PEER Screening
Case Studies & Lessons Learned

June 20, 2016
IDEA Community Energy:
Moving Microgrids Forward

Discussion Topics

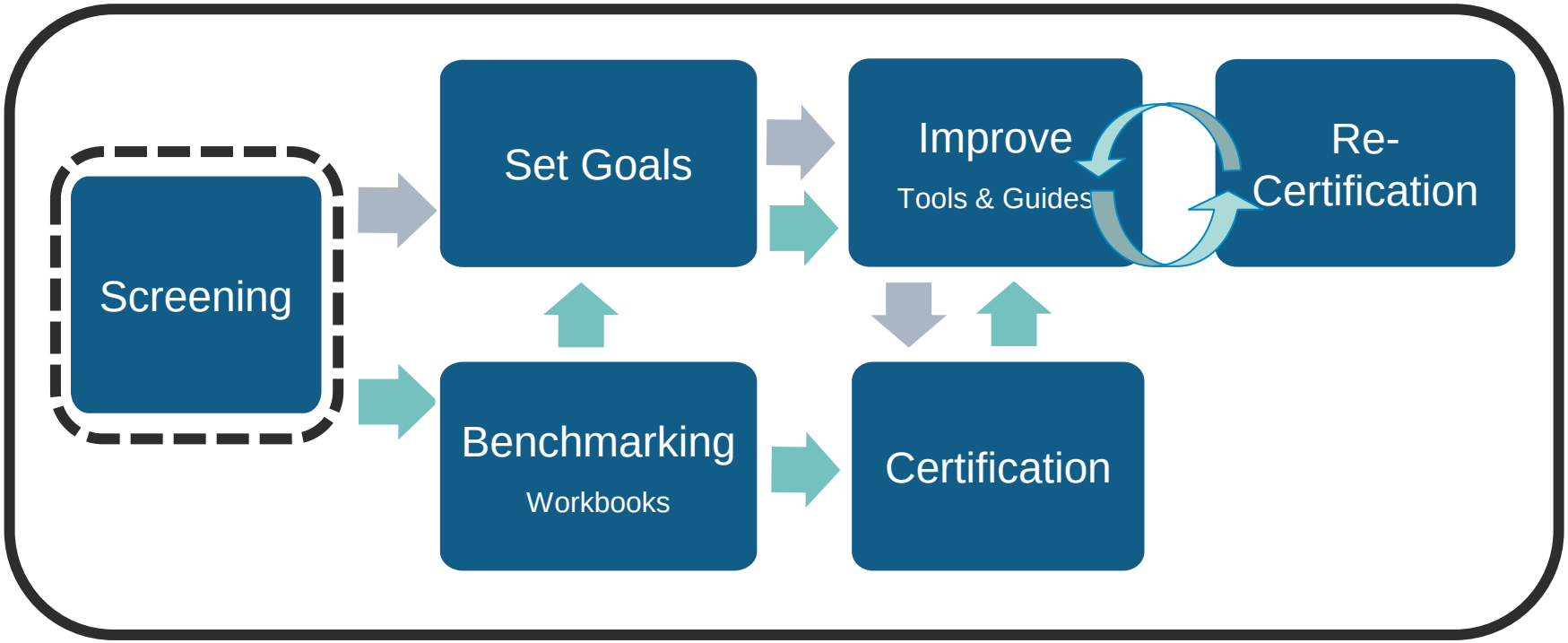
- About PEER Screening
- PEER Performance Benchmarking
- Case Studies

PEER Participation and Screening

1. Reduce Costs
2. Improve Performance
3. Minimize Risks

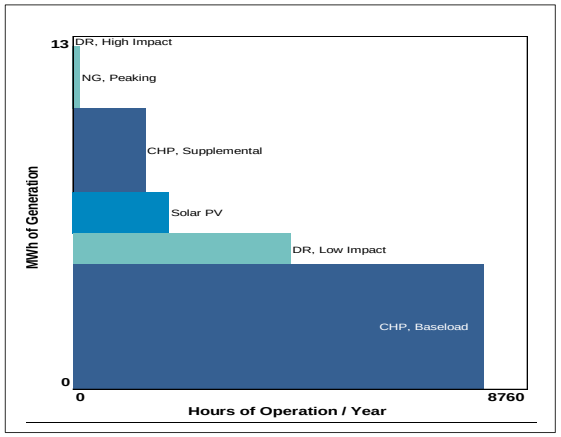
PEER Engagement

- Education – Fundamentals & Advanced
- Participation – Tools, guides, workbooks, and certification



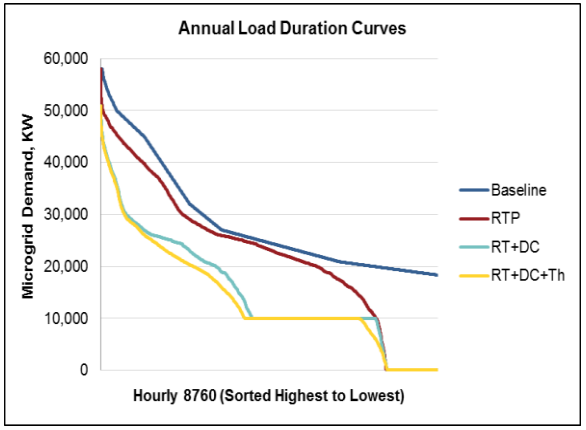
Step 1: Microgrid 8760 Analysis

Islanding Concepts



- Baseload Co-generation
- On-peak Co-generation
- Storage
- Solar PV
- Peaking generators
- Demand response

