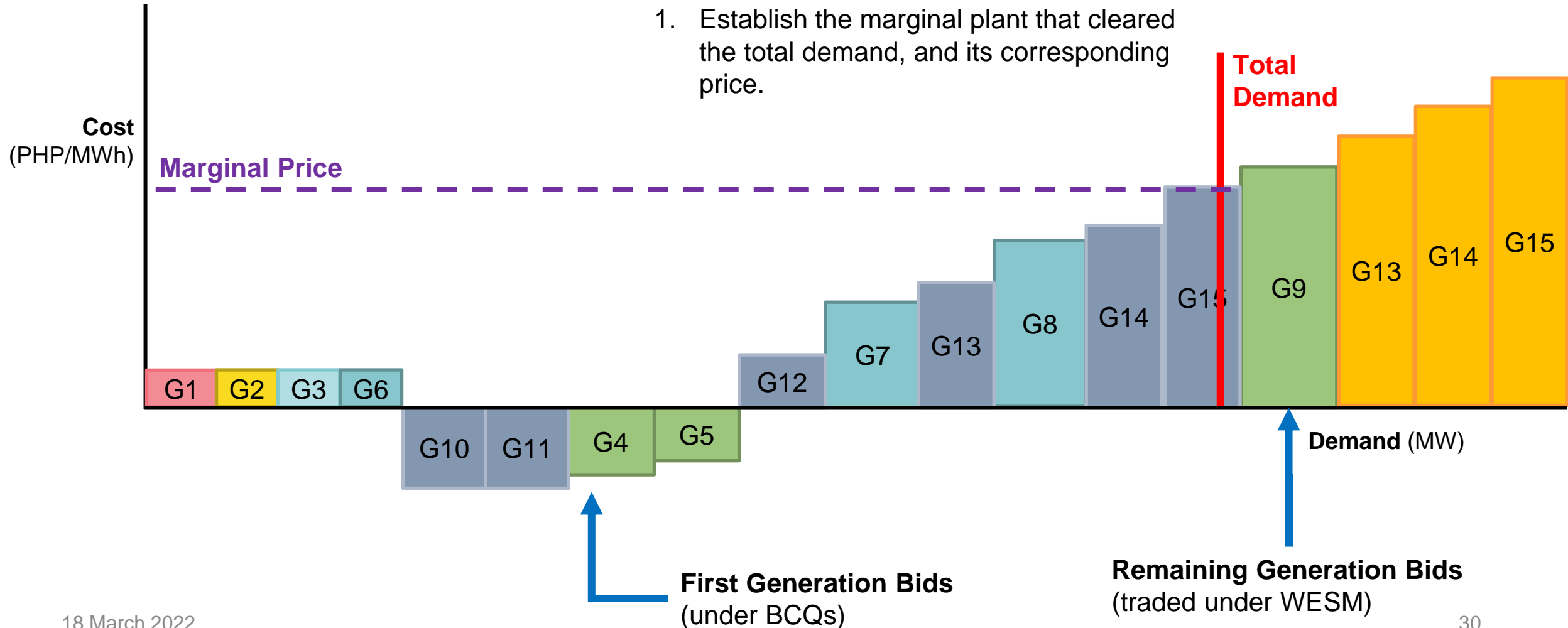
Original WESM Merit Order



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 = 1 capacity block

1. Establish the marginal plant that cleared the total demand, and its corresponding price.



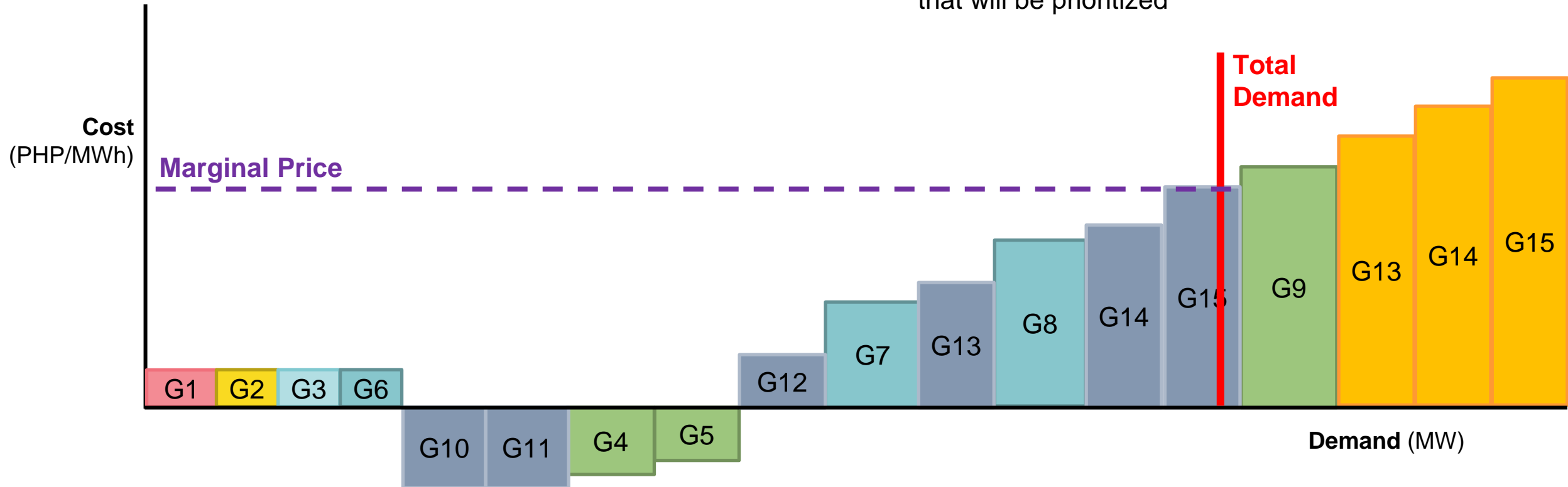
WESM with Priority Dispatch



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 = 1 capacity block

