

Varied Business Models for the Varied Regulatory Landscape

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Public

Powering a more prosperous world in 2019

190

Countries & territories

61,615

Global employees

1.4M+

Engines built in 2019

8,000

Wholly-owned & independent distributor & dealer locations

\$1B

Invested in research & development in 2019

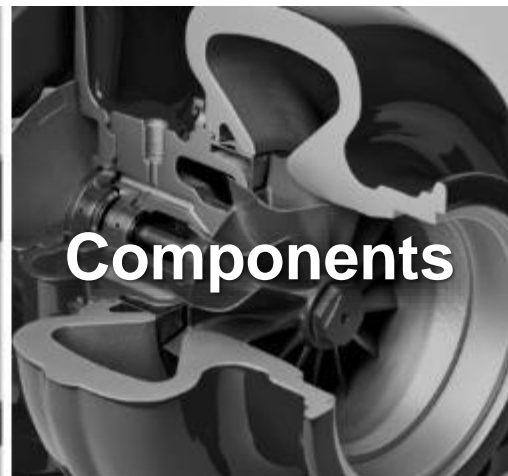
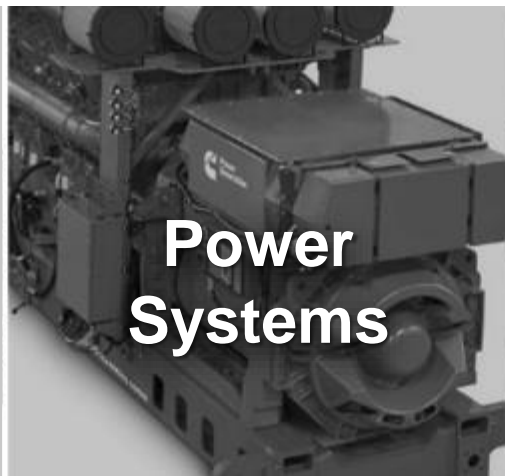
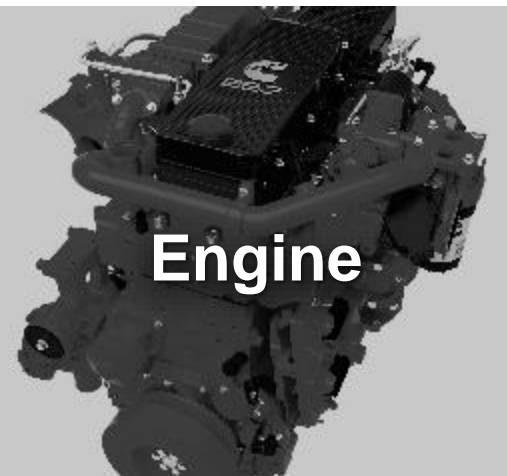
100

Years of industry leadership

As published in the 2019 10K found on cummins.com

Five operating segments

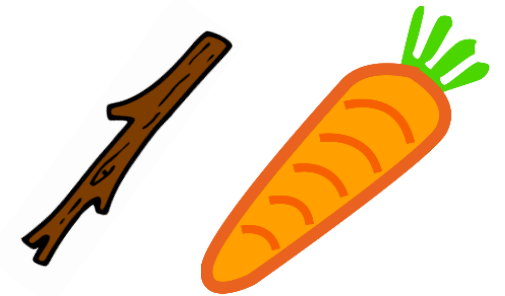
Cummins has a 100-year-long track record of delivering leading power solutions. As we look ahead, we know our industries and markets will continue to change, and we are committed to bringing our customers the right technology at the right time.



Fundamentals; Utility programs and tariffs

- Utility programs are typically written in tariffs so the terms can be used interchangeably
- Programs and tariffs can be in the form of demand response, special pricing in a rate tariff such as critical peak pricing or real time pricing, rebates
- Utility programs and tariffs can also be rules and protocols for establishing utility service, interconnection, or compliance requirements for taking utility service

Incentivizing different behaviors to optimize costs of the “system”

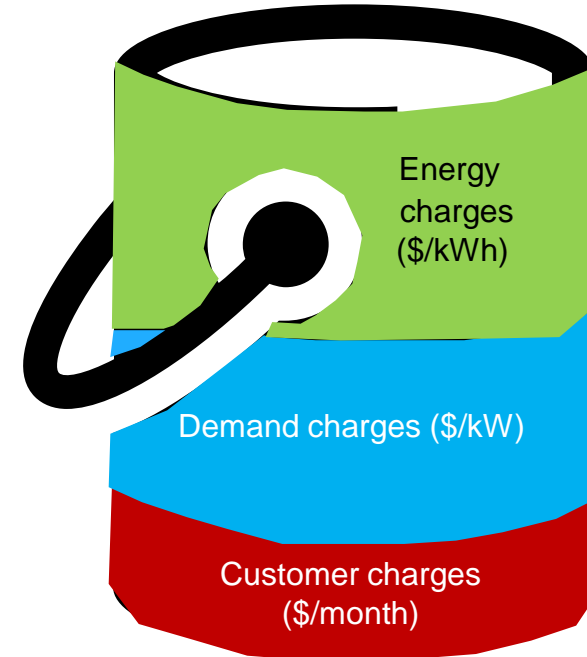


Ratemaking



Bucket of costs

Operating expense + (“utility assets” – Depreciation)rate
of return = Revenue Requirement