Rates & Operating Modes



Value, Savings & Payback

Description	Sample Project ($000)	Sample Project ($/MWh)
Baseline Cost	**~43,000**	173
Thermal Energy*	1,000	4
Power Supply*	10,000	40
Electric Distribution*	1,700	6
Demand/Standby Charge*	8,100	33
Solar PV	200	1
Storage	500	2
Ancillary Service	1,000	4
Load Response	1,400	6
Microgrid Operations	(2,600)	(10)
Savings	**~21,300**	86
% Reduction and Simple Payback	~50% / 5.5 yrs	

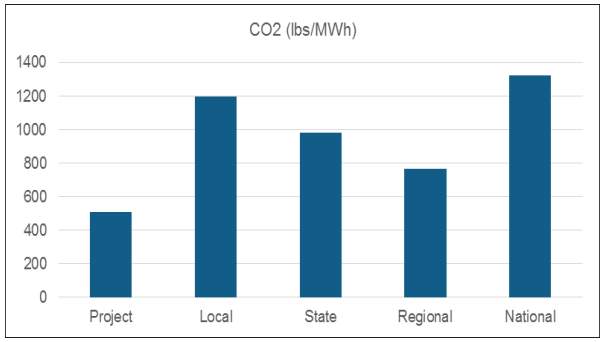
8760 Report

Step 2: PEER Screening

PEER Readiness

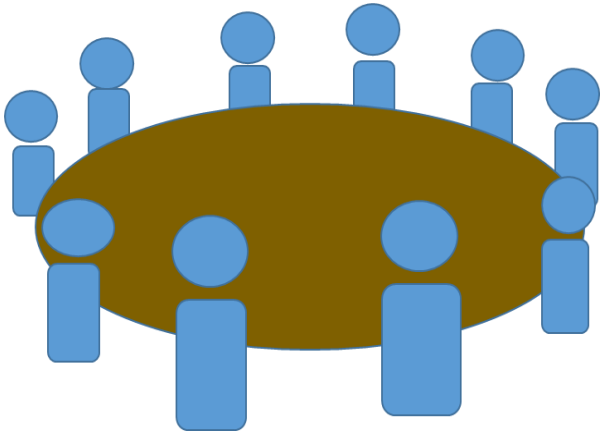
Category	Prerequisites	Minimum Points
Reliability and Resiliency	2 of 4 prerequisite(s) may not yet be satisfied	Project appears to meet point minimum
Energy Efficiency and Environment	Ready	Project appears to be on the threshold of meeting point minimum
Operational Effectiveness	1 of 1 prerequisite may not yet be satisfied	Project appears to meet point minimum
Customer Contribution	1 of 4 prerequisite(s) may not yet be satisfied	Project appears to be on the threshold of meeting point minimum
Point Total		Based on the data provided, project is likely short of minimum points needed to achieve PEER certification.
Recommendation	**Pursue PEER Participation, Improvement Path** Register for PEER Participation to gain access to the Improvement Toolkit. Use PEER insights to develop and comprehensive improvement plan including short-term and long-range objectives.	

Benchmarking

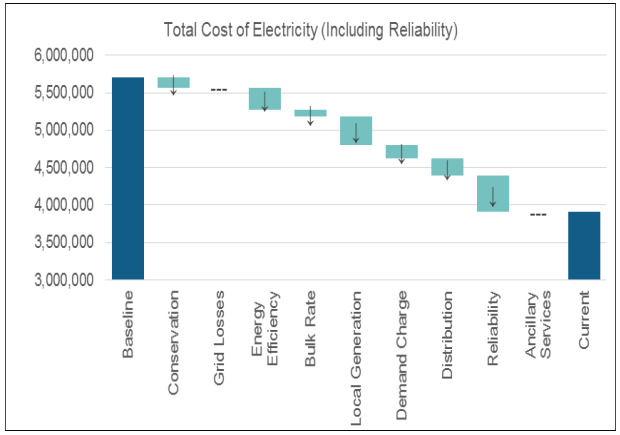


- Reliability
- Energy efficiency
- CO_2, NO_x, SO_2
- Water
- Waste

Screening Workshop



Value/Gap Analysis



Screening Report

PEER Benchmarking

PEER Benchmarking

Performance Outcomes	Benchmark	Performance	% Improve
Cost Savings, $/MWh	**$152**	**$86**	**43%**
Outage Duration, min (SAIDI)	**270**	**20**	**> 100%**
Outage Frequency (SAIFI)	**1.0**	**0.1**	**> 100%**
Energy Efficiency and Environmental			
Energy Efficiency, MMBtu / MWh	8.2	3.4	60%
CO_2 Intensity, lb. / MWh	1,000	480	52%
Water Intensity, gal / MWh	330	50	86%
SO_2 Intensity, lb. / MWh	0.8	0.00	> 100%
NO_X Intensity, lb. / MWh	1.0	0.1	90%
Solid Waste, % Recycled	73%	100%	37%
System Energy Efficiency	**60%**	**82%**	**40%**
Local Capabilities / Grid Services (DER: Solar, DR, Generation)		**43%**	