2. Determine the new capacity that will be prioritized

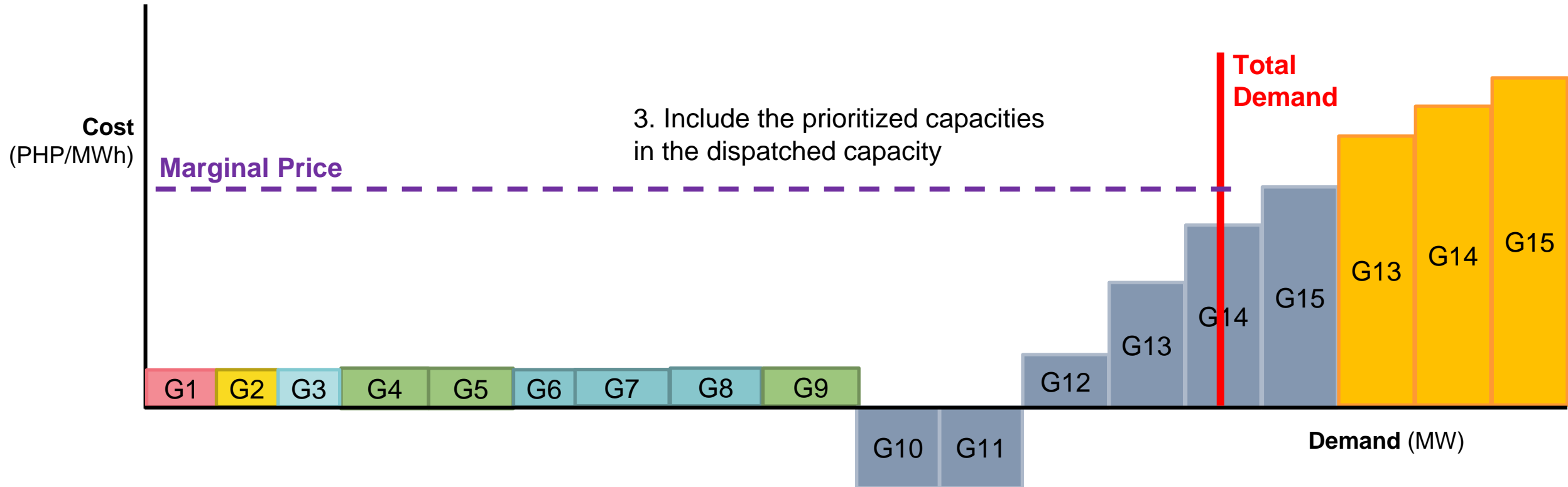


WESM with Priority Dispatch



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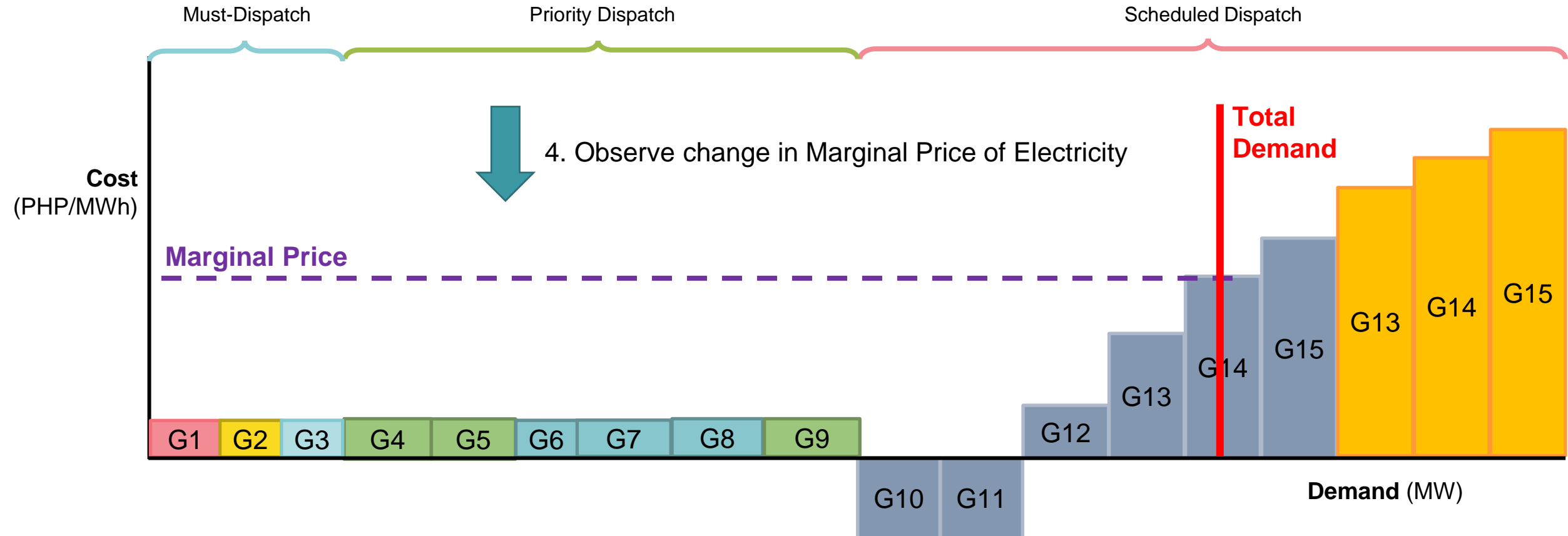
 = 1 capacity block



WESM with Priority Dispatch



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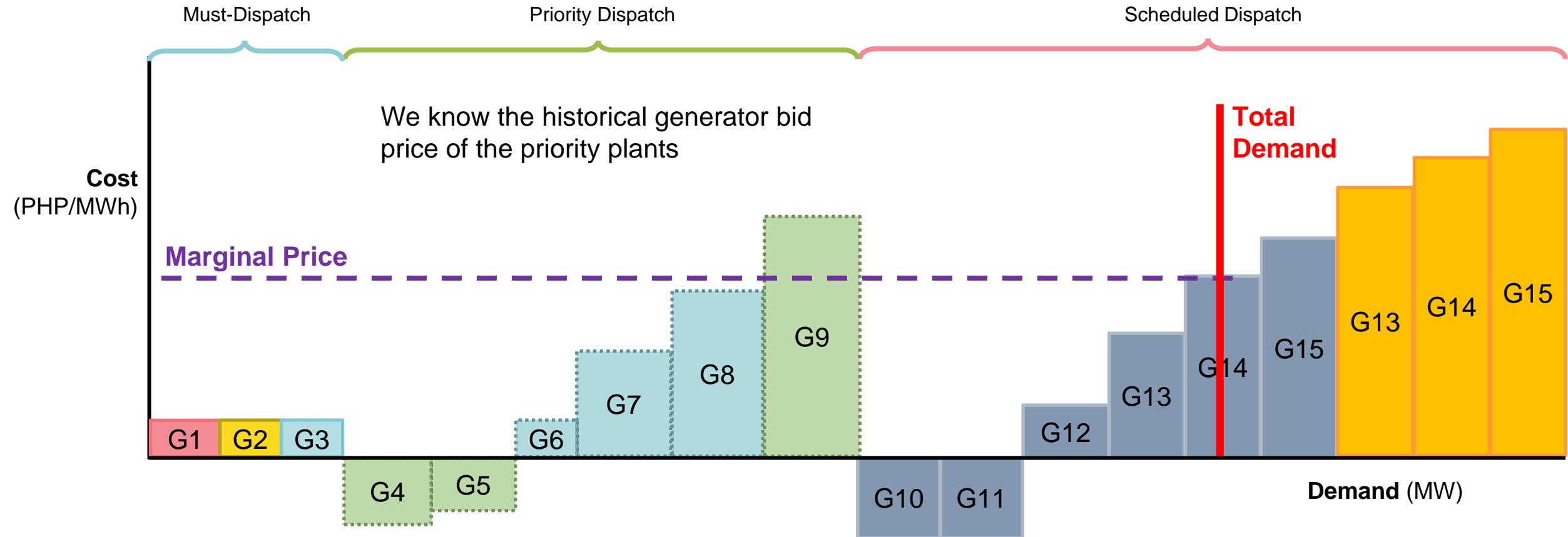