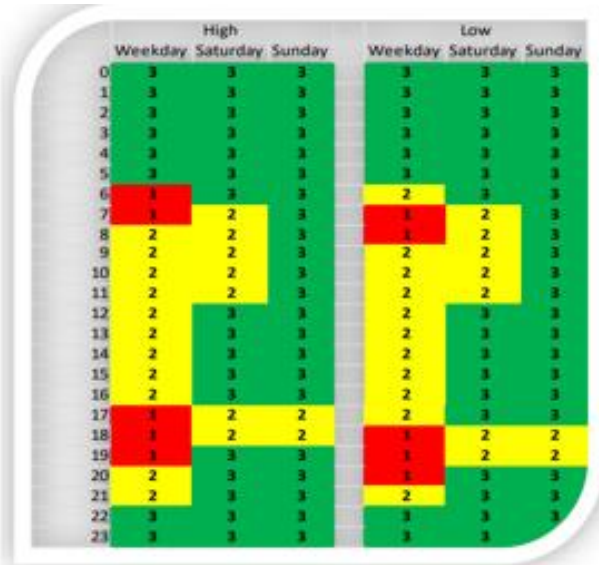
Filling the bucket Ratemaking

Case Study – incentivizing different behaviors

Price Signals (South Africa)

Season Period	High-demand			Low-demand		
	Peak	Standard	Off-Peak	Peak	Standard	Off-Peak
1) Existing ratios	8.00	2.31	1.18	2.50	1.67	1.00
2) Existing WEPS existing TOU ratios c/kWh	296.43	89.79	48.77	96.73	66.55	42.23
3) Updated CTS WEPS existing TOU ratios c/kWh	349.70	100.97	51.58	109.28	73.00	43.71
4) New ratios	6.00	1.50	1.00	2.49	1.40	1.00
5) Existing WEPS new TOU ratios c/kWh	253.40c	63.35c	42.23c	105.16c	59.13c	42.23c
6) Updated CTS WEPS new TOU ratios c/kWh	304.82c	76.20c	50.80c	126.50c	71.13c	50.80c
7) Difference between current and new ratios c/kWh	8.39c	-13.59c	2.03c	29.77c	4.58c	8.57c
8) Difference existing WEPS vs New CTS TOU c/kWh	53.27c	11.18c	2.81c	12.55c	6.45c	1.48c

Proposed new TOU Time Periods



Peak = 1
Standard = 2
Off-peak = 3

Rand conversion to USD = .06

Regulations (Massachusetts)



