Energy Market Price Trends

Energy Management & Cost Reduction Strategies

Workshop FF | March 1, 2023

Natural Gas Market Fundamentals

Russia Weaponizes Natural Gas!

Russia's Gazprom says gas flows to Europe will stay shut after G7 agreed price cap to choke Putin's war machine

Chancellor Nadhim Zahawi said the price cap would curtail Putin's effort to fund his war while also bringing down spiralling global energy costs.

Friday 2 September 2022 18:21, UK

Energy

Gazprom says it will halt gas supplies to France's Engie, cites lack of payment

Wholesale gas prices fall as Europe's plan to avert winter energy crisis takes shape

Freeport TX Fire

Europe's plans to replace Russian gas are deemed 'wildly optimistic' — and could hammer its economy

PUBLISHED WED, JUN 29 2022·1:35 AM EDT | UPDATED WED, JUN 29 2022·4:17 AM EDT

Germany to Gazprom: Your Turbine Is Ready, Let Us Deliver It

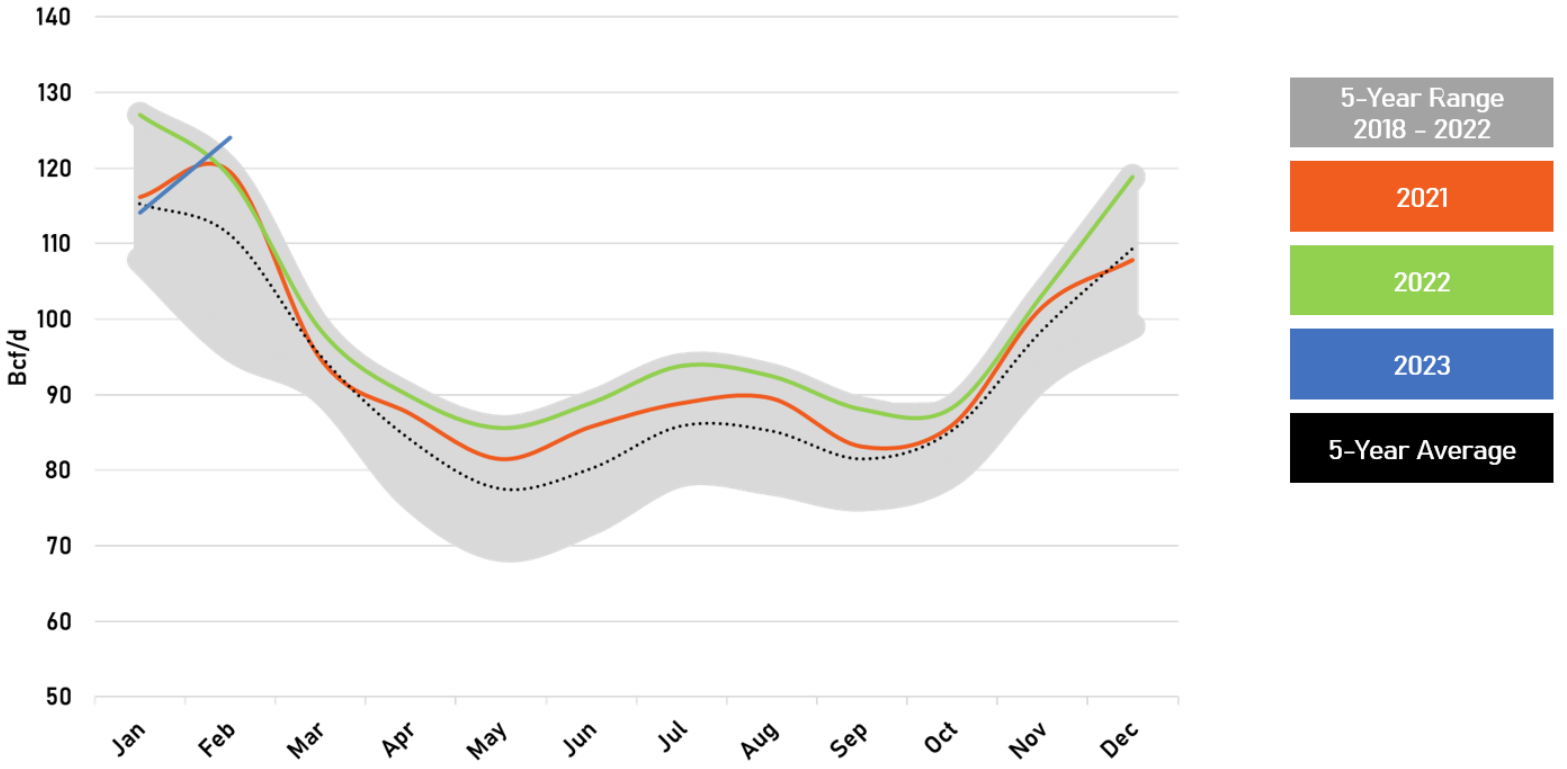
Olaf Scholz showed off a refurbished turbine for the Nord Stream 1 pipeline that Russia has said is the reason it can't send more gas to Germany.