PEER Benchmarking

Project Capabilities	Performance
Local Capabilities (DER: Solar, DR, Generation)	**43%**
Resiliency	
Islanding	30%
Alternate Supply	50%
Distribution Auto Restoration	6%
Distribution Redundancy	100%
Undergrounding	100%
Damage and Exposure Prevention	90%
District Energy	**100%**
Customer Engagement (Behind Meter)	
Demand response	13%
Renewable	0%
Clean generation	0%
Advanced Metering	0%

PEER Screening Case Studies

Case Study Descriptions

Description	Case 1	Case 2	Case 3
Type	Medical		University
Size	6 Million SF, 70 Bldgs.		110 Bldgs.
Peak Demand (MW)	15.5		15.5
Annual Demand (MWh)	75,000		77,700
Thermal (MMBtu/yr.)	190,000		260,000
Utility	NSTAR	NGRID	PA Citizens

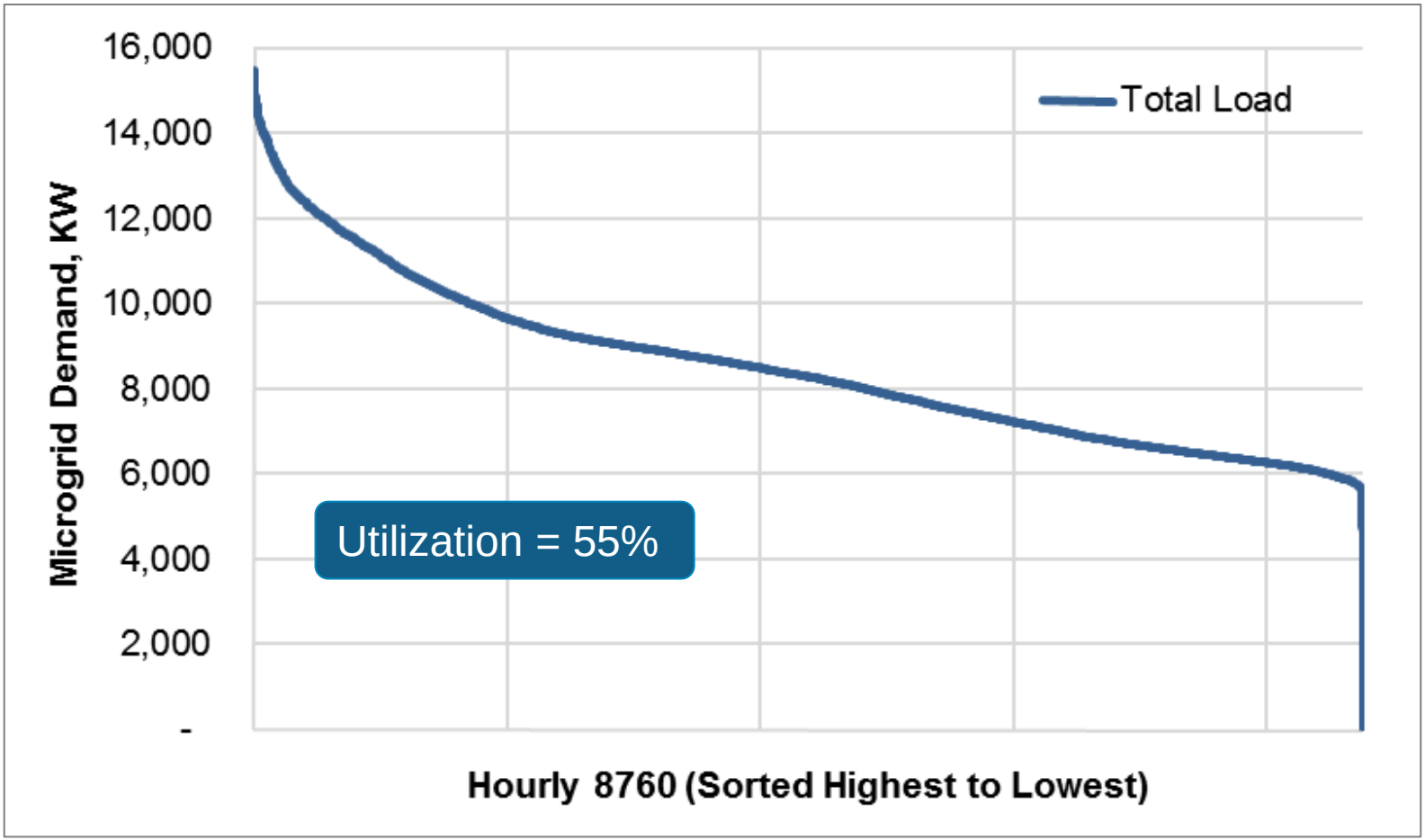
Case Study

Rates & Assumptions (2015 Prices)