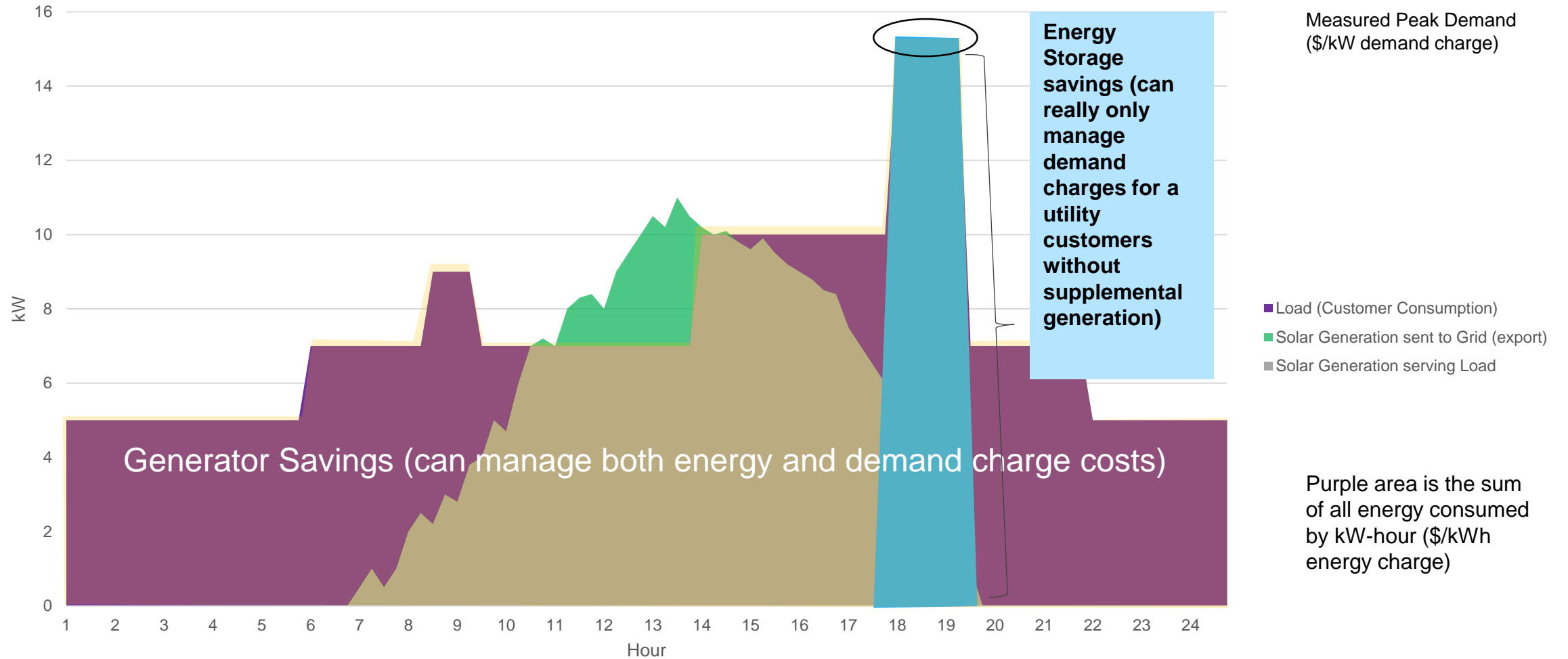
Optimize Your Energy Use with Storage

Earn incentives for helping reduce peak demand and carbon emissions with energy storage



Generation can augment behavior

Solar Generation & Load Curve over 24-hours



Massachusetts Example

2020 Baseline - Grid power + SESS

125 kW / 250 kWh SESS

Program	Annualized Energy Savings
Energy Bill Demand Reduction	9%
Utility Storage Demand Response	22%
Total Energy Savings:	31%

Annual Energy Generation

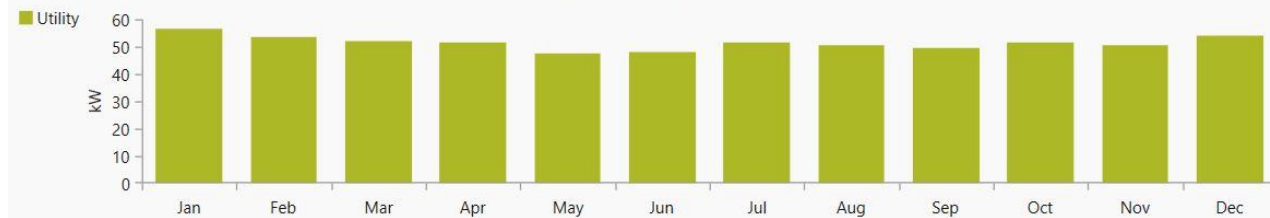
Production	kWh/yr	%
Grid Purchases	449,977	100
Total	449,977	100

Consumption	kWh/yr	%
AC Primary Load	438,000	100
Total	438,000	100

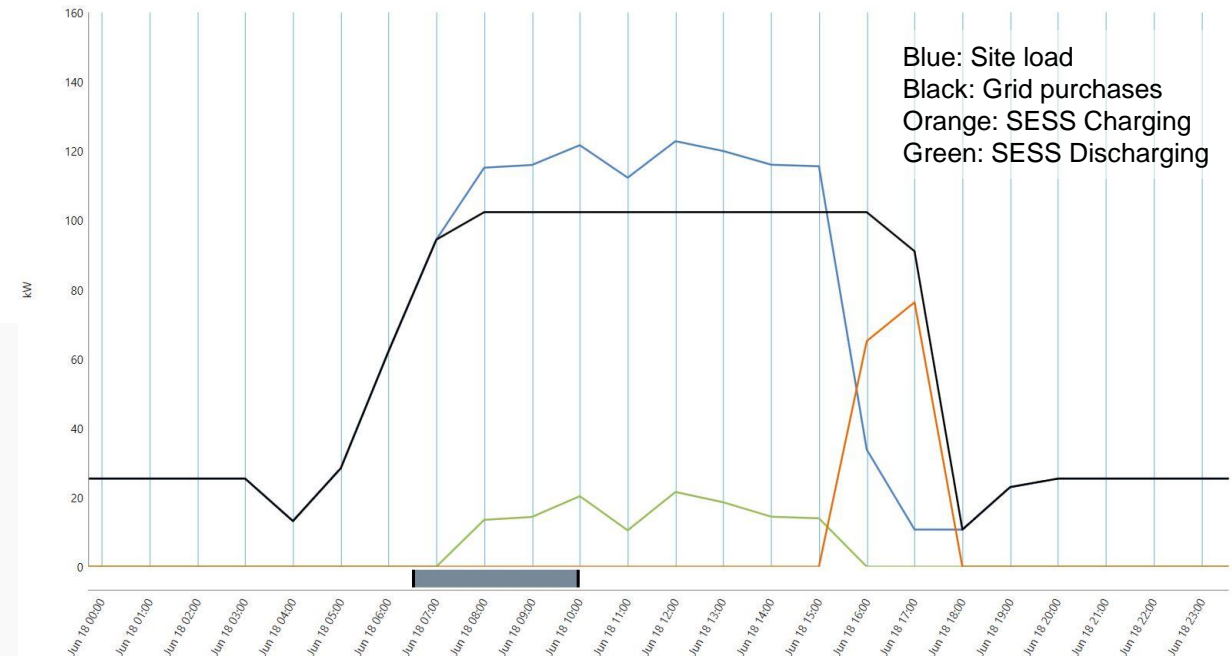
Quantity	kWh/yr	%
Excess Electricity	0	0