Natural Gas Market

Electric Market

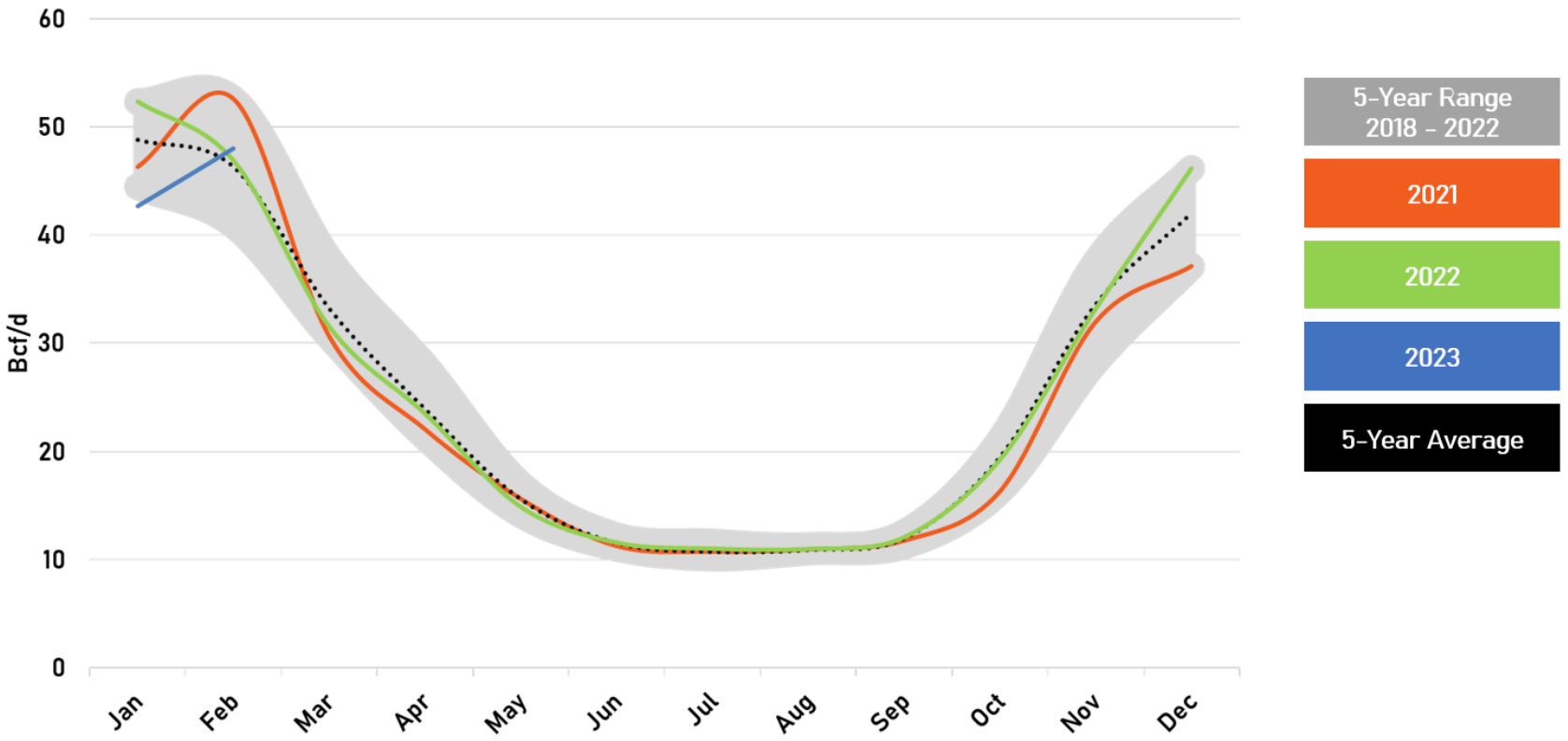
Natural Gas Fundamentals

Total Natural Gas Demand with Exports



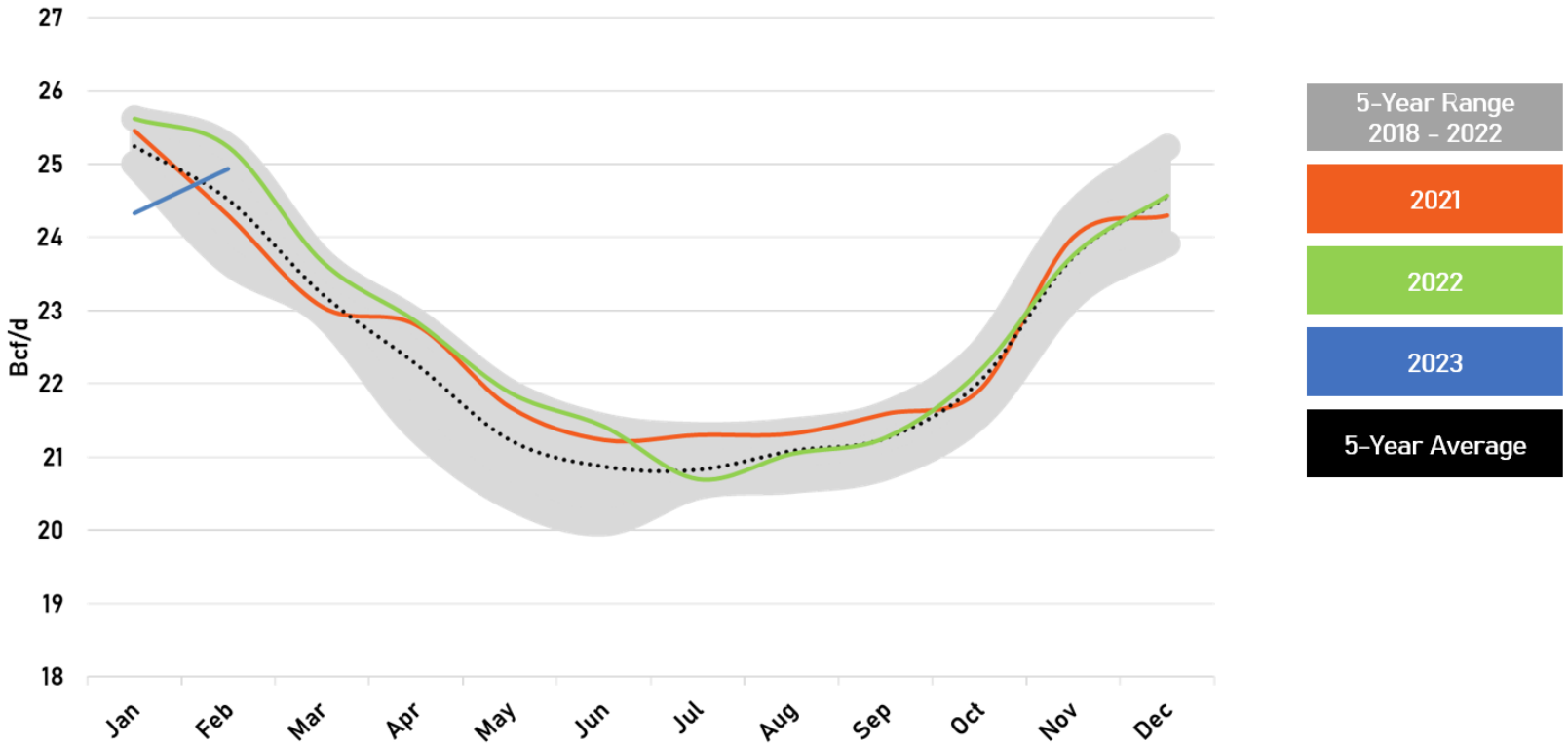
Natural Gas Fundamentals

Natural Gas – Res/Comm Demand



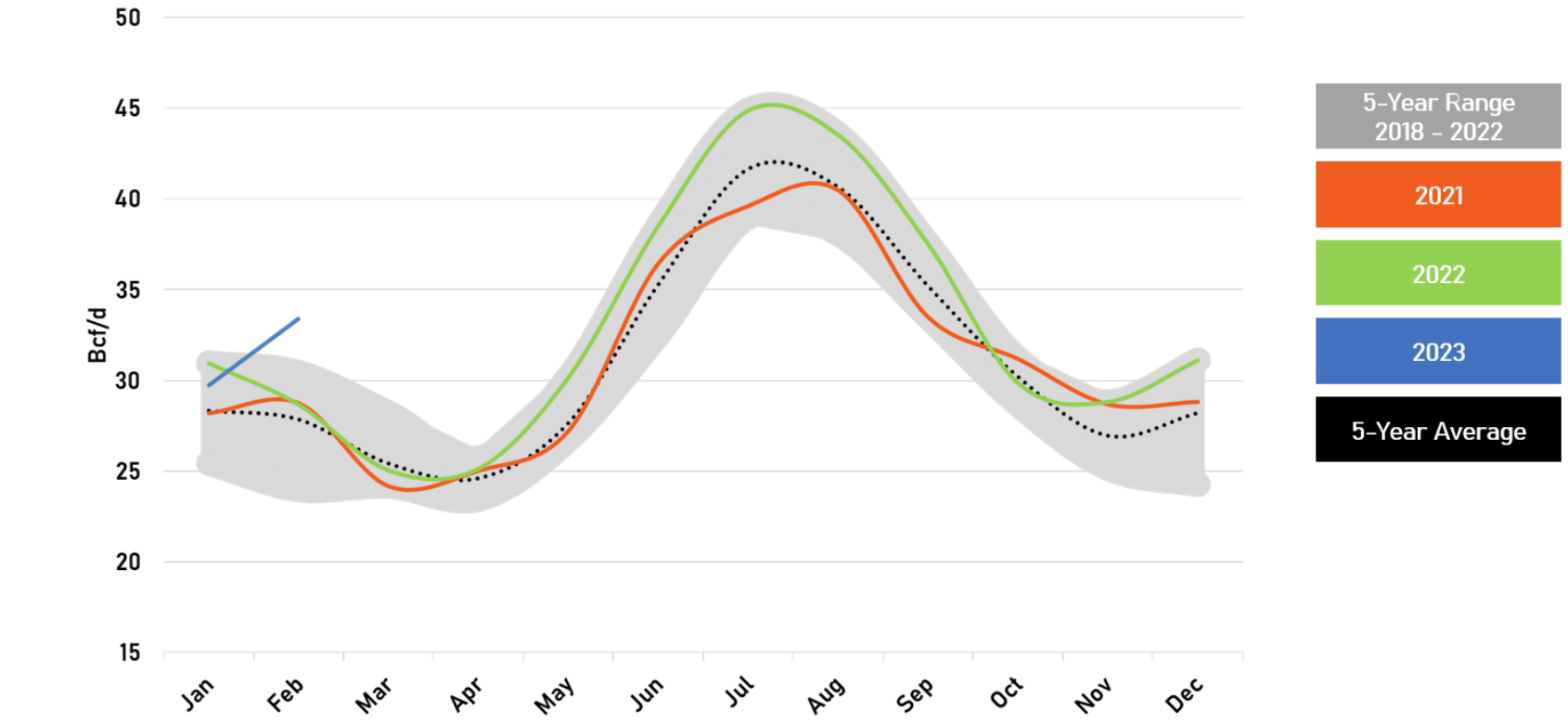
Natural Gas Fundamentals

Natural Gas – Industrial Demand



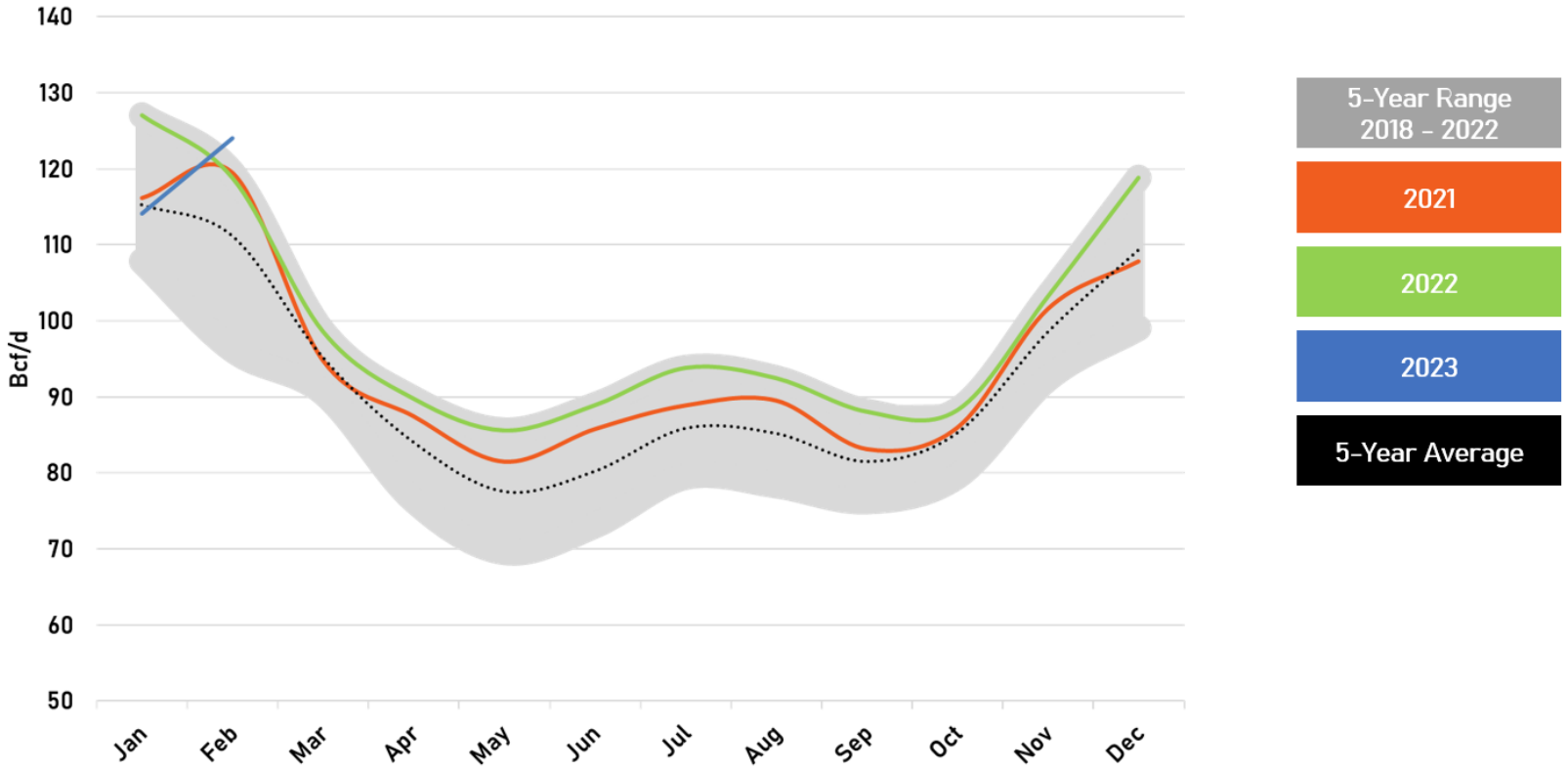
Natural Gas Fundamentals

Natural Gas – Power Burn Demand



