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Johns Manville
A Berkshire Hathaway Company

IEPR Commissioner Workshop: Using Energy Efficiency to Achieve Emissions Reductions, Energy Storage and Solar Power Integration

Bruce Ray

August 24, 2021

People Passion Perform Protect • The JM Experience

Topics to Discuss

- Using Energy Efficiency to Achieve Emissions Reductions
- AQMD Coachella Valley Project – Phase 1
- AQMD Coachella Valley Project – Phase 2
- Benefits of the Coachella-AQMD Approach
- Using Energy Efficiency to Enable Energy Storage and Integration of Solar Power

Using Energy Efficiency to Achieve Emissions Reductions

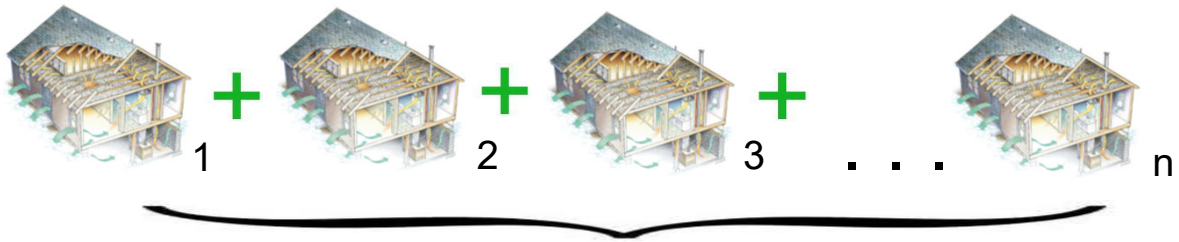
- 2/3 of JM products (insulation and roofing products) go to efficiency
- Focus on new channels and new business models
- Clean Air Act
  - National Ambient Air Quality Standards
  - Non-attainment area requirements
- Work from EPA's recognition of EE for SIP-creditable emissions reductions

EPA United States Environmental Protection Agency

Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans

40 CFR § 51.1310 - Requirements for reasonable further progress (RFP).

Energy Efficiency to Achieve Emissions Reductions



Energy savings quantification

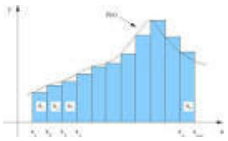
Quantify and Aggregate Energy Savings

{ Modeling; EnergyPro; Meter data

Attribution method

{ E-grid Avert

Quantify emissions Reductions

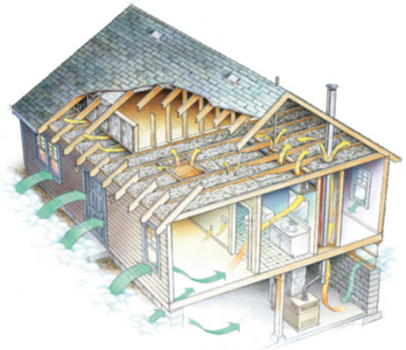


$$\int_a^b f(t)\,dt = \lim_{n\to+\infty} \sum_{i=1}^{n} f(t_i)h$$

Use the power of large numbers

AQMD Coachella Valley Retrofit Project – Phase 1

- **Total Homes Completed *2017* EOY: 2,100**
- **Environmental Justice Area: > 700 homes**
- **Average Cost Per Home**
  - **EJ: $2,200**
  - **All: $1,980**
- **Annual Estimated Energy Savings**
  - **1,560 kWh/home; 3,275,000 kWh total* = 10% site savings**
  - **35 therms/home; 73,500 therms total***
- **Annual Energy Bill Savings (SCE)**
  - **Per home: $310**
  - **Total: $650,000**
- **Total Annual Emissions Reductions**
  - **GHG: 1,800 tons**
  - **PM2.5: 100 lbs**



Air sealing, Insulation

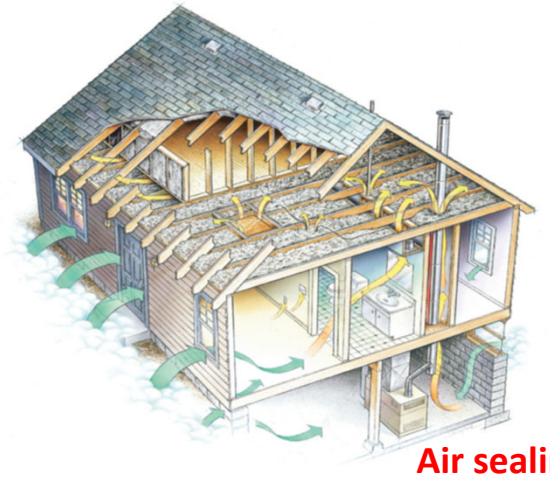
Project approach formally adopted by AQMD as pollution control measure to demonstrate RFP to meeting NAAQS **- Control Measure No. ECC-02 ("CO-BENEFITS FROM EXISTING RESIDENTIAL AND COMMERCIAL BUILDING ENERGY EFFICIENCY MEASURES [NOX, VOC]"**