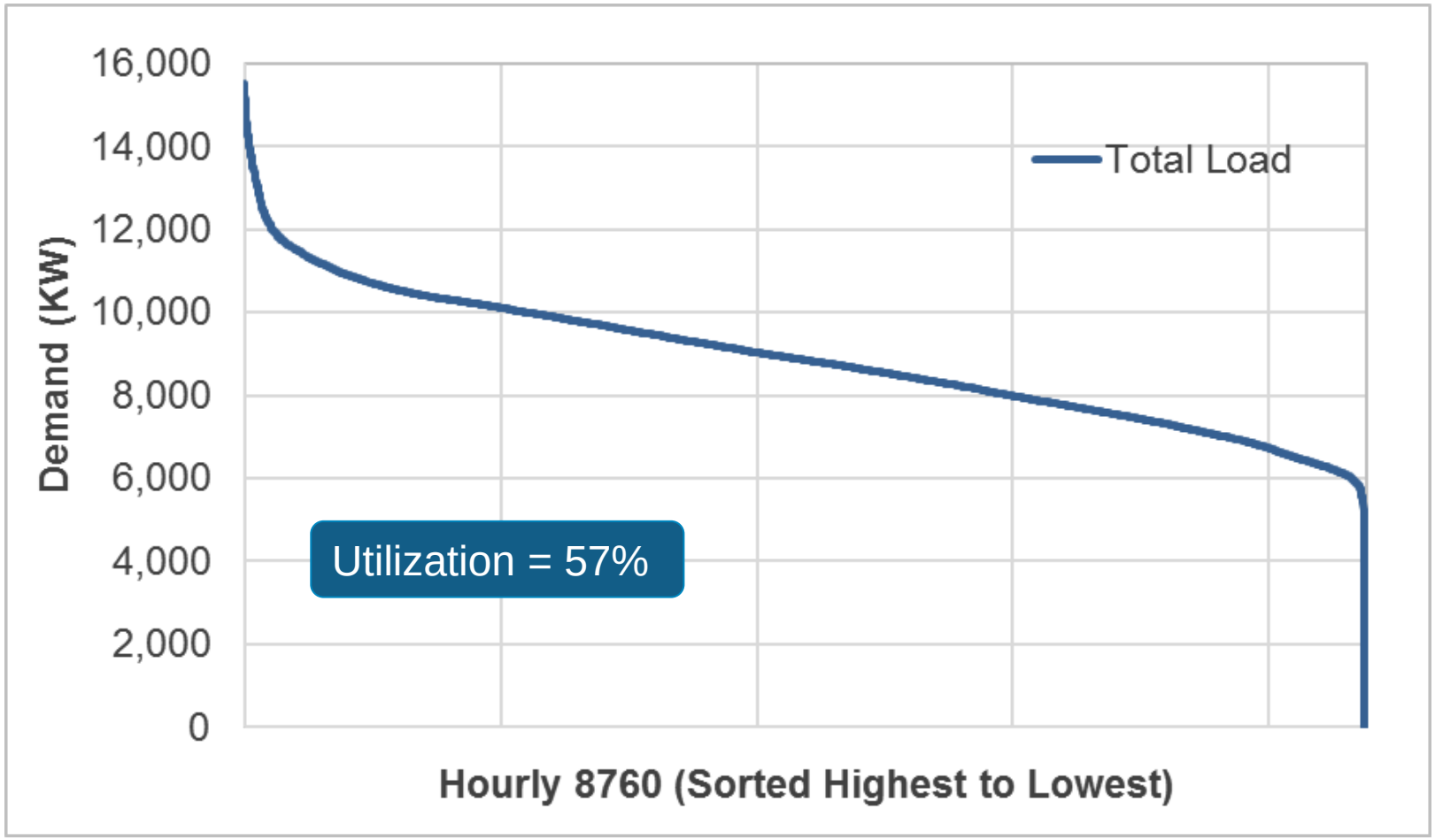
Description	Case 1	Case 2	Case 3
Demand Charge - Summer, $/kW-mo	23	4	5.2
Demand Charge – Winter, $/kW-mo	18	4	5.2
Standby Charge, $/kW-mo	8.6	0	2.4
T&D Charge On-Peak, $/MWh	10	46	10
T&D Charge Off-Peak, $/MWh	6	38	10

Description	Case 1	Case 2	Case 3
Power Supply Cost, $/MWh	75 / RTP	69 / RTP	73 / RTP
Natural Gas Fuel Cost, $/MMBtu	7.5	7.5	6
ISO Capacity Charge, $/kW-yr	40.8	40.8	49.1