Natural Gas Fundamentals

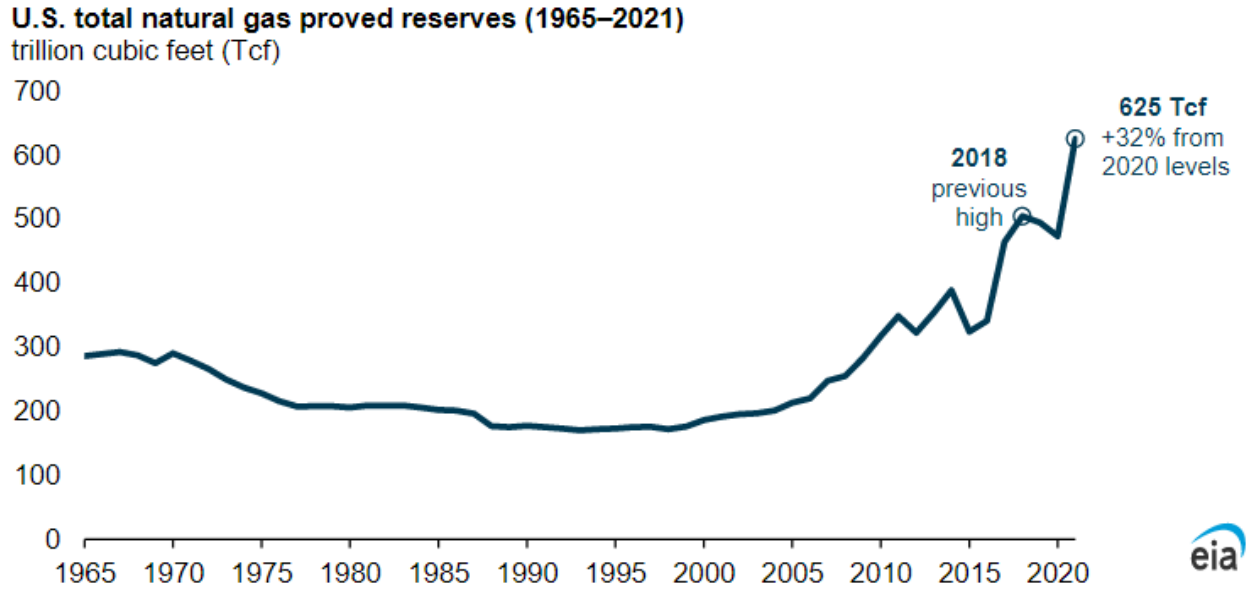
Total Natural Gas Demand with Exports



US Natural Gas Reserves Are Up

JANUARY 30, 2023

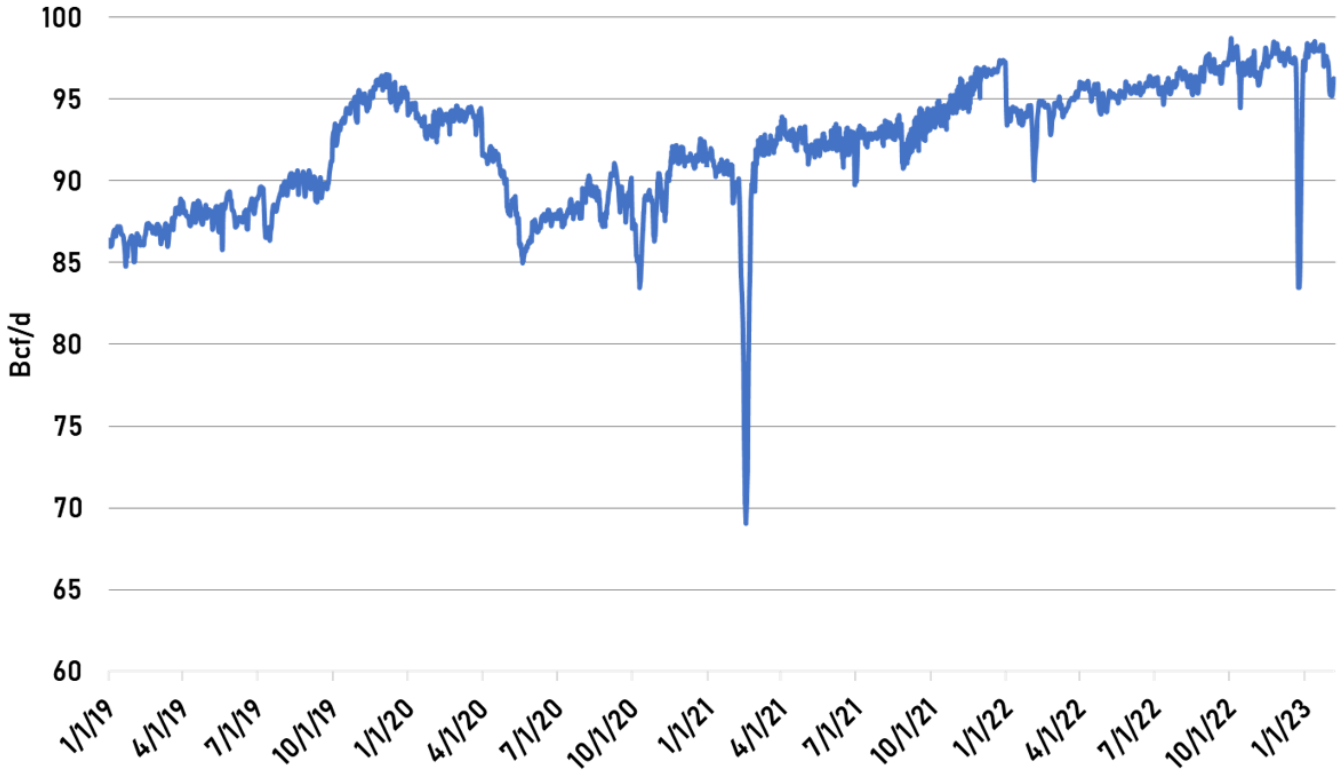
Proved reserves of natural gas increased 32% in the United States during 2021



Data source: U.S. Energy Information Administration, *Proved Reserves of Crude Oil and Natural Gas in the United States, Year-End 2021*