Quantity	Value	Units
Renewable Fraction	0	%
Max. Renew. Penetration	0	%

Monthly Average Electric Production



Example single day load profile and asset response



System Operation Notes

- SESS operates as peak shaving asset
- SESS charging takes place as demand lowers

Solar Option 1 - Grid power + SESS + Roof-mounted PV

125 kW / 250 kWh SESS + 111 kW PV + Cummins Control

Massachusetts Programs	Annualized Energy Savings
Energy Bill Demand Reduction	9%
Utility Storage Demand Response	28%
Solar Net Metering & Incentive	74%
Total Energy Savings	105%

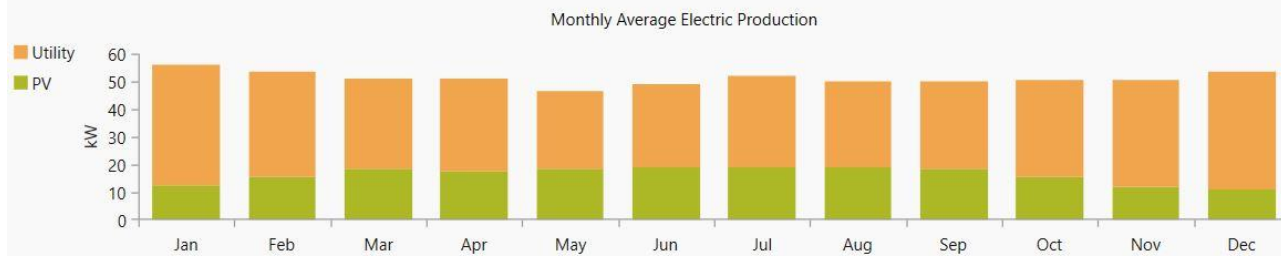
Annual Energy Generation

Production	kWh/yr	%
Generic flat plate PV	142,769	31.9
Grid Purchases	305,451	68.1
Total	448,220	100

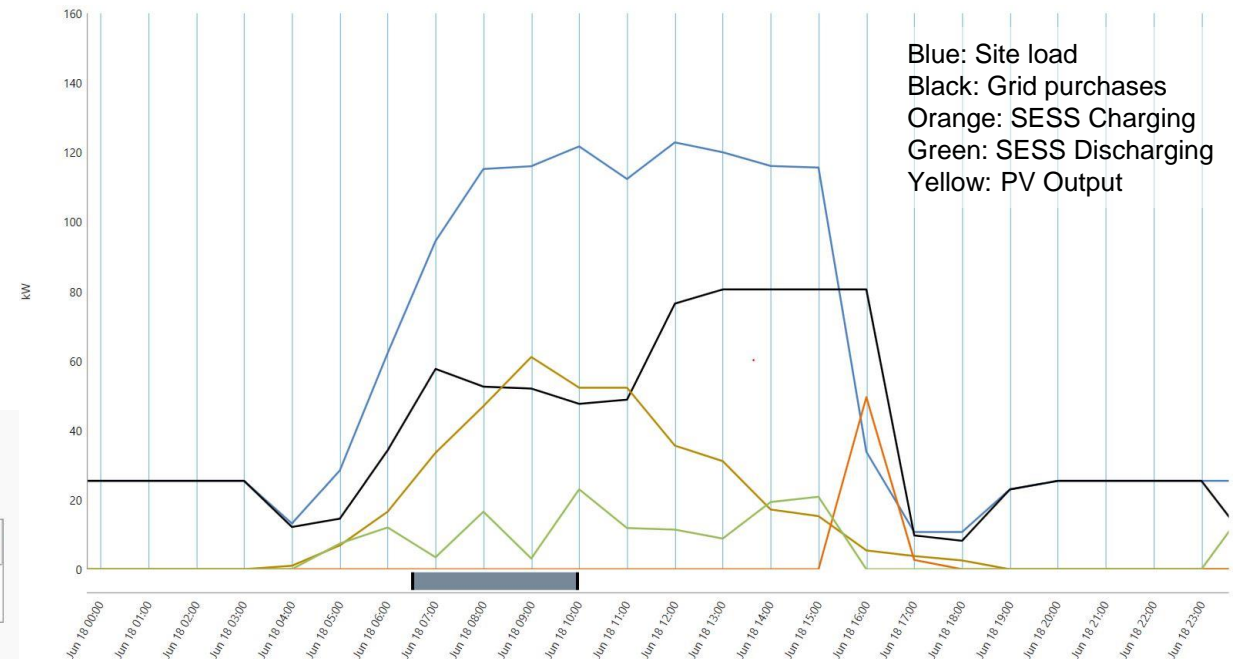
Consumption	kWh/yr	%
AC Primary Load	438,000	99.3
Grid Sales	3,149	0.714
Total	441,149	100