Case 1 & 2: Customer Annual Load Duration Curve



Case 3: Customer Annual Load Duration Curve

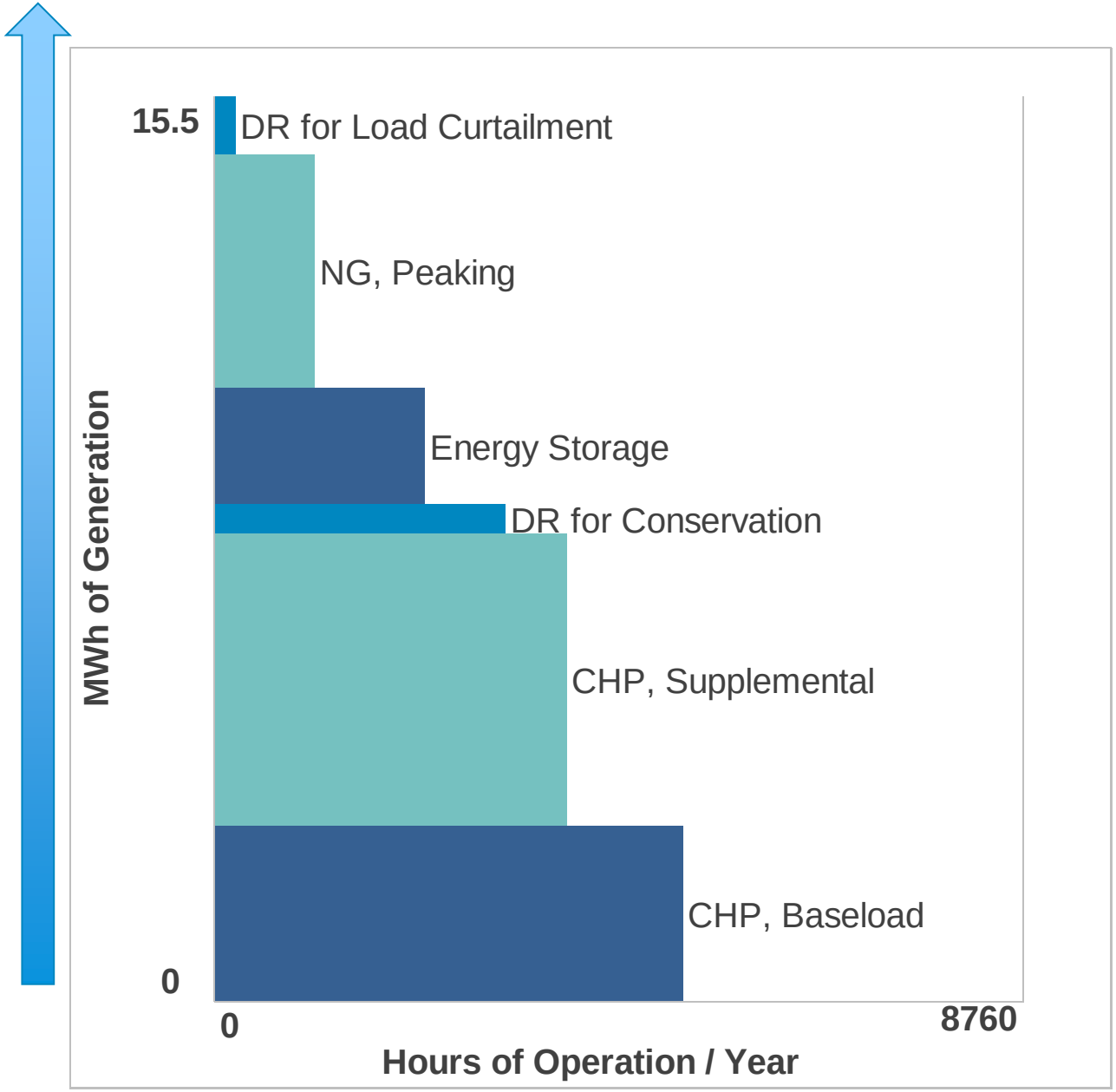


Customer Baseline Annual Energy Costs

Description	Case 1	Case 2	Case 3
Thermal Energy	21	21	23
Electric Energy	131	126	103
Power Supply	75	69	73
Demand	40	8	10
Capacity Charge	8	8	10
T&D	8	41	10
Baseline Cost, $ / MWh	**152**	**147**	**126**
Baseline Cost, $ million	**11.3**	**10.9**	**9.8**