Natural Gas Fundamentals

Natural Gas Production, Lower 48 States

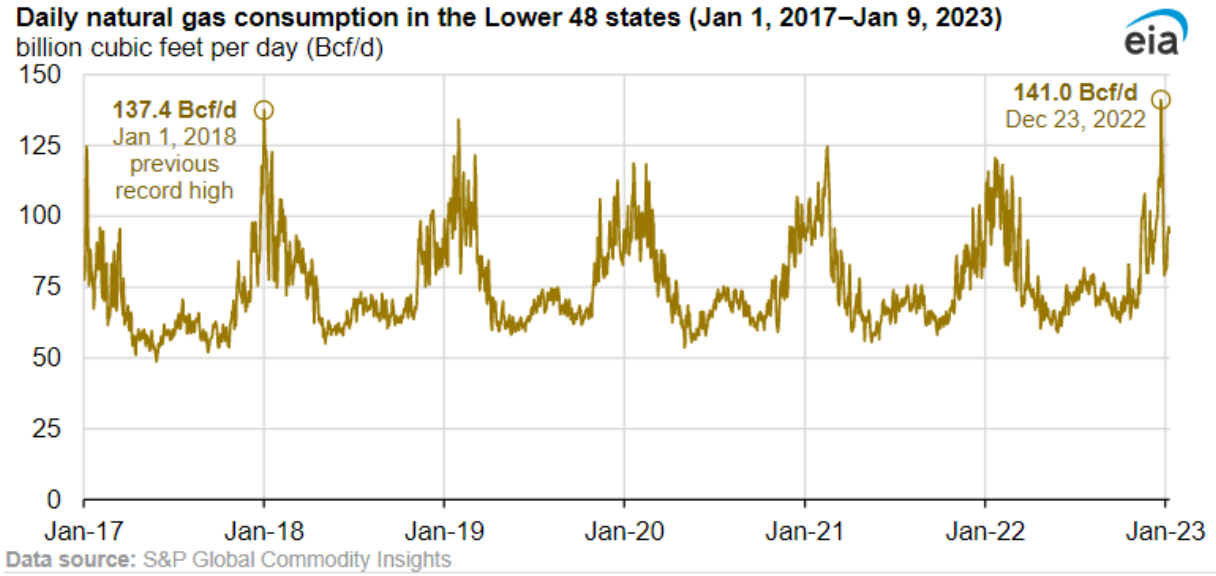


Production slips to 96 Bcf/d

US Natural Gas Consumption Hits New Record

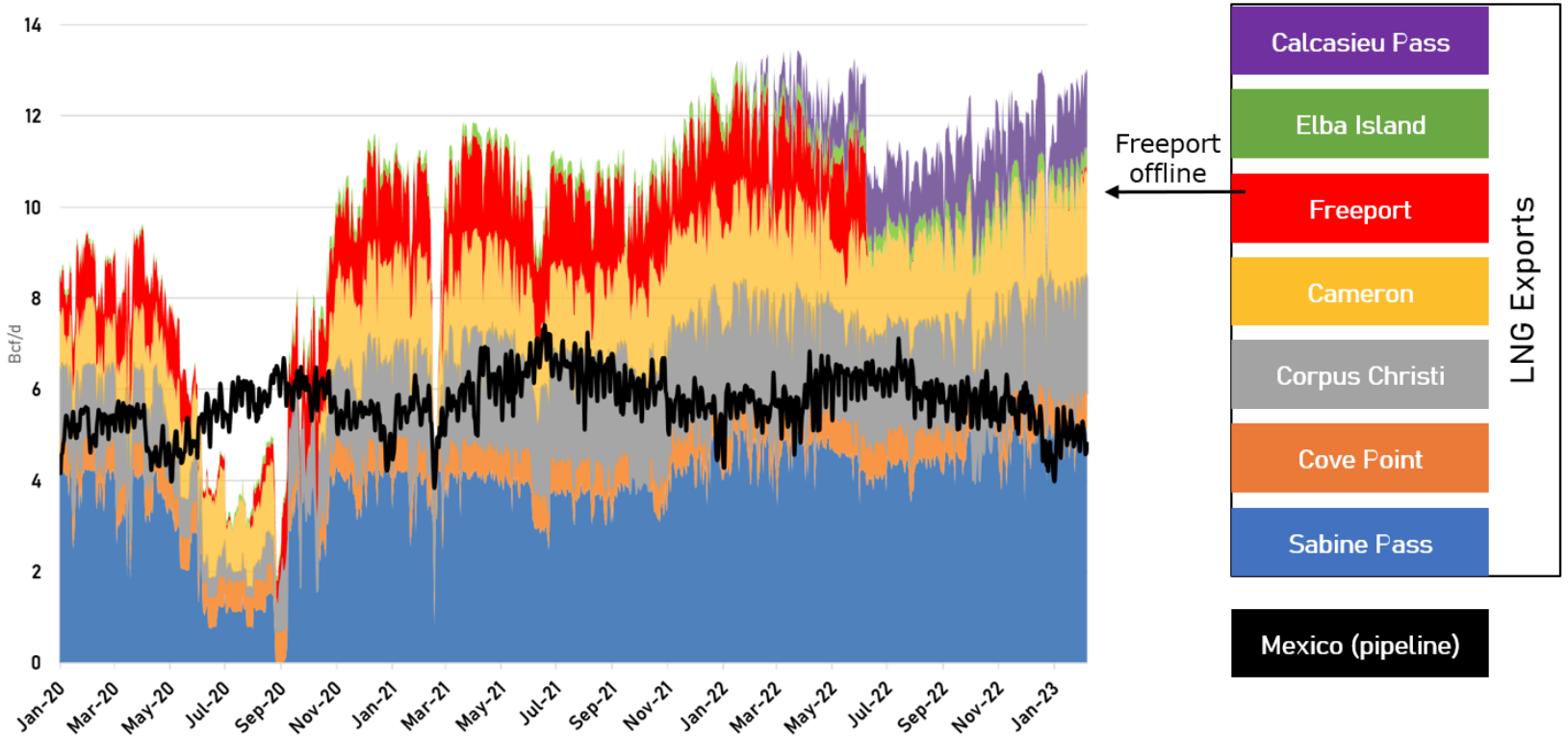
JANUARY 31, 2023

U.S. natural gas consumption reached record daily high in late December 2022



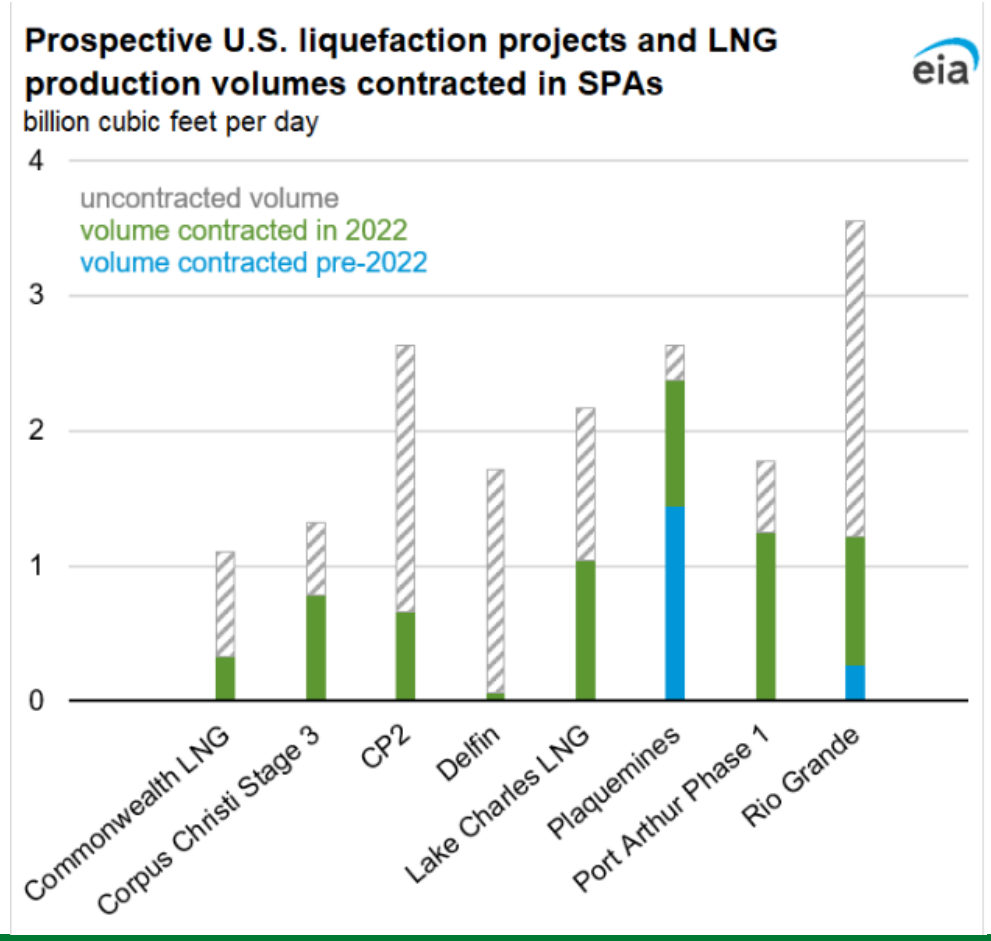
Natural Gas Fundamentals

Natural Gas Exports – LNG and Mexico



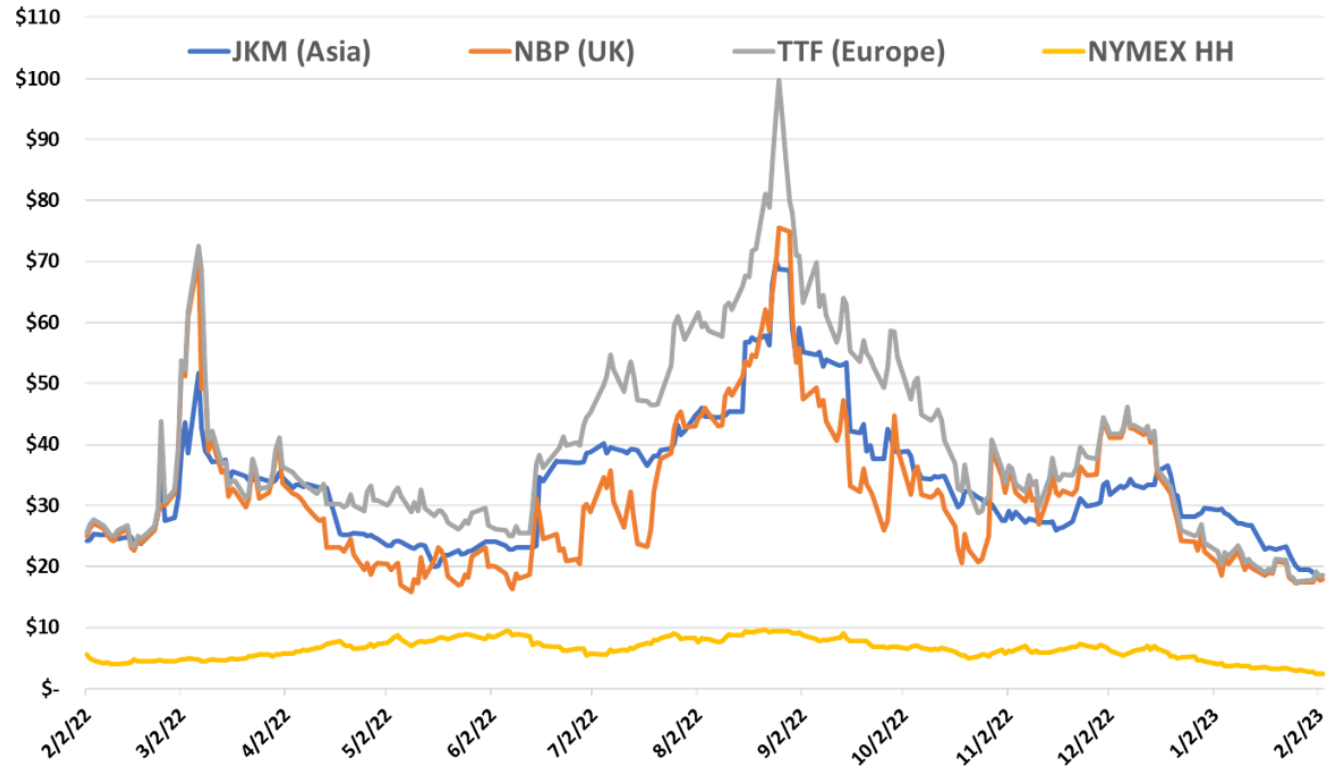
US LNG Production Volumes Hit New Record

Natural gas consumption, production, and exports broke records in 2022 as real average prices hit 14-year high



Natural Gas Fundamentals

Prompt Month Prices - NYMEX vs. Global LNG



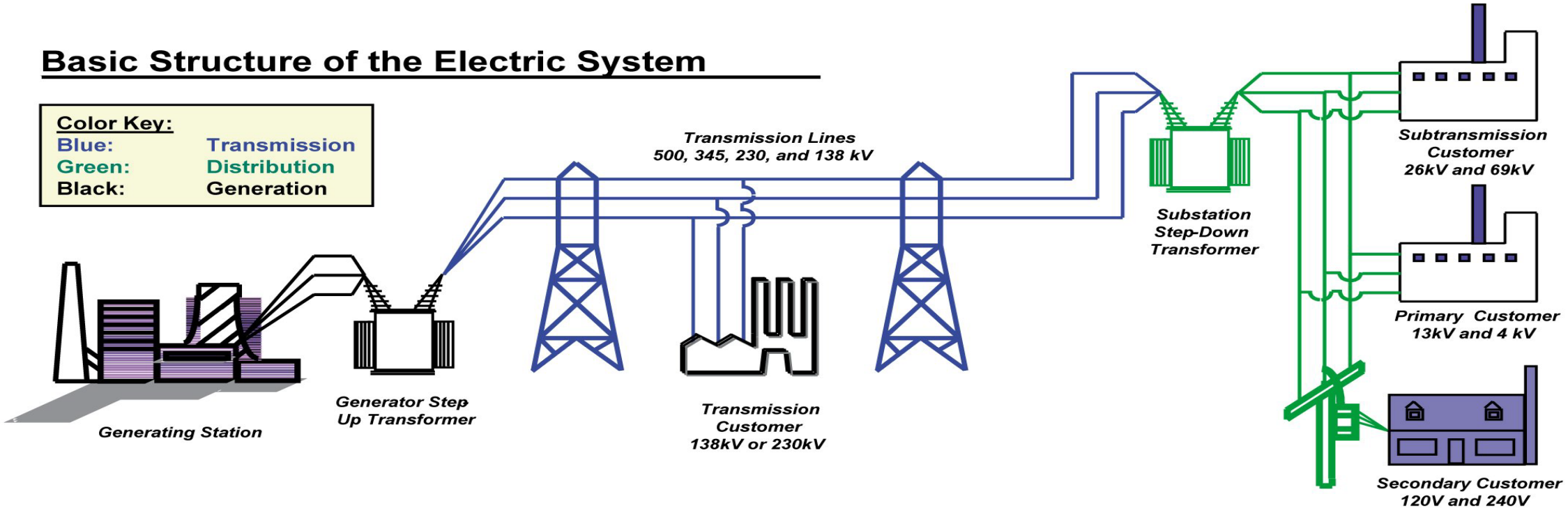
Use a 3 Prong Strategy to Reduce Energy Costs