Conduct of Simulations

Understanding Potential Outcomes



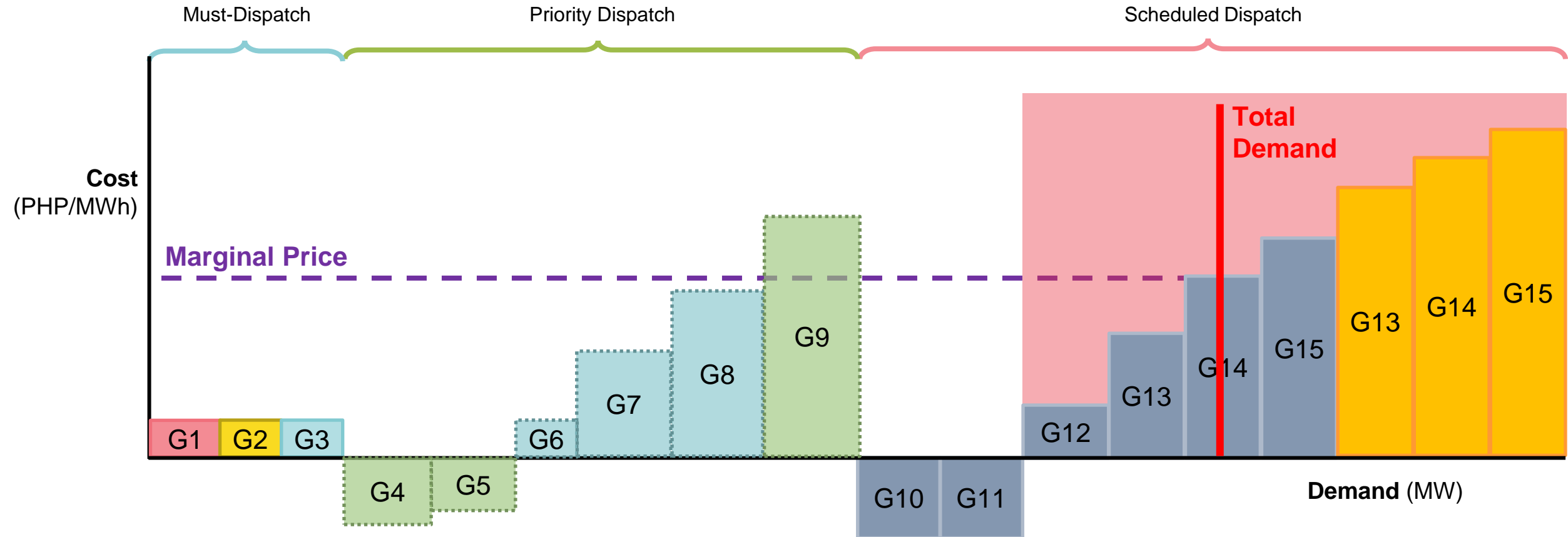
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Zone 1: Price Increase or Reduction



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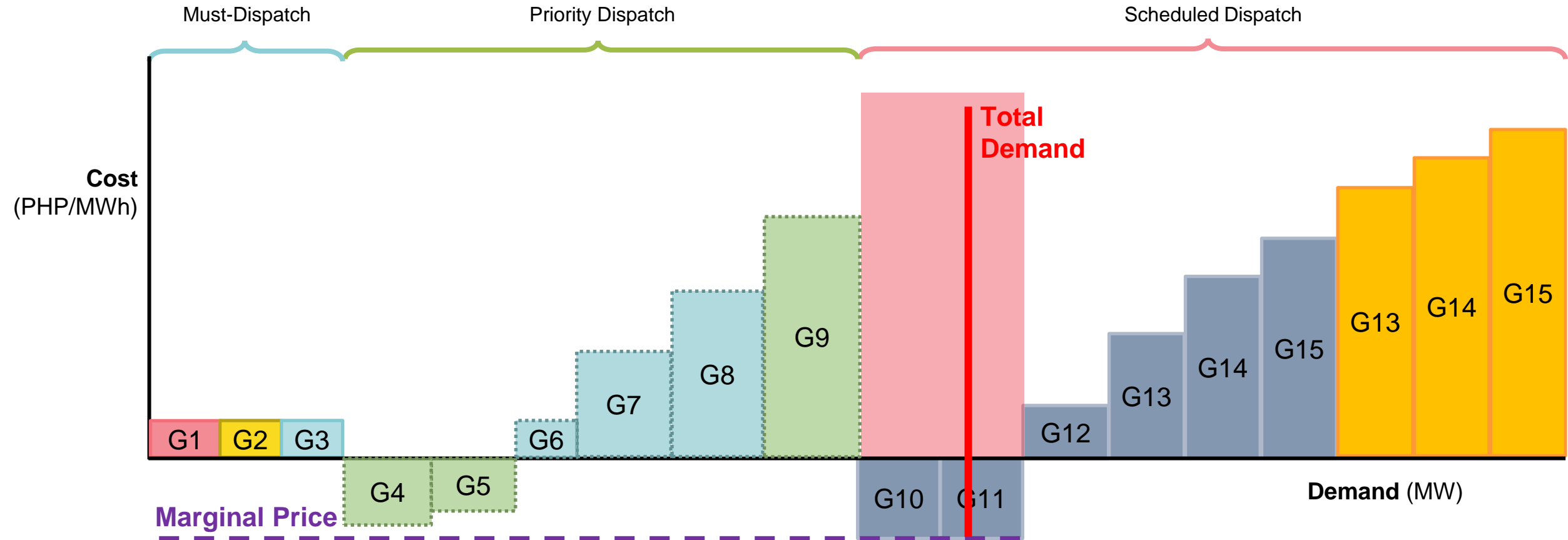


Most of our simulations fall in this zone.