Case 1 & 2: Microgrid Islanding and Price Response

Typically, assets installed over a phased evolution

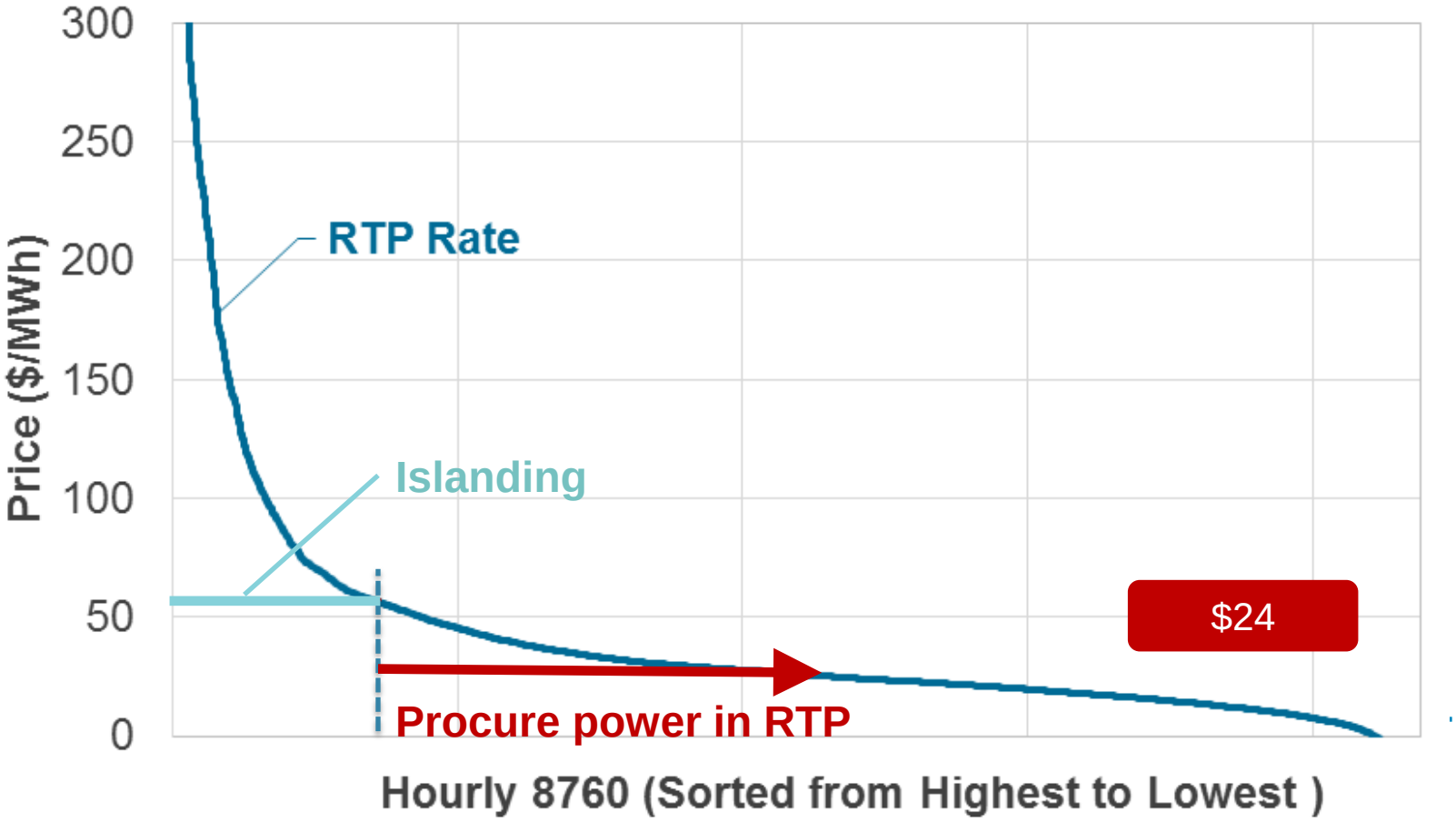


Case 2: Microgrid Capital and Operating Costs

Description	Capital Cost ($000±30%)	Generation O&M Cost		SEI (MMBtu/MWh)	
		Fixed ($/kW-yr)	Variable ($/MWh)	Min	Max
3 MW Turbine & HRSG	6,300	0	10	5.5	10.5
5 MW Cogeneration	10,500	0	10	7	9
4 MW Reciprocating Engine	7,600	0	0	N/A	10
12 MWh of storage	2,160				
500 kW DR for Conservation	500				
1 MW DR for Load Curtailment	1,000				
Master Controller	1,300	$150,000 in additional operating costs			
Investment Cost	**29,360**				