1st Prong to Strategy

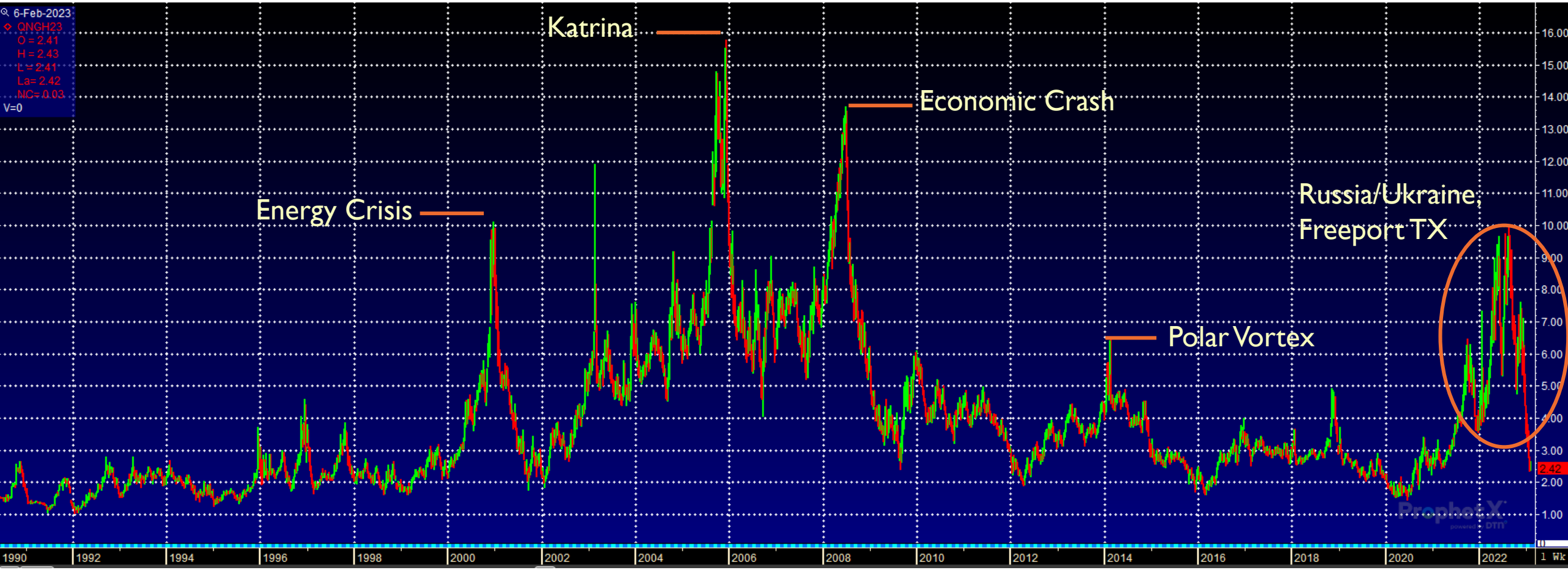
Strategic Procurement

Electric System from Generators to Your Facility

Your **Tariff Rate** Depends on Where You Take Your Power



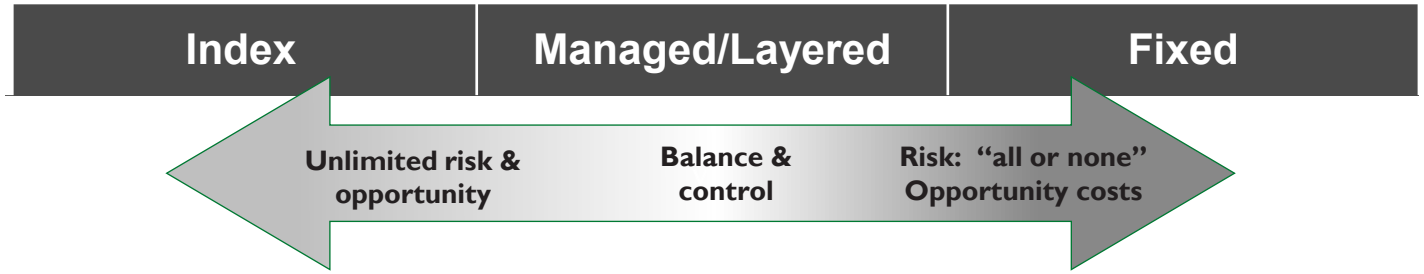
A 30–Year Historical Look at Natural Gas Prices



Product Risk & Opportunity Spectrum

No product structure fully removes market exposure & risk

Product Spectrum

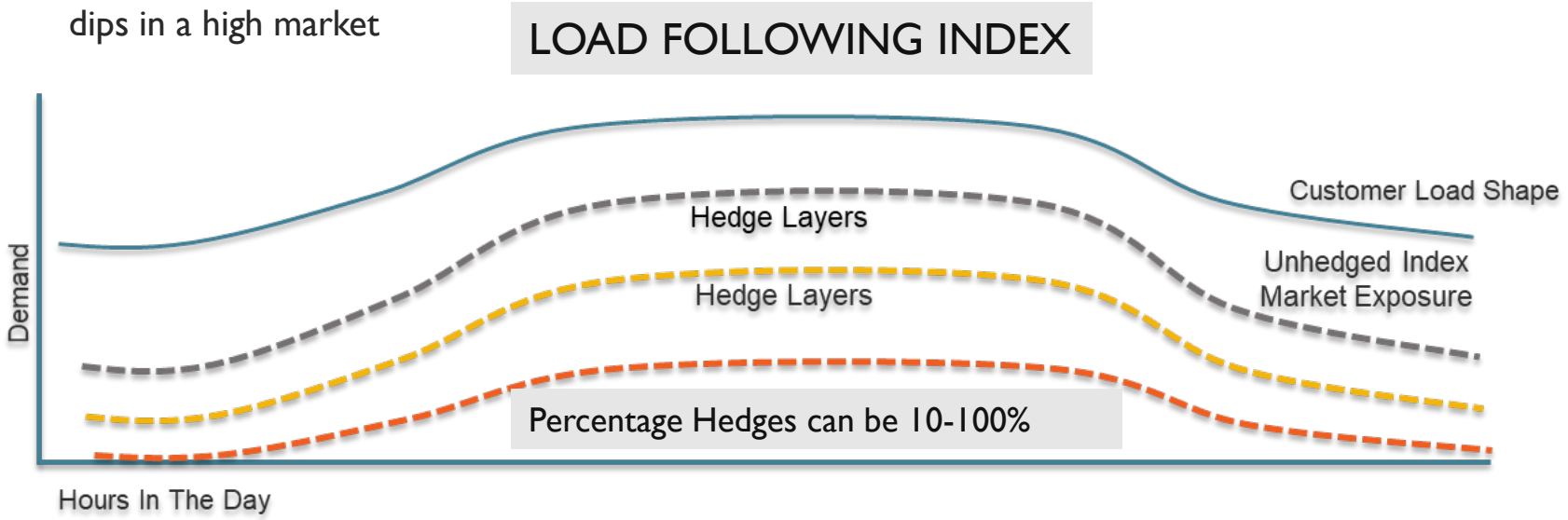


Product Risk and Opportunity	• Complete exposure to market volatility • No limit to upside risk • Pricing uncertainty can increase Op Ex	• Risk is spread over multiple layers • Can layer in defensive buys based on market movements • Access to Energy Advisor to help navigate the market	• Price certainty, but only have one chance to "time" the market • No optionality to buy if market drops • Fully exposed to market upside while waiting

How Load Following Index Works

Customized Product Structure

- Choose the percentage of your load that you want to lock in at a fixed price (Around The Clock pricing); in increments of 10% up to 100% - and the duration of the term
- Hedges can be seasonal, monthly, annually or full term
- Any unhedged load remains in the hourly Index Market.
- **Benefit**: Customers can lock in load over time to become fully fixed, allowing them to take advantage of dips in a high market



Capacity and Transmission may be Passed-Through or Fixed upfront.

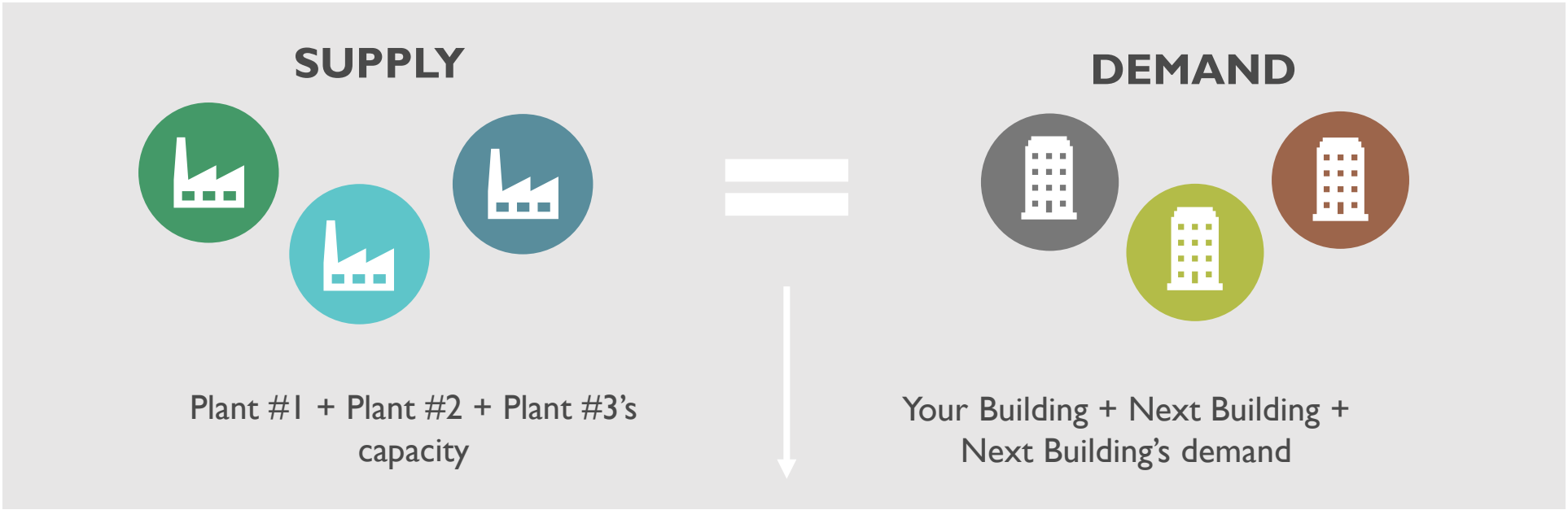
Source: Direct Energy / NRG

2nd Prong to Strategy

DR – Demand Response
SR – Synchronized Reserve
ER – Economic Reserve
FR – Frequency Regulation
EV – EV Charging
EE – Energy Efficiency