Quantity	kWh/yr	%
Excess Electricity	0	0

Quantity	Value	Units
Renewable Fraction	30.8	%
Max. Renew. Penetration	986	%



Example single day load profile and asset response



System Operation Notes

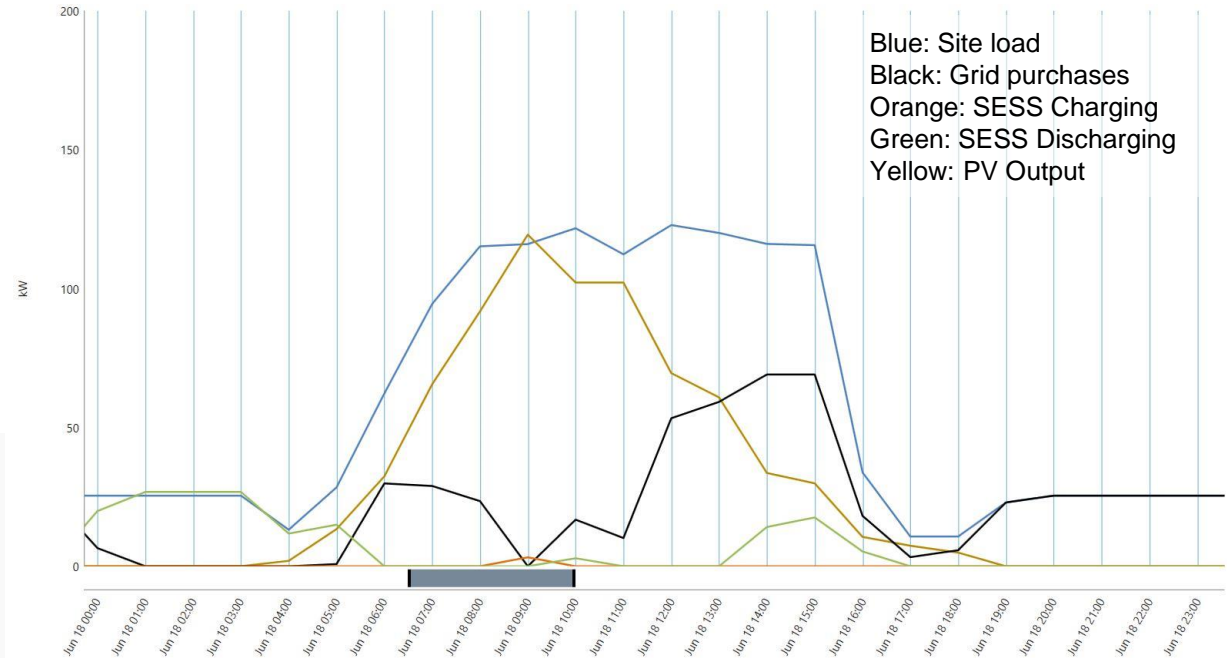
- SESS and PV operate as peak shaving assets
 - During higher solar production, PV alone can peak shave
- SESS charging takes place as demand lowers
 - During high PV/low load, SESS charges from PV

Solar Option 2 - Grid power + SESS + Roof and Carport PV

125 kW / 250 kWh SESS + 217 kW PV + Cummins Control

Program	Annualized Energy Savings
Energy Bill Demand Reduction	9%
Utility Storage Demand Response	22%
Solar Net Metering & Incentive	81%
Storage adder	14%
Total Energy Savings	126%

Example single day load profile and asset response



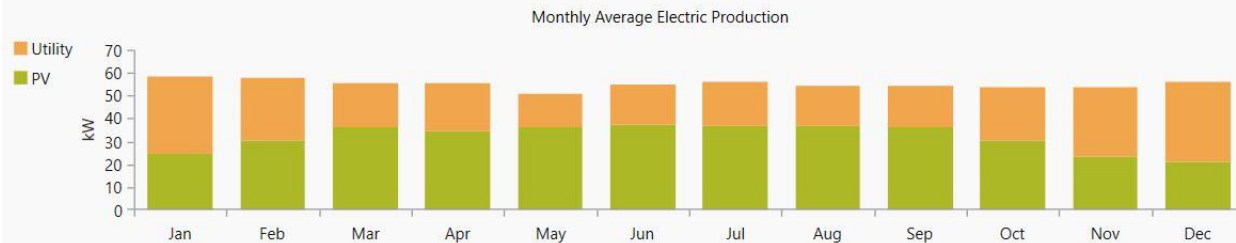
Annual Energy Generation

Production	kWh/yr	%
Generic flat plate PV	279,106	58.0
Grid Purchases	202,114	42.0
Total	481,220	100

Consumption	kWh/yr	%
AC Primary Load	438,000	93.3
Grid Sales	31,467	6.70
Total	469,467	100

Quantity	kWh/yr	%
Excess Electricity	0	0

Quantity	Value	Units
Renewable Fraction	56.9	%
Max. Renew. Penetration	1,928	%



System Operation Notes

- PV functions as close to stand-alone peak shaving asset
 - High solar production will out-produce load
- SESS has enough residual charge to cover early morning load

South Africa Example

Johannesburg 2020 Baseline - Grid power + PV

Site will have grid access, 600 kW PV, and (2) 1 MW backup diesel gensets

South Africa Programs	Annualized Energy Savings
Solar Energy Bill Reduction (w/export rate)	40%
Total Energy Savings	40%