Zone 2: Negative Marginal Price



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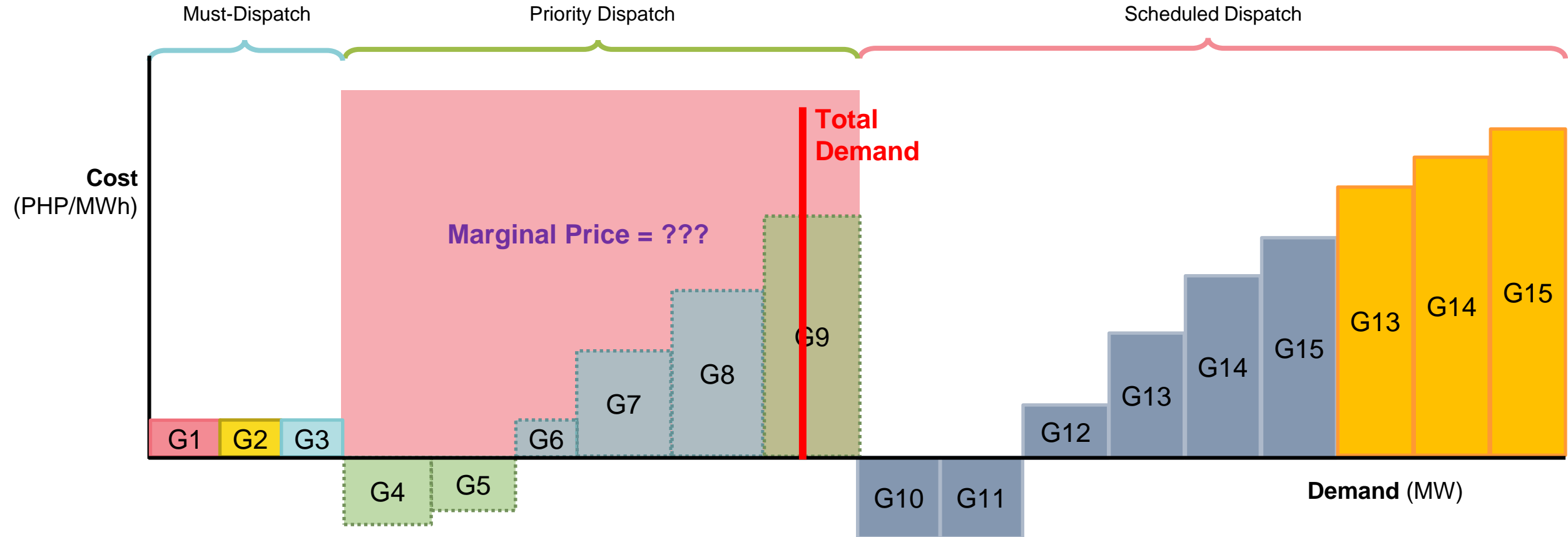


Some of our simulations fall in this zone.

Zone 3: RE Plants cleared the Demand



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No simulation have fallen in this zone.



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Impact on Prices

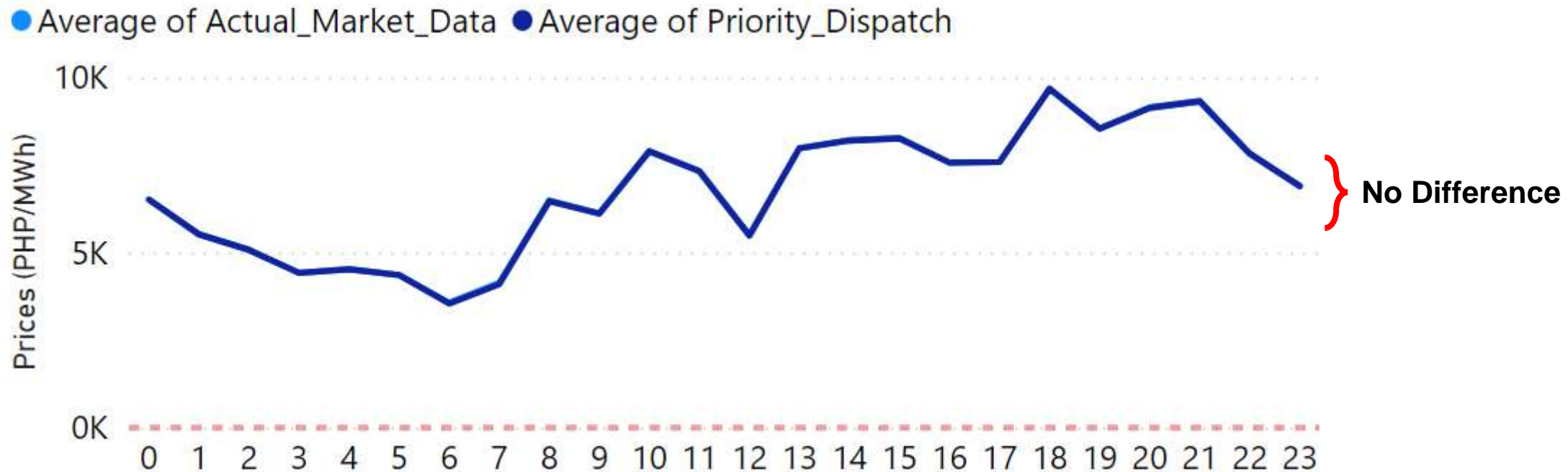
Impact on Prices – Luzon

OPTION 1: Considering Geothermal and Biomass as Priority Dispatch



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No Reduction in Market Clearing Price since Geothermal and Biomass Plants no longer bid in the WESM in the 5-minute dispatch