The Electric Grid

- ✓ Because electricity cannot be stored, supply must equal demand at all times
- ✓ Demand Response provides the grid with a 'line of last defense' for preventing blackouts



How to Balance Supply and Demand

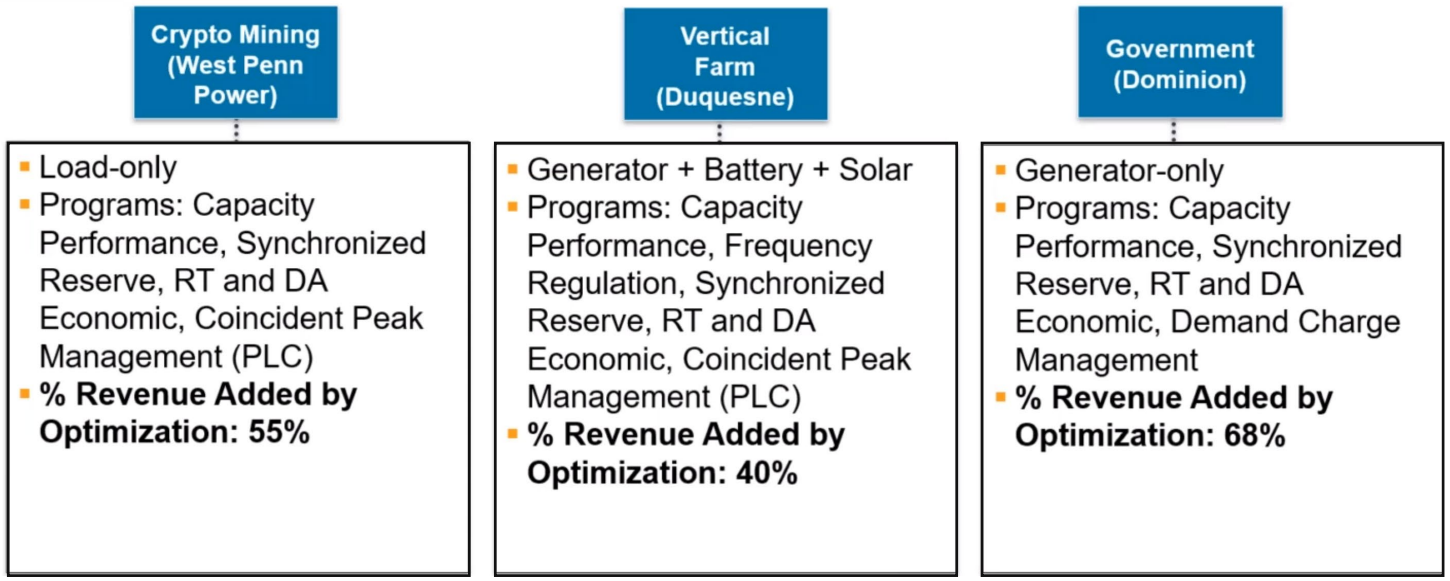
Bring more Power Generation online via Ancillary power plants

Curtail During Critical Times Consume less

PJM Based Revenue Programs

Specifics	Capacity (CP)	Economic	Ancillary (SR)	Frequency Reg (FR)	Energy Efficiency (EE)	Peak Demand (PDM)
Notification Lead Time	LONGER 30 min. – 2 hour	LONGER Day-Ahead / Day-Of	SHORTER 0 – 30 min.	SHORTER: 2 second Signal	No curtailment action required	LONGER: Day Ahead/ Day of
Event Duration	LONGER 2 – 15 Hours	VARIABLE Customer price trigger choice	SHORTER </=10 min. to several hours	SHORTER: 1-5 Min +/- swing	No curtailment action required	Longer: 2-3 Hours
Event Frequency (annual)	Unlimited*	VARIABLE Customer price trigger choice	MORE >10	CONSTANT in Hours APPROVED	No curtailment action required	More: 10-15 Notifications
Performance Obligation	Mandatory	VARIABLE Customer price trigger choice	VARIABLE Customer participation choice	Variable Customer participation choice.	Measurement & Verification	Voluntary

PJM Based Revenue Programs – Example Scenarios



Source: PJM

How You Earn Revenue

Capacity and Energy Payments

Capacity Payment

- ✓ Main compensation – be on standby for actual emergency and for performance during a test

Energy Payment

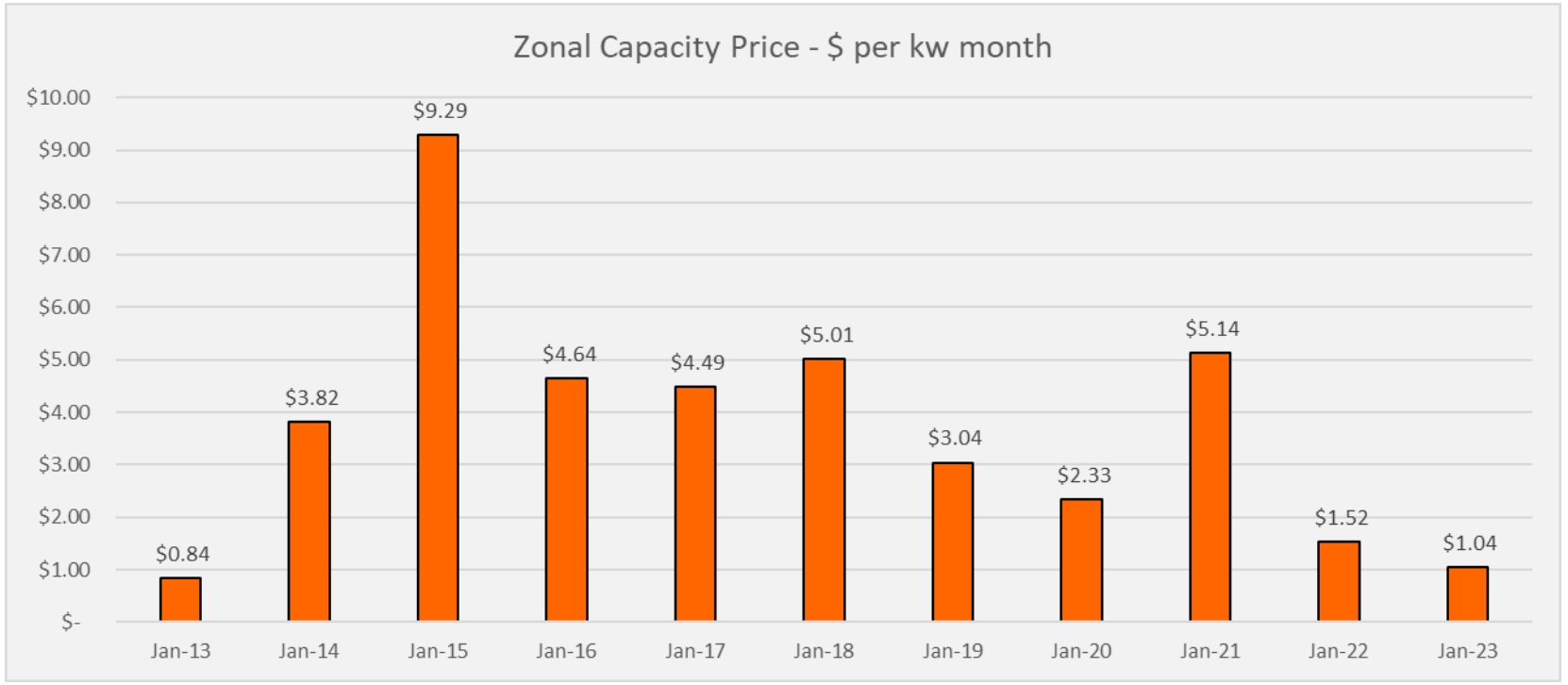
- ✓ Energy payments are based on the kWh amount reduced during an actual emergency

During Test or Event

- ✓ Get down to Target = PLC – Nomination
- ✓ Reduce to Target for duration of test/event to receive payment
- ✓ Smart meter provided to monitor drop

PJM Auction Results

Auction determines DR pay-outs and also Capacity Costs - part of Supply



Your Capacity ($) = PLC X Capacity cost X PJM factor 1 X PJM Factor 2

Sync Reserve Market

Program Overview

The Synchronized Reserve Market (SRM) program provides short-term, fast-response support to the grid in case of an unexpected spike in demand or shortfall in supply:

- Participants have 10 minutes to fully enact their participation plan
- Dispatches last 9 minutes on average– The program operates 24x7x365

Any CSP provider can utilize automated control over your curtailment and the CSP's automated system will adjust equipment or temperature set points to quickly reduce load, with minimal impact on operations

OR

On-Site Generators equipped with remote control capabilities seamlessly transfer facility load. SR-eligible generators must be able to transfer load in less than 10 min

28

Sync Reserve Overview

Response Types	Curtailment and Generation (Non-Emergency Permits Required)
Payments	Capacity payments for hours of availability
Costs	No upfront, out-of-pocket costs to participate
Program Period & Hours	Year-round, Available 24x7x365. Rolling enrollments. Customers opt in/out on hourly basis and set schedules
Notification Lead Time	10 minutes
Response Duration	Up to 30 minutes (most events are <15 minutes)
Dispatch Frequency	5-15 events per year; no maximum
Dispatch Trigger	Short-term imbalances in Supply/Demand (generator outage, transmission, etc.)
Baseline Measurement	Usage immediately prior to dispatch, raw drop measurement
Testing Requirement	Full AT required, up to 3 may be required in some cases
Metering Requirement	Standard ESS, 1-minute data required
Annual Payments	Increasing to ~$70K/MW-year in 2022
Penalties	Potential for retroactive loss of 25 days' revenue proportional to underperformance. Enel X Portfolio can often shield customers from Penalties. Customer will never owe Enel X or PJM any money.