Annual Energy Generation

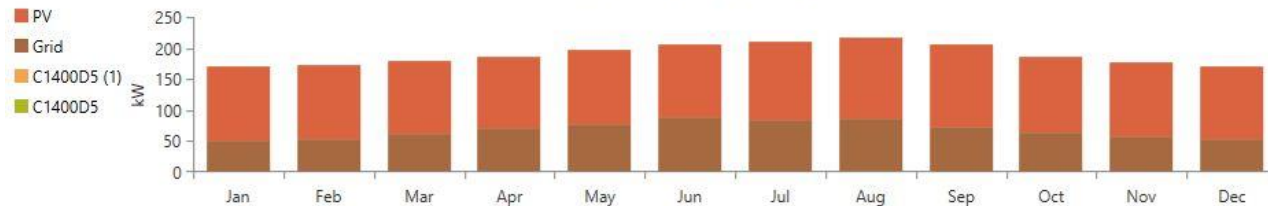
Production	kWh/yr	%
Generic flat plate PV	1,063,247	63.8
CMI C1400 D5 (1)	5,000	0.300
CMI C1400 D5 (2)	0	0
Grid Purchases	597,183	35.9
Total	1,665,430	100

Consumption	kWh/yr	%
AC Primary Load	1,241,000	100
DC Primary Load	0	0
Deferrable Load	0	0
Total	1,241,000	100

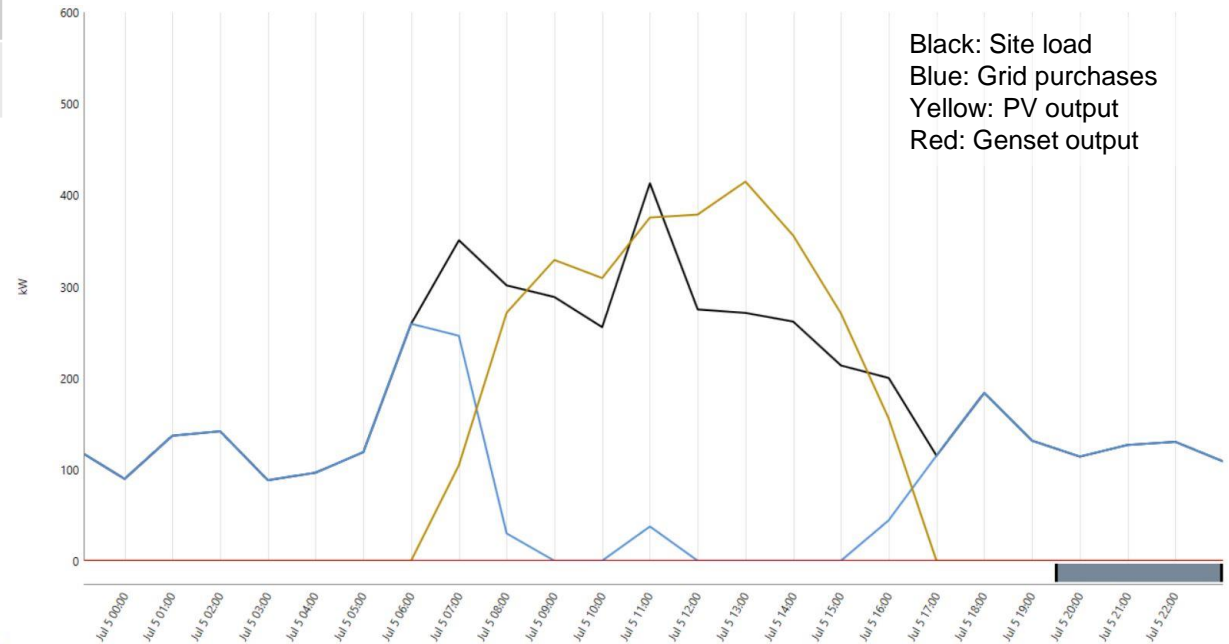
Quantity	kWh/yr	%
Excess Electricity	424,430	25.5
Unmet Electric Load	0	0
Capacity Shortage	0	0

Quantity	Value	Units
Renewable Fraction	51.5	%
Max. Renew. Penetration	1,501	%

Monthly Average Electric Production



Example single day load profile and asset response



System Operation Notes

- PV covers the daytime load from late morning to early evening
- Excess solar is sold back to the grid in this model

Johannesburg Energy System Option 1- Grid power + PV + SESS

Proposal to add 125 kW / 250 kWh Stationary Energy Storage System to existing assets

South Africa Programs	Annualized Energy Savings
Solar Energy Bill Reduction (w/export rate)	40%
Storage Savings (onsite solar use)	5%
Total Energy Savings	45%

Annual Energy Generation

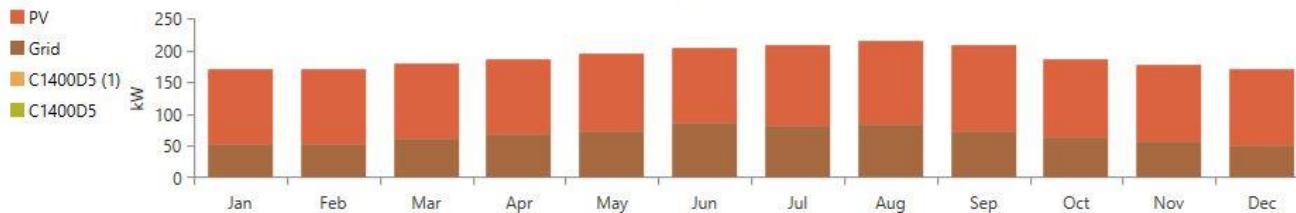
Production	kWh/yr	%
Generic flat plate PV	1,063,247	64.2
CMI C1400 D5 (1)	3,250	0.196
CMI C1400 D5 (2)	0	0
Grid Purchases	590,595	35.6
Total	1,657,091	100