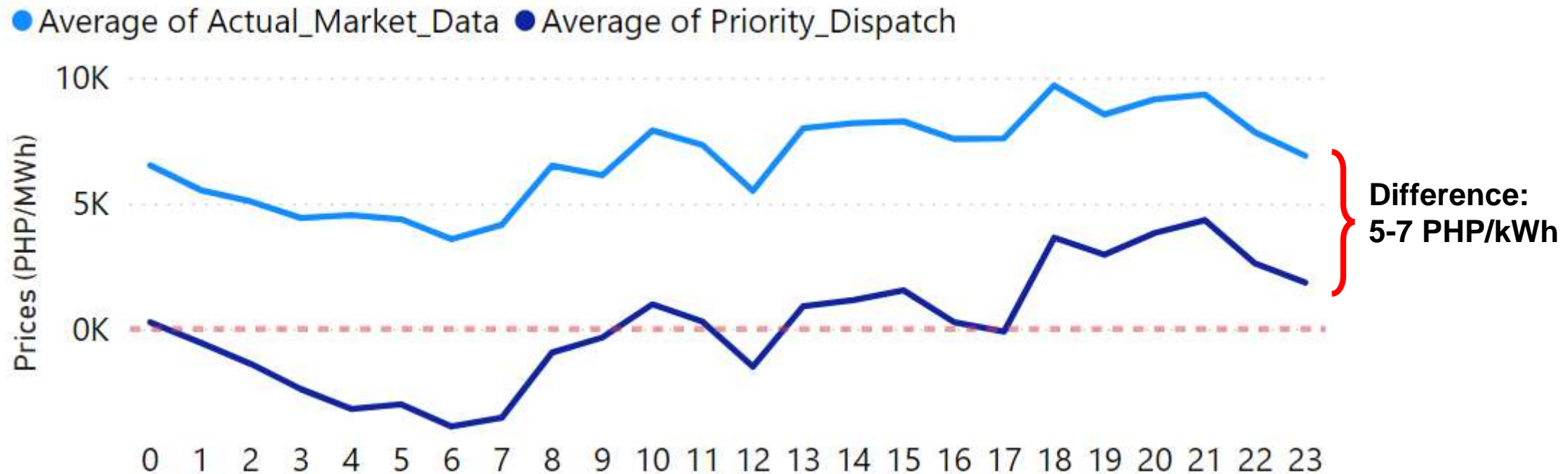
Impact on Prices – Luzon

OPTION 2: Considering Hydro, Geothermal and Biomass as Priority Dispatch



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Huge reductions in Market Clearing Price in all Hours due to large capacities of prioritized Hydro plants



Impact on Prices – Visayas

OPTION 1: Considering Geothermal and Biomass as Priority Dispatch



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No reduction in Market Clearing Price due to Geothermal Plants already being maximized based on their current bidding behavior

● Average of Actual_Market_Data ● Average of Priority_Dispatch



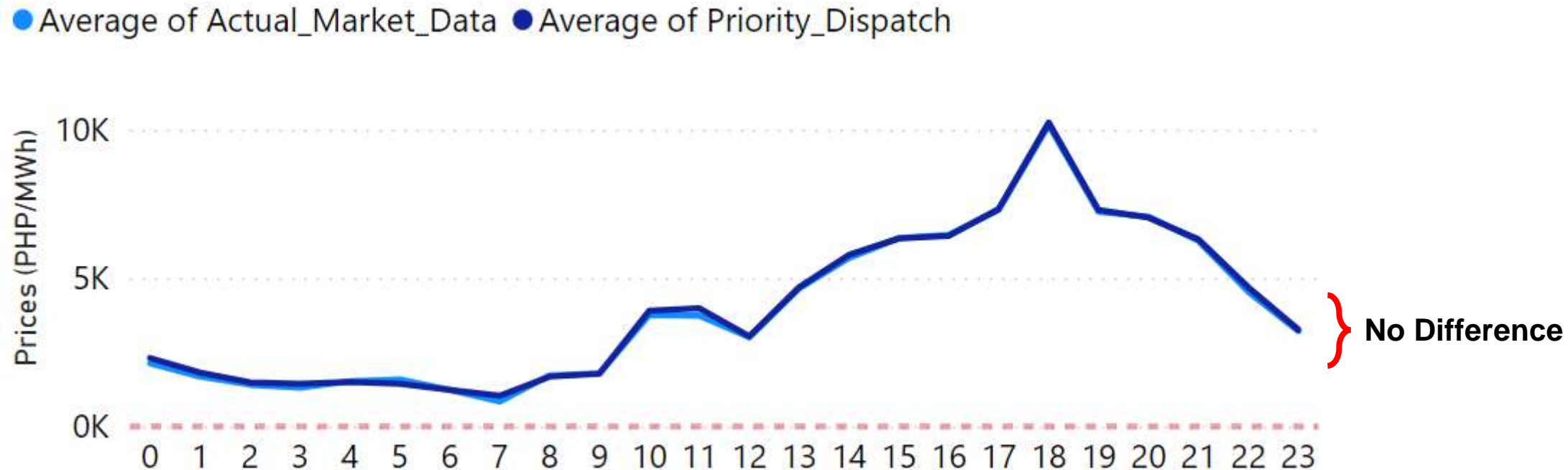
Impact on Prices – Visayas

OPTION 2: Considering Hydro, Geothermal and Biomass as Priority Dispatch



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**No reduction in Market Clearing Price
due to no hydroelectric plants in the region**