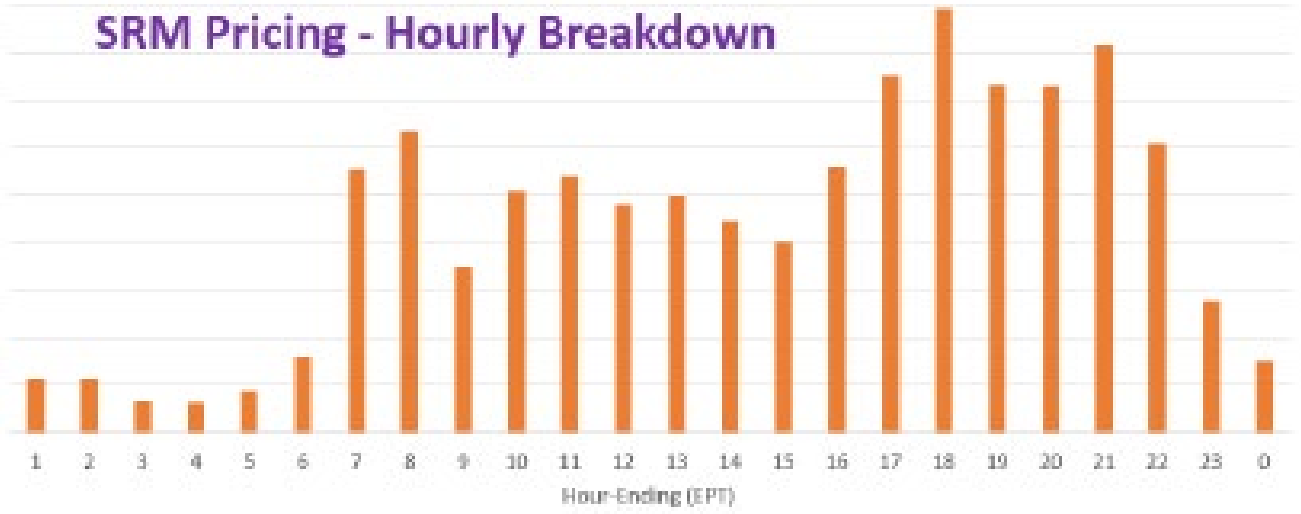
Sync Reserve Market

Program is Customizable

Pricing varies by hour and zone. CSP's bidding strategy ensures that Customer participates during the most lucrative hours based on your operating schedule

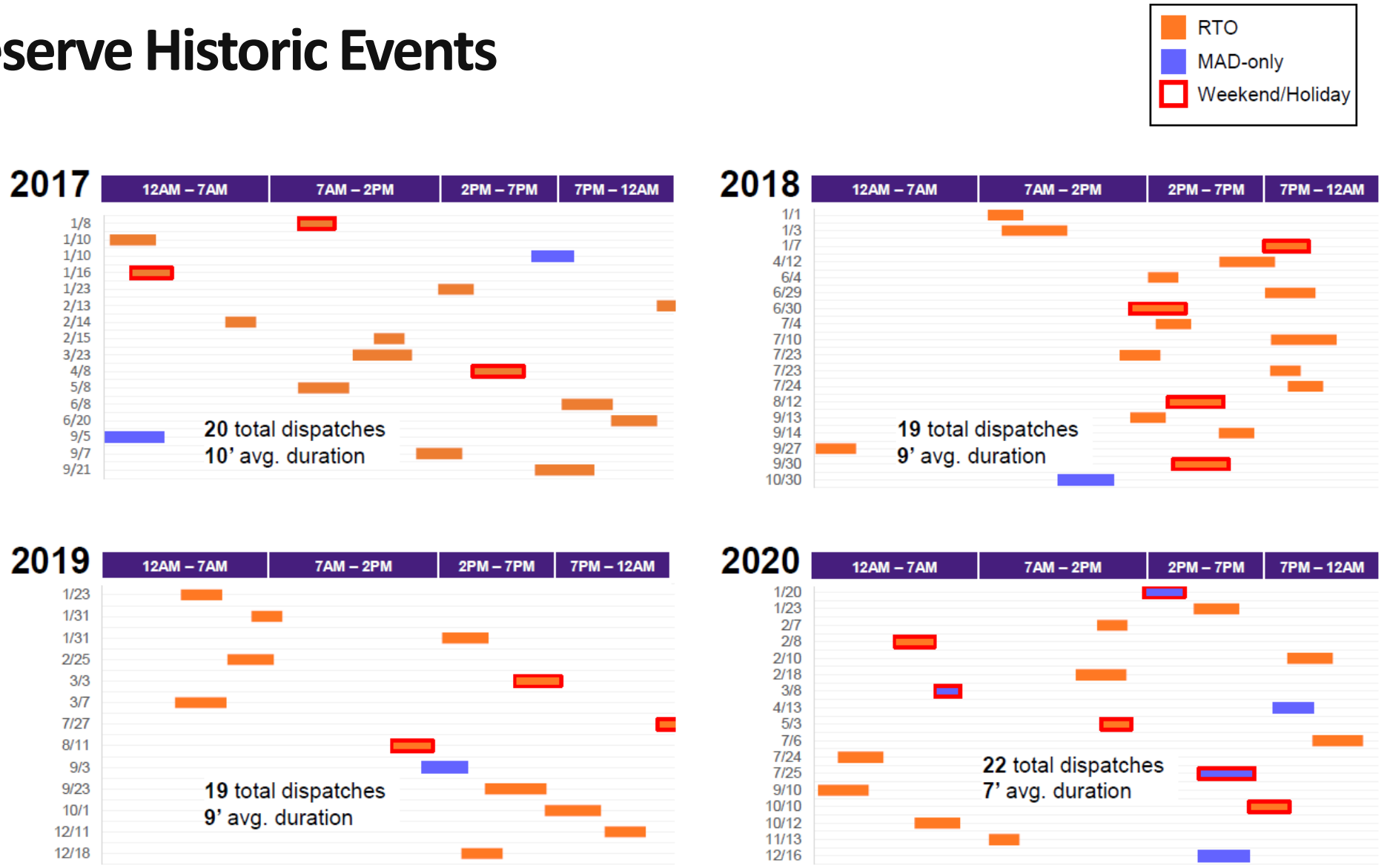
Customer will be paid regardless of whether an SRM event occurs, for the hours your facility is available to opt-in

CSP will bid Customer into the program on an hourly basis, based on a set operating schedule



30

Sync Reserve Historic Events



Stacking PJM Based Revenue Programs

Specifics	Capacity (CP)	Economic	Ancillary (SR)	Frequency Reg (FR)	Energy Efficiency (EE)	Peak Demand (PDM)
Notification Lead Time	LONGER 30 min. – 2 hour	LONGER Day-Ahead / Day-Of	SHORTER 0 – 30 min.	SHORTER: 2 second Signal	No curtailment action required	LONGER: Day Ahead/ Day of
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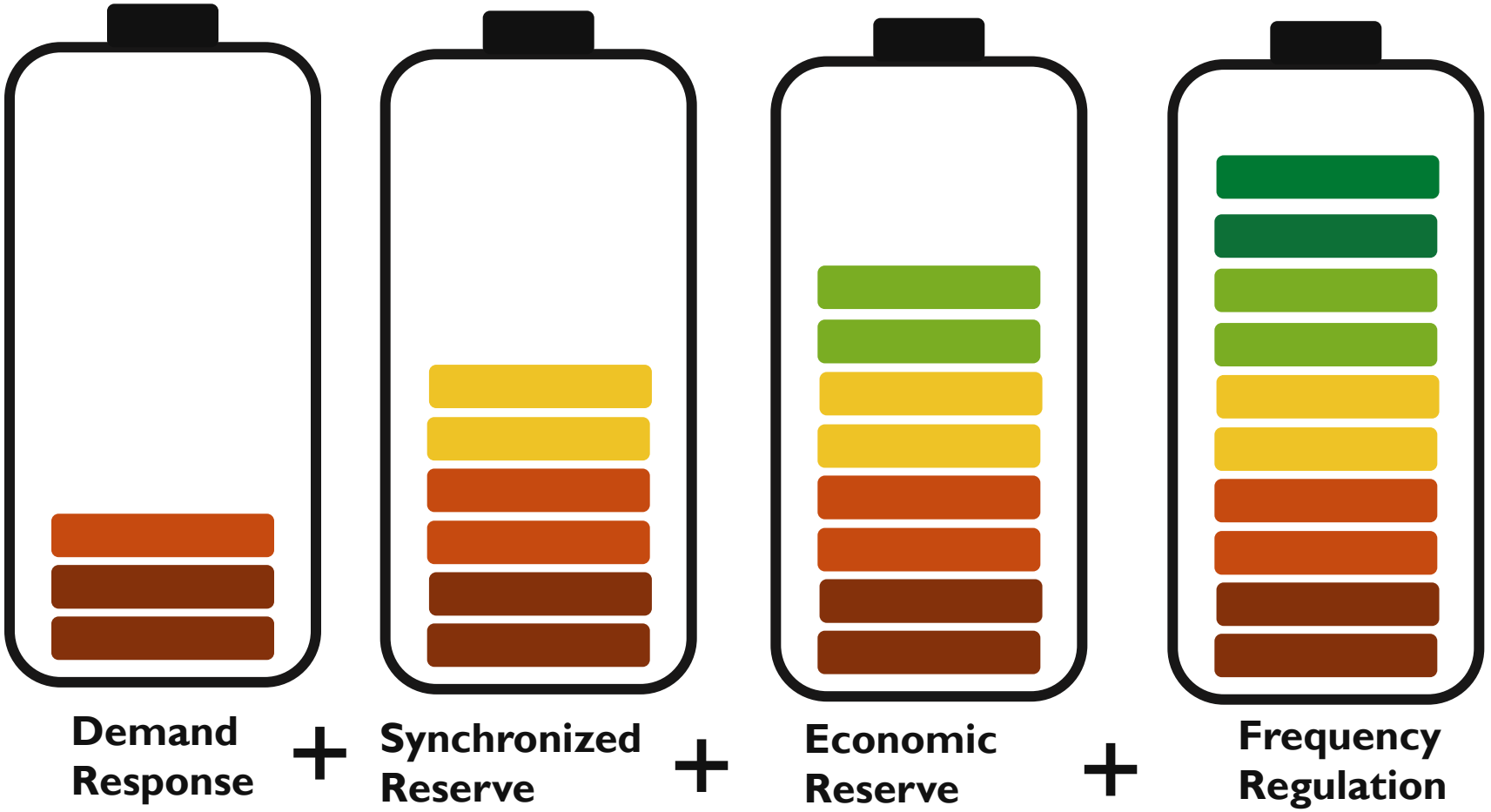
Stacking the Opportunities



3rd Prong to Strategy

Energy Efficiency & Renewables

3rd Prong to Strategy

ASHRAE

American Society of Heating, Refrigeration & Air-Conditioning Engineers

Energy auditing is unregulated

Lighting and HVAC contractors will say they do energy audits

How do you know what will be included in an energy audit?

How do you know what level of rigor will be used?

Will energy savings be calculated or estimated? If calculated – by what standard?

Will recommendations be unbiased and independent?