* Energy savings based on ***EnergyPro*** v5.1 software

AQMD Coachella Valley Project Phase 2: - 2020

Energy Efficiency Measures:

- Air Seal Attic Floor
- Attic Insulation to R-38 - 49
- Air seal AC ducts
- Insulate/Deep Bury AC ducts
- Nest Thermostat
- 3-5 LED lights



Air sealing,
Insulation

Coachella Phase 2: Focus on EJ and DACs

- Older homes (< 1990) offer greatest savings
- Frequently in disadvantaged comms. and EJ areas
- Phase 2: select homes via ***CalEnviroScreen***
  - uses environmental, health, and socioeconomic info/data to produce scores for every census tract
  - scores are mapped so that different communities can be compared.
  - area with a high score is one that experiences a much higher pollution burden than areas with low scores.

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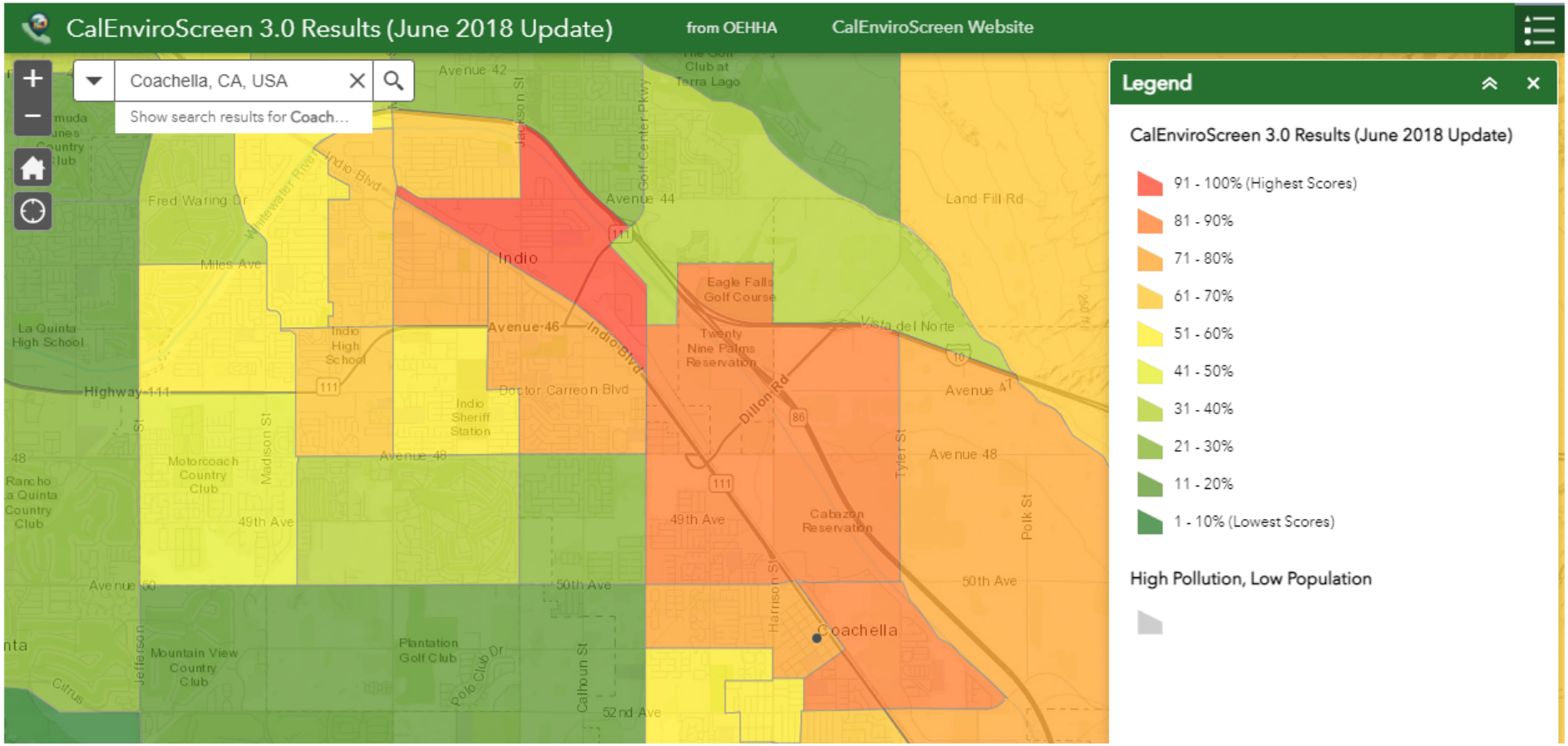
Coachella Phase 2: Focus on EJ and DACs