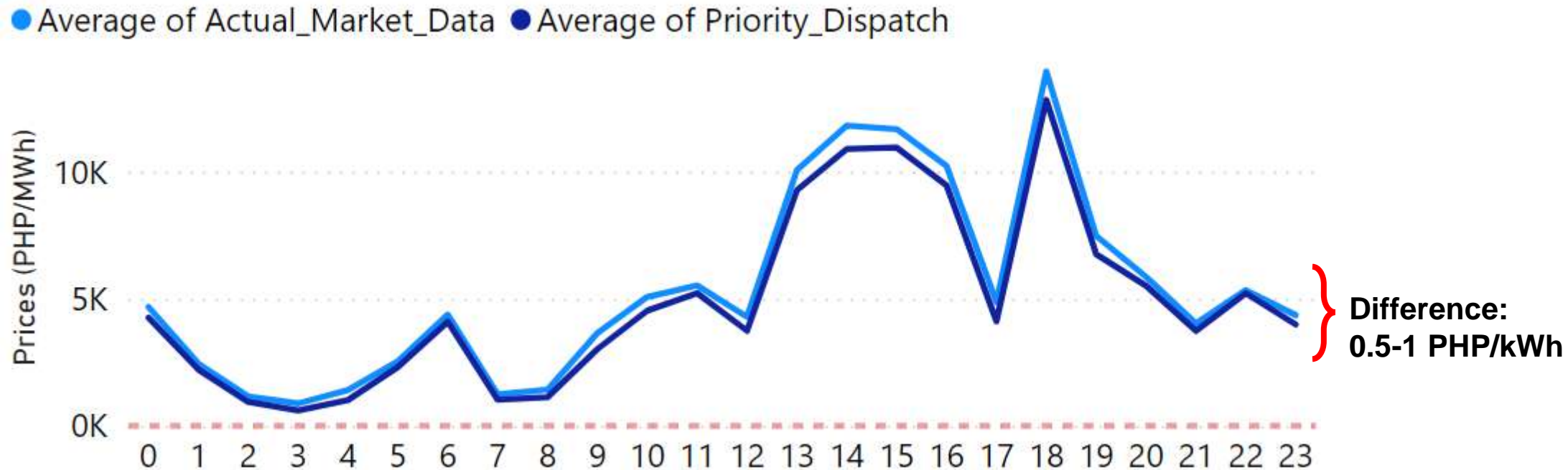
Impact on Prices – Mindanao

OPTION 1: Considering Geothermal and Biomass as Priority Dispatch



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Minimal reductions in Market Clearing Price in all Hours due to capacities of prioritized Geothermal plants



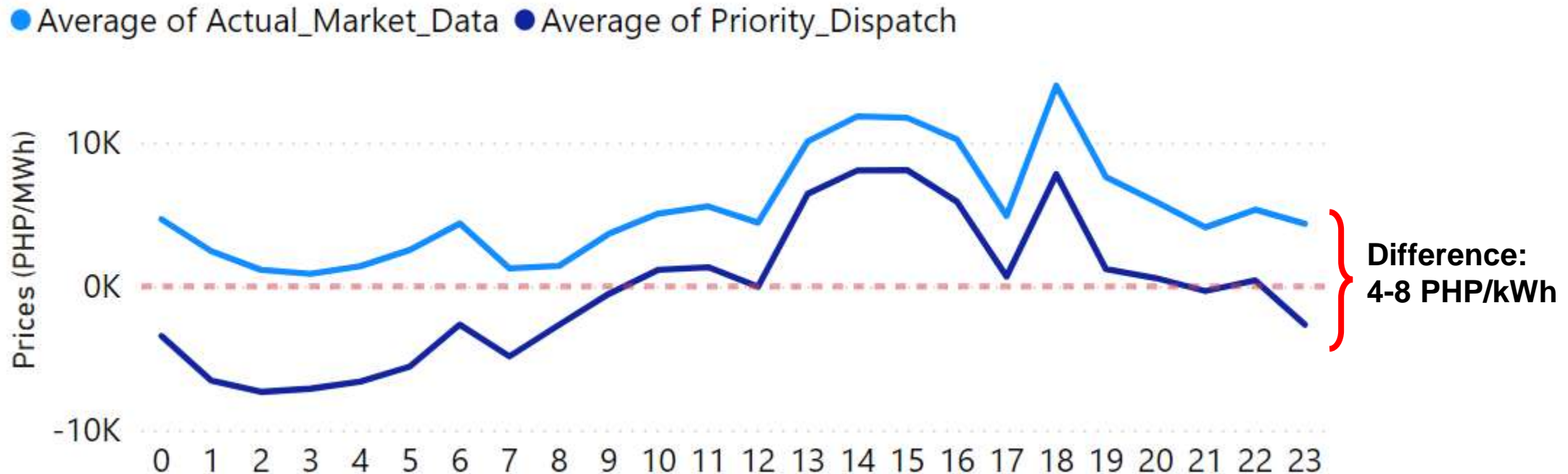
Impact on Prices – Mindanao

OPTION 2: Considering Hydro, Geothermal and Biomass as Priority Dispatch



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Huge reductions in Market Clearing Price in all Hours due to large capacities of prioritized Hydro plants



Impact on Prices

Pricing Simulations Summary



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	Luzon	Visayas	Mindanao*
Option 1 (Biomass & Geothermal)	No change Their bidding behavior allows them to be maximized in the current WESM mechanism	No change Their bidding behavior allows them to be maximized in the current WESM mechanism	Minimal changes based on preliminary WESM runs
Option 2 (Biomass, Geothermal & Hydroelectric)	Significant change* Large unutilized capacities of Hydroelectric plants. *Confirmation of potential impact required.	No change No WESM registered Hydroelectric plants in the region	Significant change based on preliminary WESM runs