Case 3: RTP Price Duration Curve

PJM ISO 2015

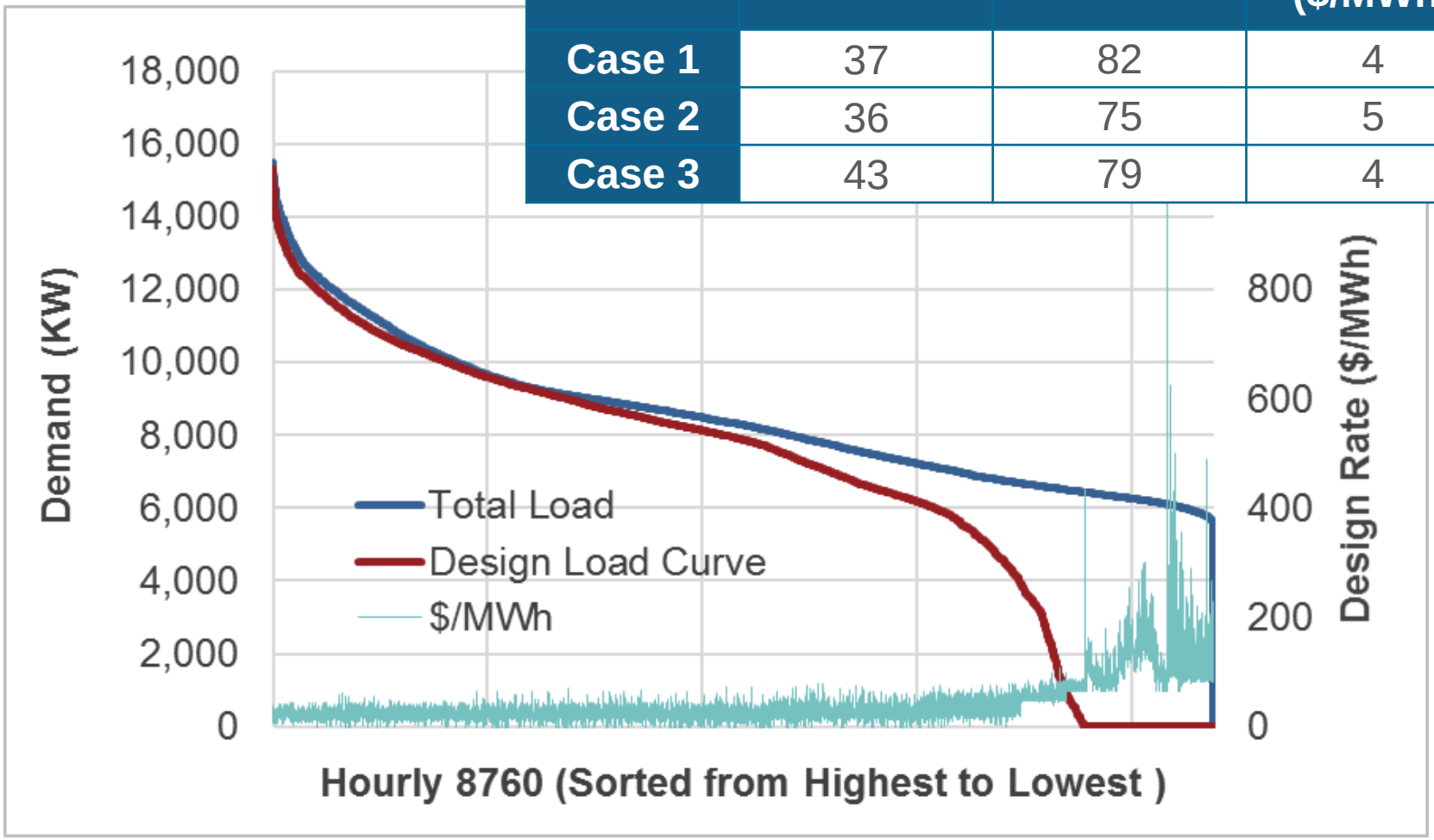


Microgrid Operating Strategies

Real-Time Procurement 2015 (Mode 1)

PJM ISO East

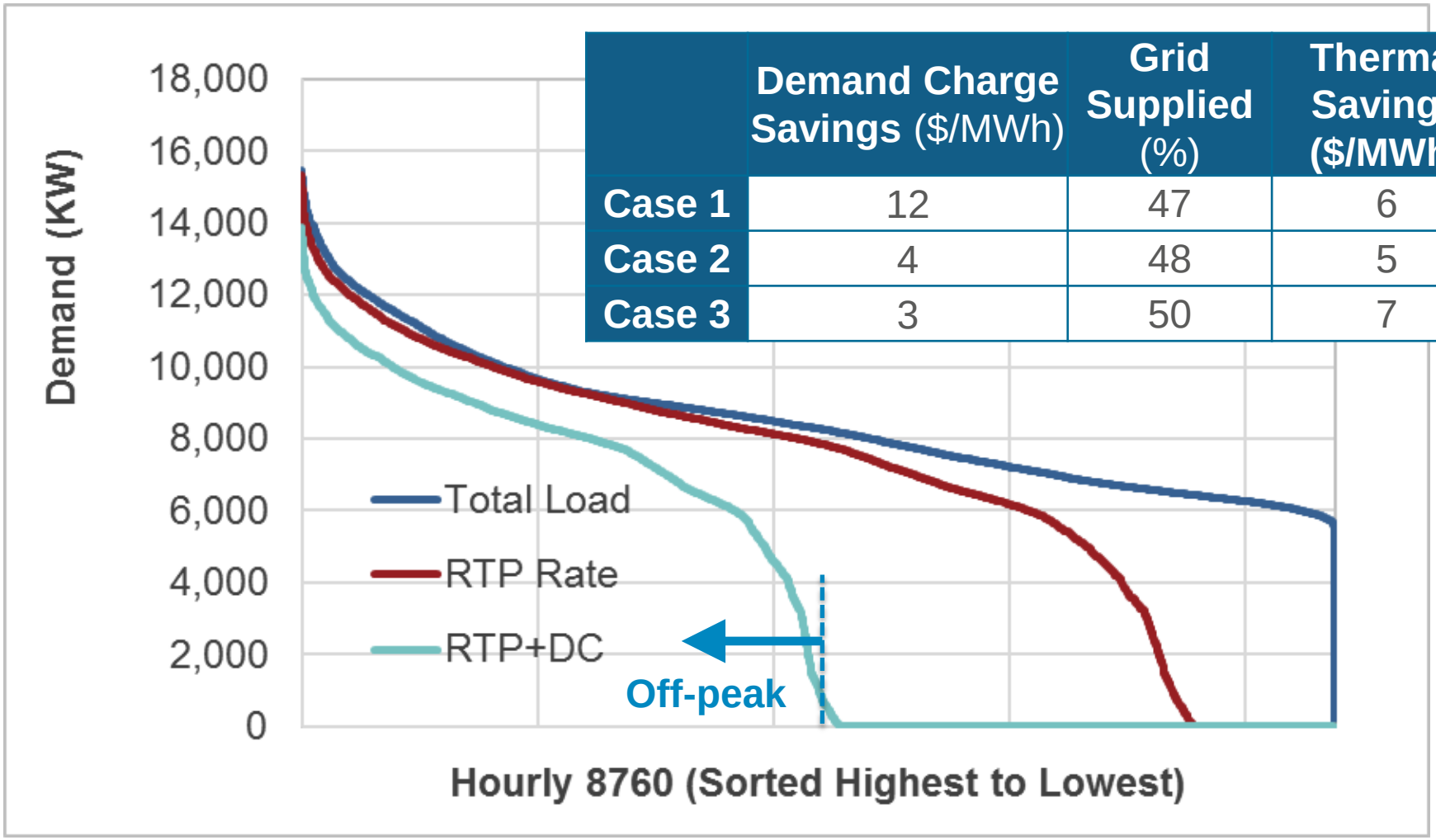
	RTP Savings ($/MWh)	Grid Supplied (%)	Thermal Savings ($/MWh)
Case 1	37	82	4
Case 2	36	75	5
Case 3	43	79	4



Microgrid Operating Strategies

Demand Charge Reduction (Mode 2)