Consumption	kWh/yr	%
AC Primary Load	1,241,000	100
DC Primary Load	0	0
Deferrable Load	0	0
Total	1,241,000	100

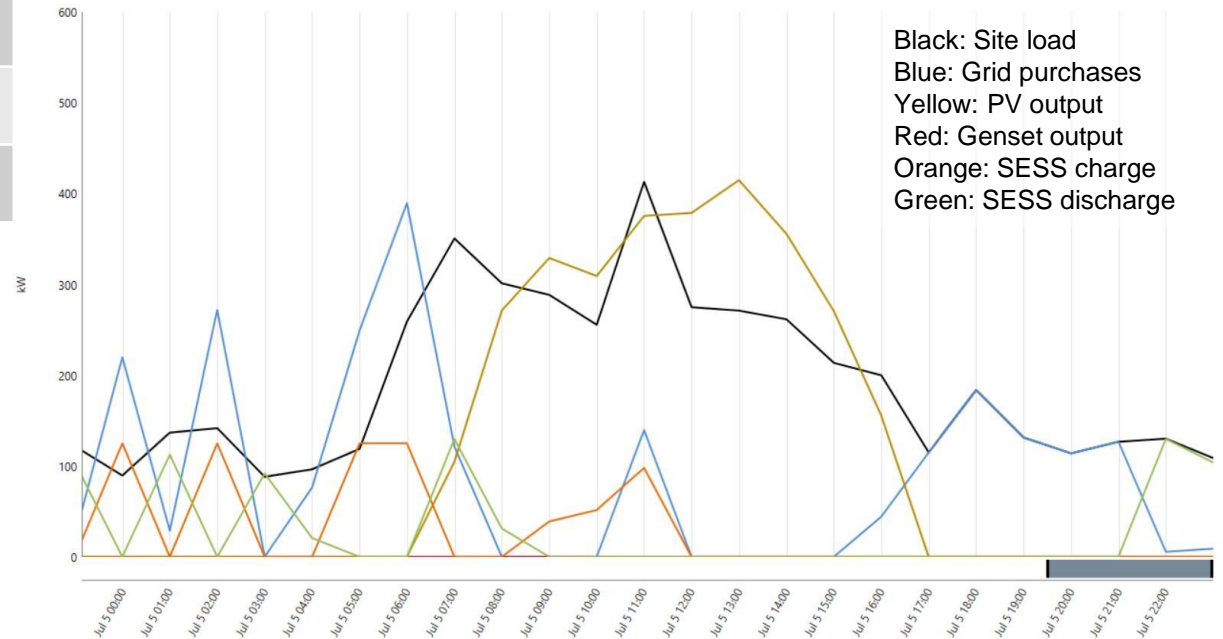
Quantity	kWh/yr	%
Excess Electricity	406,050	24.5
Unmet Electric Load	0	0
Capacity Shortage	0	0

Quantity	Value	Units
Renewable Fraction	52.1	%
Max. Renew. Penetration	1,501	%

Monthly Average Electric Production



Example single day load profile and asset response



System Operation Notes

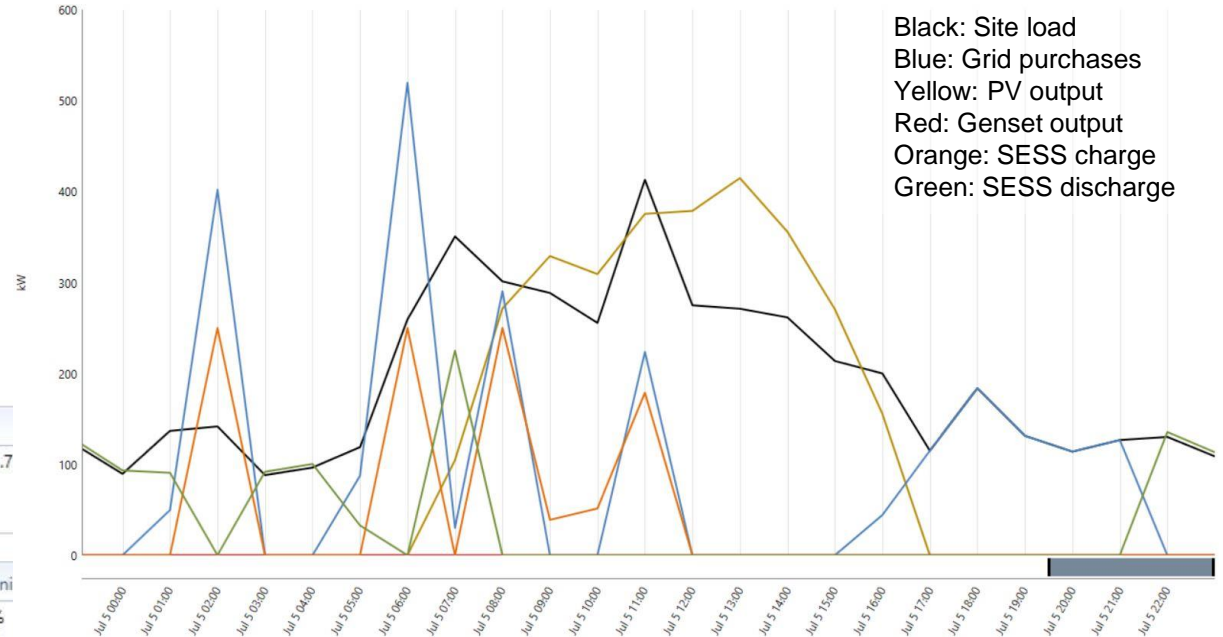
- SESS during late night/early morning hours
- SESS charging takes place from both grid and PV