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Impact on Supply

Impact on Energy Mix – Luzon



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Benchmark Case

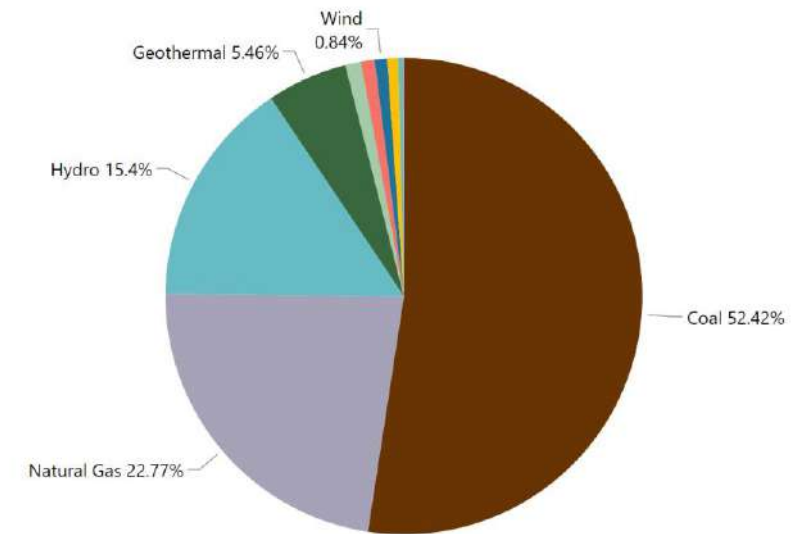
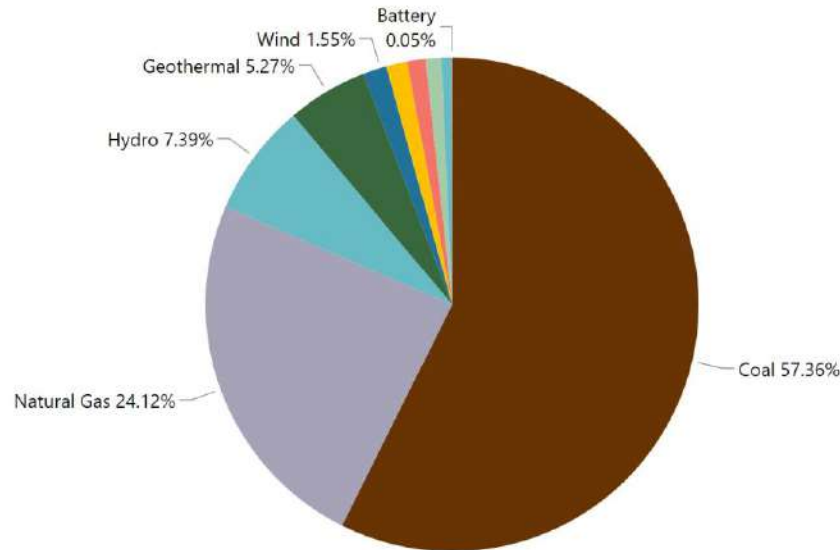
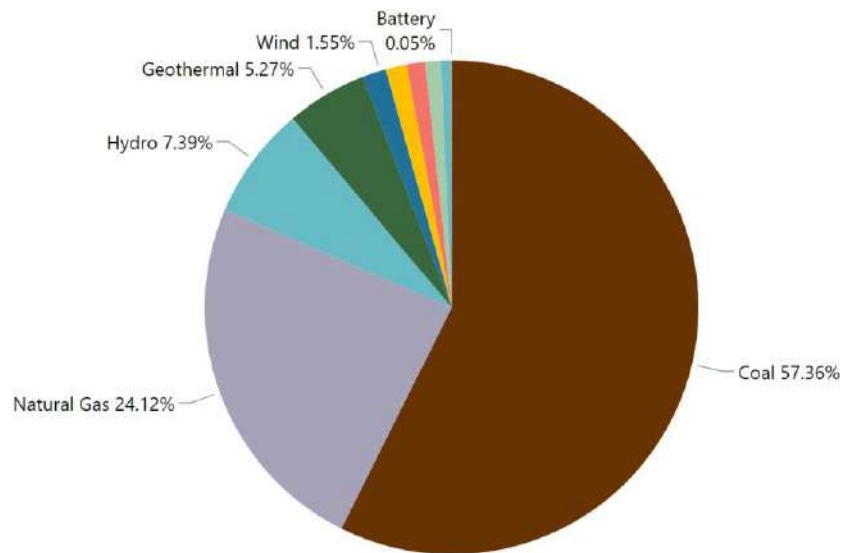
Option 1: Geothermal/ Biomass

Option 2: Hydro/ Geothermal/ Biomass

No effect on energy mix.
Same as benchmark case.

Due to Hydro plants, there are:

- 37% Increased RE share
- 8% Decreased Fossil fuel share

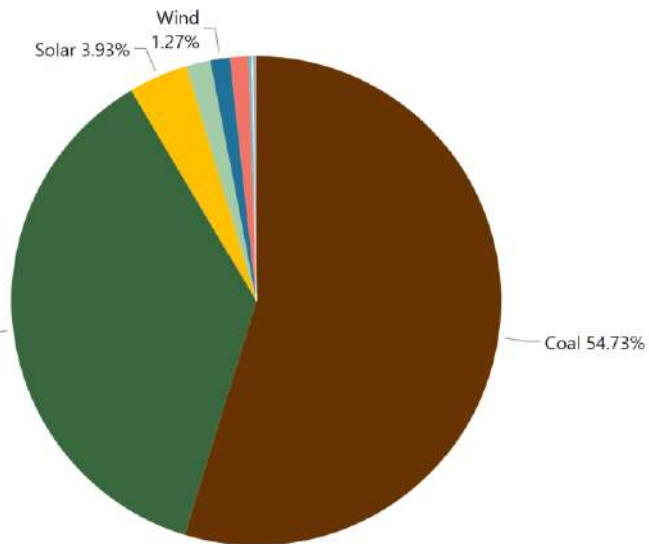


Impact on Energy Mix – Visayas



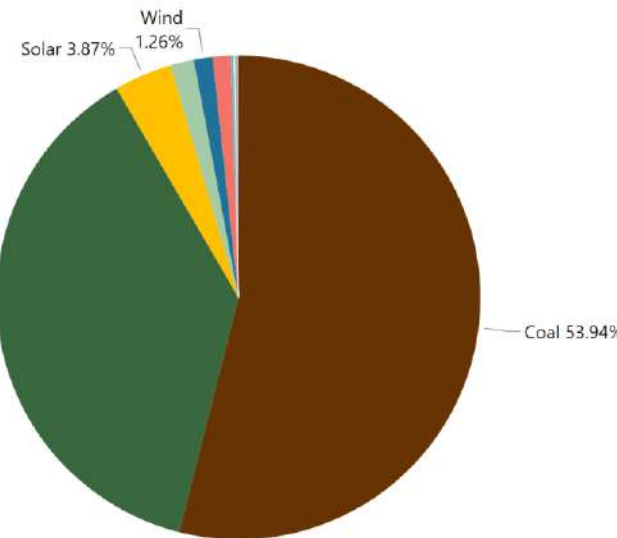
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Benchmark Case



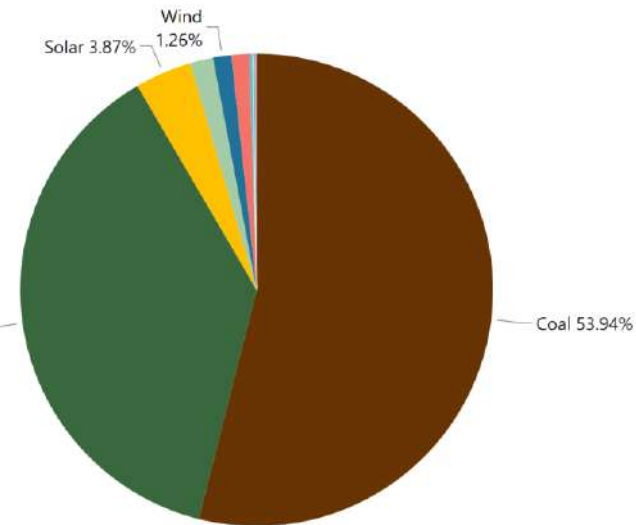
Option 1: Geothermal/ Biomass

- Due to Geothermal plants, there are:
- 1.8% Increased RE share
 - 1.5% Decreased fossil fuel share



Option 2: Hydro/ Geothermal/ Biomass

- Same as Option 1.
No Hydro plants to prioritize.