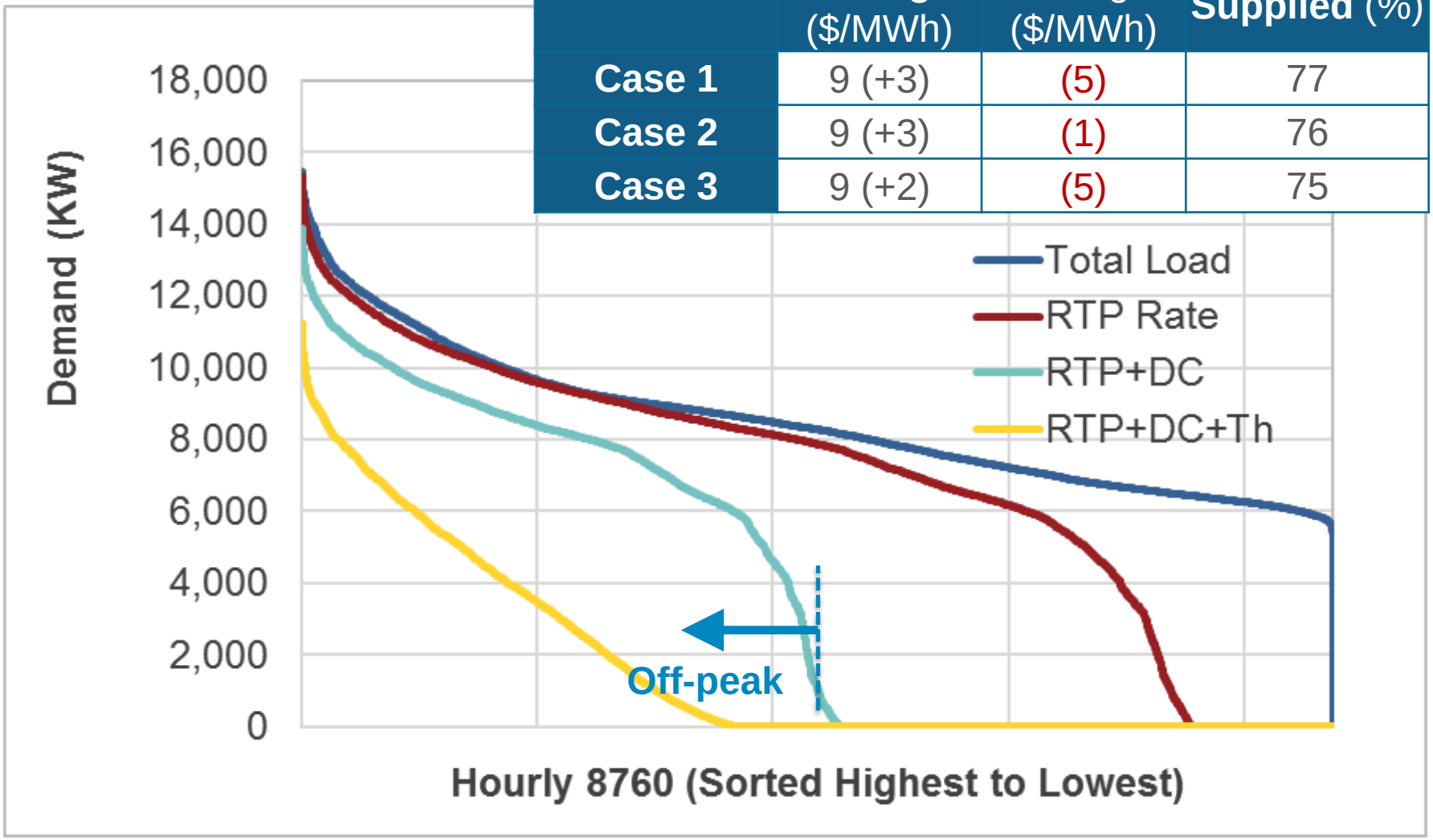
	Demand Charge Savings ($/MWh)	Grid Supplied (%)	Thermal Savings ($/MWh)
Case 1	12	47	6
Case 2	4	48	5
Case 3	3	50	7



Microgrid Operating Strategies

Maximum Thermal (Mode 3)

	Thermal Savings ($/MWh)	RTP Change ($/MWh)	Grid Supplied (%)
Case 1	9 (+3)	(5)	77
Case 2	9 (+3)	(1)	76
Case 3	9 (+2)	(5)	75



Microgrid Annual Savings and Payback

Description	Case 1	Case 2	Case 3
Baseline Cost	**152**	**147**	**126**
Thermal Energy*	6	9	7
Power Supply*	37	35	38
Demand/Standby Charge*	12	3	3
Capacity Charge*	4	4	6
Electric Distribution*	3	13	3
Ancillary Service	1	1	5
Energy Storage	1	2	1
Demand Response	3	2	1
Microgrid Operations	(2)	(2)	(2)
Savings, $ / MWh	**66**	**67**	**62**
Savings, $ million	**4.9**	**5.0**	**4.8**
% Savings	**43%**	**46%**	**49%**
Simple Payback	**6.0**	**6.1**	**6.1**

* Includes generation fuel and O&M costs

Microgrid Annual Savings and Payback

Description	Case 1	Case 2	Case 3
Baseline Cost	**152**	**147**	**126**
Savings	**66**	**67**	**62**
Combined cycle – gas & steam tur			**4**
Improved chilling COP (0.2 kW/ton)	**6**	**6**	**6**
Recovered rental space savings			
Power factor			
Power quality			
Power reliability			
Lower insurance cost			
Other ?			
Savings			**72+**
Simple Payback			**< 5.3**

* Includes generation fuel and O&M costs

QUESTION AND ANSWER