This is an Actual Audit Report

1. Change lighting to LED technology

2. Change setpoints on thermostats

3. Upgrade HVAC units to higher EER rated models

4. Add insulation and seal areas with infiltration

ASHRAE

American Society of Heating, Refrigeration & Air-Conditioning Engineers

ASHRAE got involved and developed ASHRAE Standard 211, which provides clear guidelines on energy audits

This Standard applies to all buildings except single-family homes, multi-family structures of 3-stories or less above grade, manufactured houses, and mobile homes.

Also, it is not meant to cover industrial plants but the framework is still useful.

Purpose of the Standard

The purpose of this standard is to establish consistent practices for conducting and reporting energy audits for commercial buildings.

Defines the procedures required to perform Energy Audit levels 1, 2 and 3;

Provides a common scope of work for these audit levels for use by building owners and others;

Establishes consistent methodology and minimum rigor of analysis required; and

Establishes minimum reporting requirements for the results of energy audits.

Qualified Auditor

Your Qualified Auditor should comply with ASHRAE Standard 211-2018.

Level 1 – Walk-around with very experienced engineer; only observations noted; utility bills reviewed. No calculations made, only estimates provided.

Level 2 – Comprehensive. Data collected, technical and financial calculations made. 95% of all audits are this level.

Level 3 – Deeper engineering level of analysis. Often called for when building must be modeled with software or 3rd party financing for large upgrade. Also includes assessing risk levels.

Auditor should hold a CEM, or CEA

Auditor should have previous experience with similar buildings.

ASHRAE Standard 211

Scope of an Energy Audit

- ✓ Building envelope
- ✓ Lighting (interior and exterior)
- ✓ HVAC
- ✓ BASs and EMSs
- ✓ Heating, chilled water, condenser, and DHW systems/pumps
- ✓ Motors and pumps
- ✓ Steam systems
- ✓ Refrigeration
- ✓ Onsite power generation
- ✓ Uninterruptible power systems
- ✓ Data centers
- ✓ Conveyance systems
- ✓ Plug loads
- ✓ Laundries
- ✓ Food prep
- ✓ Pool, saunas, and spas

ASHRAE Standard 211

NOT INCLUDED IN SCOPE

- ✓ Compressed air
- ✓ Industrial refrigeration
- ✓ Industrial heat processing
- ✓ Industrial process efficiency
- ✓ Irrigation systems
- ✓ Agricultural systems

ASHRAE Standard 211

General Procedures and Level 1

General

- Prelim evaluation of energy use from 12 – 36 months of bills
- Determine energy intensity (EUI) (kBtu/SF or as appropriate)
- Determine energy cost index (Total $/SF)
- Compare EUI to peer group
- ID any hazardous materials and notify appropriate personnel

Level 1

1. Review historical utility data
2. Review rate structure
3. Pre-visit interview
4. Facility site survey
5. Review O&M problems/needs
6. Interview key personnel
7. Space function analysis
8. ID no/low cost EEMs
9. ID potential capex EEMs
10. Review results with key personnel

ASHRAE Standard 211

Level 2

Level 2

1. All Level 1 procedures
2. Breakdown of energy use, demand and cost categories
3. Facility site survey with knowledgeable personnel
4. Review of O&M procedures
5. Determine key operating parameters
6. Conduct end use breakdown
7. Review building end-use categories
8. Evaluate distributed and renewable energy opportunities
9. Develop initial EEM list
10. Determine impact of each EEM as well as method to determine savings (calculation, energy model, stipulated values)
11. Evaluate each EEM
12. Consider interactive effects
13. Estimate EEM costs
14. Provide written report
15. Review with owner's representative

ASHRAE Standard 211

Level 3

Level 3

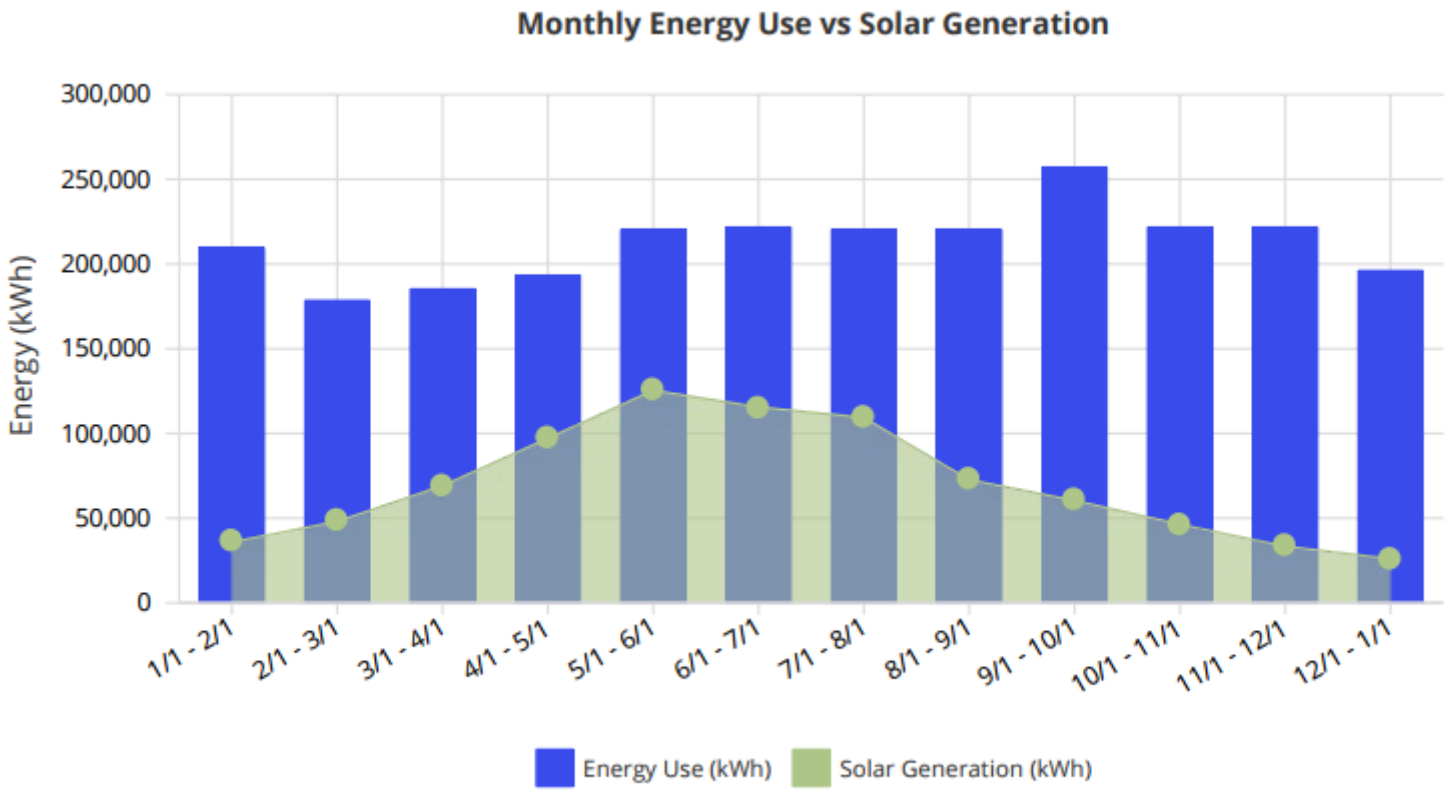
1. All Level 2 procedures
2. Conduct deeper energy analysis on capex EEMs
3. Determine which EEMs are recommended for implementation
4. Develop energy models as required
5. Conduct more in-depth economic analysis on EEMs
6. Conduct life cycle cost analysis
7. Evaluate risk assessment
8. Provide written report

3rd Prong to Strategy

Energy Efficiency & Renewables

3rd Prong to Strategy

Solar PV


Monthly Energy Use vs Solar Generation
Energy (kWh)
300,000
250,000
200,000
150,000
100,000
50,000
0
1/1 - 2/1
2/1 - 3/1
3/1 - 4/1
4/1 - 5/1
5/1 - 6/1
6/1 - 7/1
7/1 - 8/1
8/1 - 9/1
9/1 - 10/1
10/1 - 11/1
11/1 - 12/1
12/1 - 1/1
Energy Use (kWh)
Solar Generation (kWh)

Renewables

- ✓ Solar PV: $2 - $3.50/W SPB = 7 to 15 years
- ✓ Wind: $1.30 - $1.50/W (2-3 MW) SPB = 5 years
- ✓ Geothermal: $4 - $4.50/W SPB = 7 to 8 years
- ✓ EV Charging: Level 2, DCFC, Tesla - Revenue Opportunity

Two Compelling Facts

Renewable energy would have to expanded 90-fold to replace hydrocarbons in 20 years. It took 50 years for oil to expand only 10-fold.

The tiny 2% decline in hydrocarbon share of world energy use involved over $2 trillion in total spending on alternatives over the same period. Today renewables are less than 5% of global energy use.

Source: Manhattan Institute

Three Prong Strategy

Strategic Procurement

Energy Efficiency & Renewables

Demand Response SR/ER/FR EV/EE

Final Thought

Energy efficiency increases energy demand by making products & services cheaper: since 1990, global energy efficiency improved 33%, the economy grew 80% and global energy use rose over 50%

Source: Manhattan Institute

Contact Us

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BIOGRAPHICAL INFORMATION

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Tom is the founder and president of Sustainable Energy Services, Inc., an unbiased and independent, nationally certified woman-owned energy management services company that serves non-residential customers throughout the U.S. Services include ASHRAE Level 1, 2 & 3 Energy Audits, Energy Procurement, Demand Response, Energy Project Management, Post Project Measurement and Verification, Utility Rebates, and other energy-related services.

Prior to Sustainable Energy Services, Tom was co-founder of PCX Energy Services where he was the lead auditor for industrial and commercial energy audits. He was also a member of the energy consulting practice at FirstEnergy Corporation and held senior management positions at Buschman Corporation, Enersys and Sola Electric.

Tom has been a regular speaker on energy efficiency at regional and national energy conferences including the Annual Ohio Energy Conference, AEE World Energy Conference, AEE East Energy Conference and AEE West Energy Conference. He has also been a past speaker at the National Retail Construction Conference, National Restaurant Association Conference, National Grocers Association Conference, AEP Conference on Compressed Air, and is a speaker/trainer for the Operator Training Committee of Ohio. He is a member of the Association of Energy Engineers, and is a Certified Energy Manager (CEM), Certified Energy Auditor, (CEA), Certified Demand Side Manager (CDSM), and Certified Compressed Air System Specialist (CCASS). Tom earned his BS in Physics from Northeastern Illinois University and an MBA from Lake Forest Graduate School of Management.