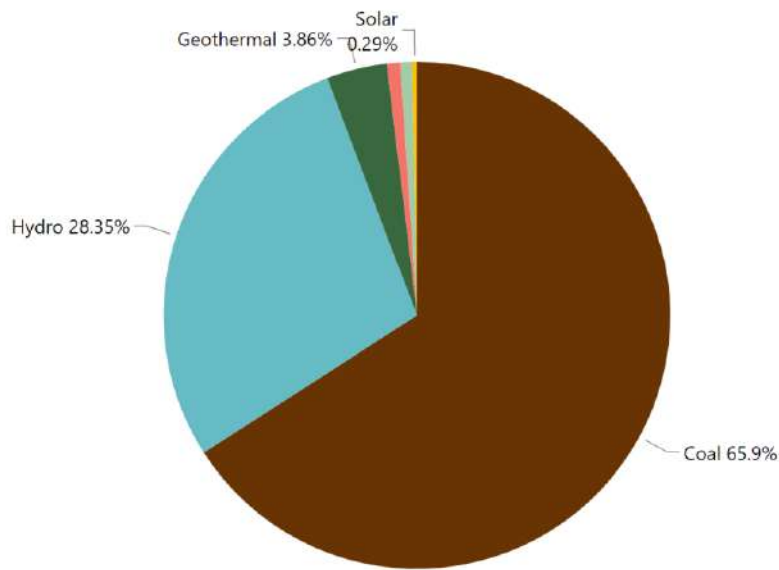


Impact on Energy Mix – Mindanao



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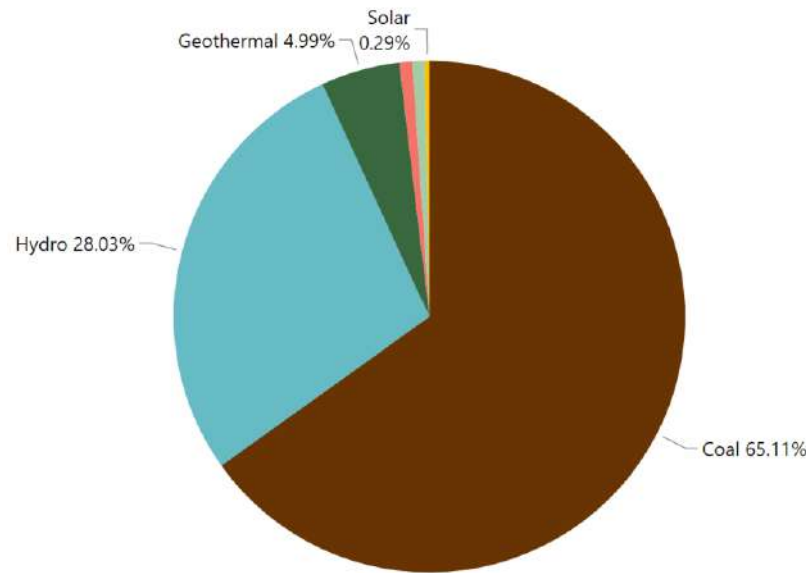
Benchmark Case



Option 1: Geothermal/ Biomass

Due to Geothermal plants, there are:

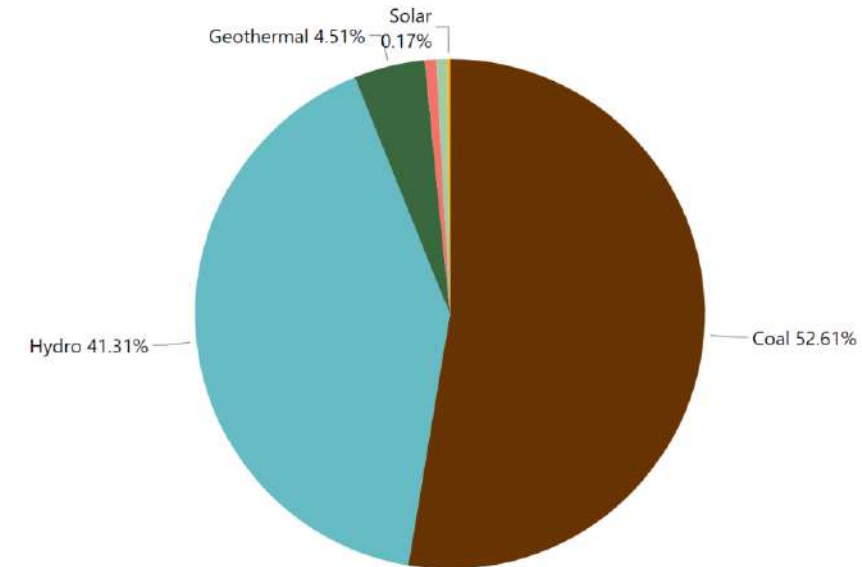
- 2.4% Increased RE share
- 1.2% Decreased fossil fuel share



Option 2: Hydro/ Geothermal/ Biomass

Due to Hydro plants, there are:

- 40% Increased RE share
- 20% Decreased fossil fuel share



Impact on Supply

Energy Mix Simulations Summary



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OPTION 1: Considering Geothermal and Biomass as Priority

- **Slight increase in RE utilization** on Visayas and Mindanao.
- **Slight reduction in fossil fuel plant utilization** on Visayas and Mindanao.
- **No anticipated effect** on system flexibility and transmission congestion.

OPTION 2: Considering Hydro, Geothermal and Biomass as Priority

- **Huge increase in RE utilization** on Luzon and Mindanao.
- **Huge reduction in fossil fuel plant utilization** on Luzon and Mindanao.
- **Need to confirm the potential effect** on system flexibility, transmission congestion, and dam water reserves



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Findings

Findings



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1. In most cases, there is an **increased utilization of indigenous RE in the energy mix** due to the maximization of available RE in the dispatch schedule. The amount increased is dependent on the existing RE share of the grid.
2. Increased **diversification on the power generation supply and reduced dependency on imported fossil fuel resources.**
3. As an added co-benefit, **notable price reductions were observed** in the spot market clearing prices due to more expensive next-in-line power plants being displaced in the WESM Merit Order.

Recommendations



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- 1. Proceed with Biomass and Geothermal plants to be included in the Priority Dispatch (Option 1),** since there will be minimal changes in the grid's operation.
- 2. Implement a trigger mechanism on the priority dispatch for Hydro-electric power plants.** Potential effect on grid flexibility and congestion, water dam levels, and multi-service contracts should be confirmed.
- 3. Implementation of the Ancillary Markets** to complement this RE priority policy.



Implemented by