- All areas scored >75%



Results of Coachella Valley Project – Phase 2

Table 1: Project Energy Savings Summary (All Measures, 124 Homes)

Energy Savings Term	Electric Energy Savings [kWh]	Electric Demand Savings [kW]	Gas Savings [Therm]	Program Savings [%]	Program Savings [TDV%][3]	Cost Savings [$][4]
Annual	448,728	94	6,395	18.4%	17.7%	$66,023
Measure Lifetime	8,974,560	94	127,900	18.4%	17.7%	$1,320,460

Table 2: Program Wide, Lifetime Financial Metrics (All Measures, 124 Homes)

Net Present Value (NPV) of Benefits	Total Installed Cost	Payback (Years)	Savings to Investment Ratio (SIR)[6]	Internal Rate of Return (IRR)[7]	Return on Investment (ROI)[8]
$692,615	$562,770	7.8	1.22	14.0%	21.7%

Results of Coachella Valley Project – Phase 2

Table 3: Cost per kWh by Source (Program vs. Utilities)

Measure Lifetime Energy Savings [kWh]	Total Installed Cost	Program Cost of Energy Savings [$/kWh]	IID Cost of Energy [$/kWh]	California Average Cost of Energy [$/kWh]
8,974,560	$562,770	$0.063	$0.117	$0.167

Table 8: Annual Project Emissions Avoidance (All Measures, 124 Homes)

Greenhouse Gases	Avoidance Per Year (lbs)	Avoidance Per Year (Tons)
Carbon Dioxide (CO2)	303,972	151.99
Methane (CH4)	31.14	1.557 E-02
Nitrous Oxide (N2O)	3.17	1.587 E-03
Total Greenhouse Gases CO2e	305,769	152.88
Pollution Affecting Health	Avoidance Per Year (lbs)	Avoidance Per Year (Tons)
Sulfur Dioxide (SO2)	52.36	2.618 E-02
Nitrogen Oxide (NOx)	327.86	1.639 E-01
Mercury (Hg)	7.804 E-04	3.902 E-07
PM2.5	56.54	2.827 E-02