Johannesburg Energy System Option 2 - Grid power + PV + SESS

Proposal to add 250 kW / 500 kWh Stationary Energy Storage System to existing assets

South Africa Programs	Annualized Energy Savings
Solar Energy Bill Reduction (w/export rate)	40%
Storage Savings (onsite solar use)	5%
+Larger Battery	2%
Total Energy Savings	47%

Example single day load profile and asset response



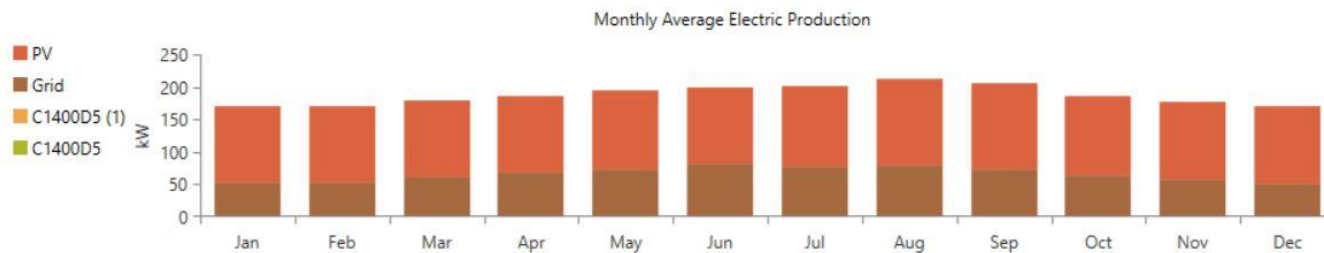
Annual Energy Generation

Production	kWh/yr	%
Generic flat plate PV	1,063,247	64.6
CMI C1400 D5 (1)	557	0.0338
CMI C1400 D5 (2)	0	0
Grid Purchases	581,778	35.4
Total	1,645,582	100

Consumption	kWh/yr	%
AC Primary Load	1,241,000	100
DC Primary Load	0	0
Deferrable Load	0	0
Total	1,241,000	100

Quantity	kWh/yr	%
Excess Electricity	390,577	23.7
Unmet Electric Load	0	0
Capacity Shortage	0	0

Quantity	Value	Unit
Renewable Fraction	53.1	%
Max. Renew. Penetration	1,501	%



System Operation Notes

- SESS during late night/early morning hours
- SESS charging takes place from both grid and PV

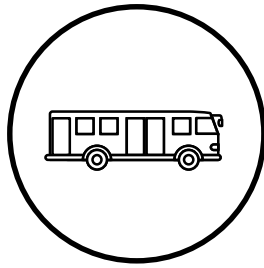
The markets we serve



Heavy-duty
Truck



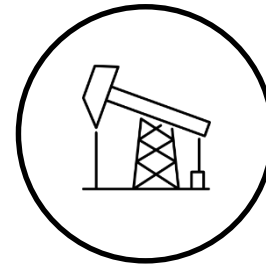
Medium-duty
Truck



Bus



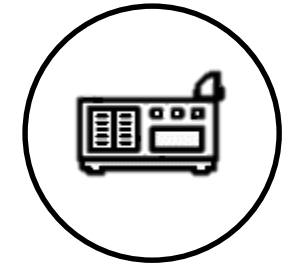
Construction



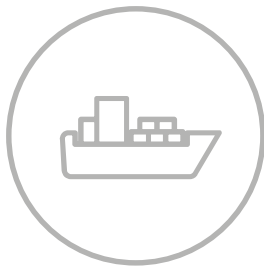
Oil & Gas



Fire &
Emergency



Power
Generation



Marine



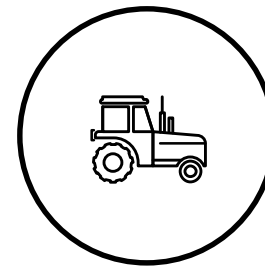
Mining



Light-duty Automotive
& Recreational
Vehicle



Defense



Agriculture



Rail

This is not an exhaustive display of Cummins-powered markets. Please refer to cummins.com for the most updated product information.

THANK YOU

Q+A