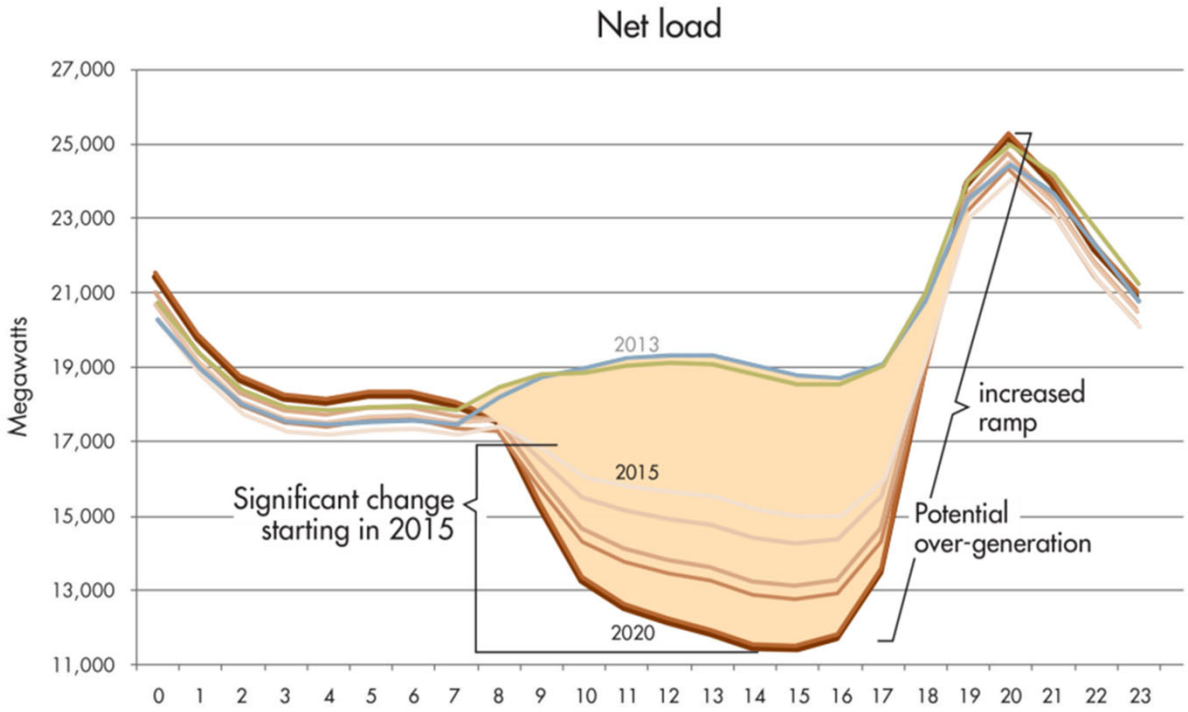
Benefits of the Coachella-AQMD Approach

- Cost-effective energy savings
- Cost-effective emissions reduced/avoided
  - NAAQS pollutants
  - GHGs
- Scalability
- Foundation for future upgrades
- Direct benefits to disadvantaged communities
  - Lower cooling and heating bills
  - Better IAQ
  - Increased comfort and safety
  - Increased home value
- Promotion of climate justice/equity and resilience

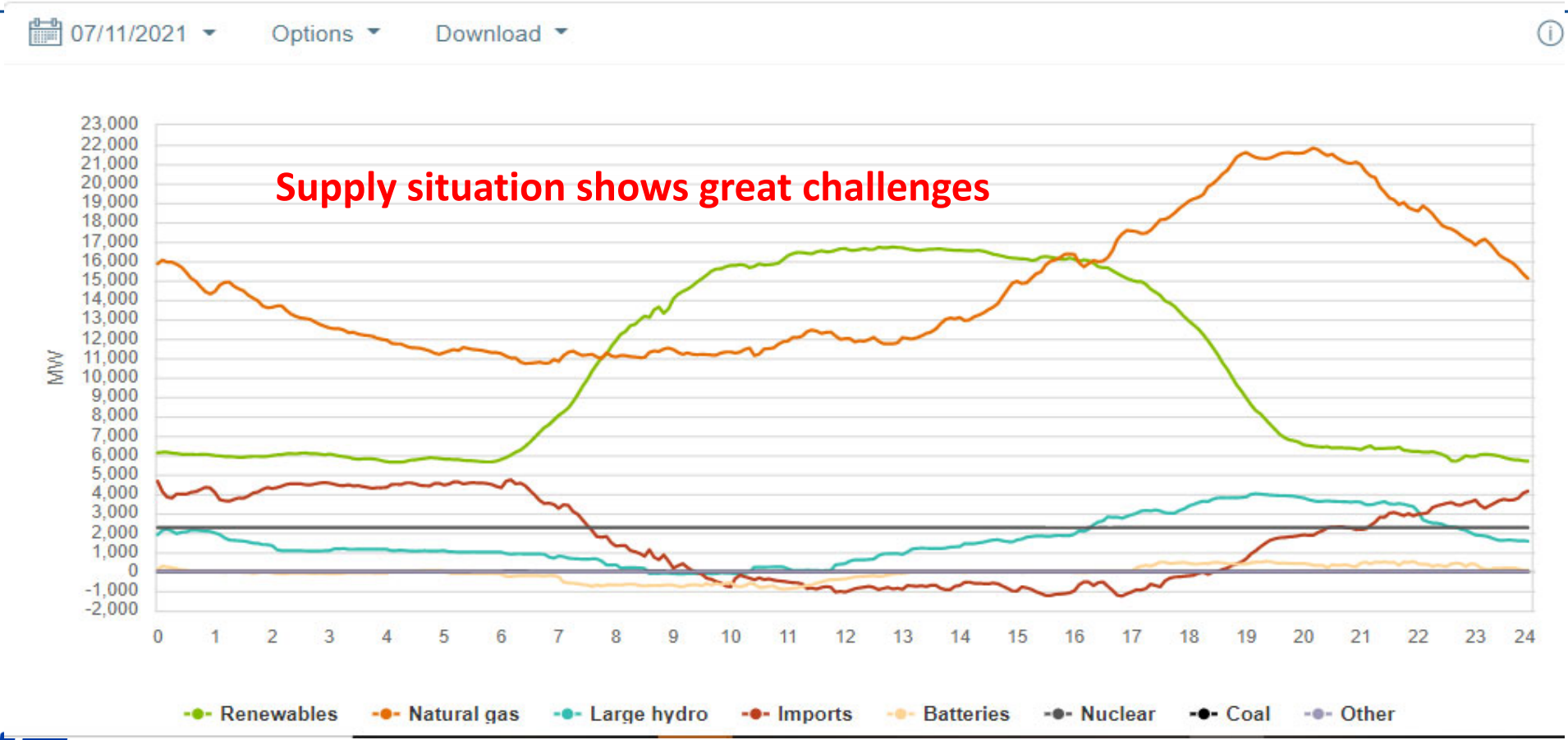
Comite Civico Del Valle, Inc.

Using Energy Efficiency to Enable Energy Storage and Integration of Solar Power

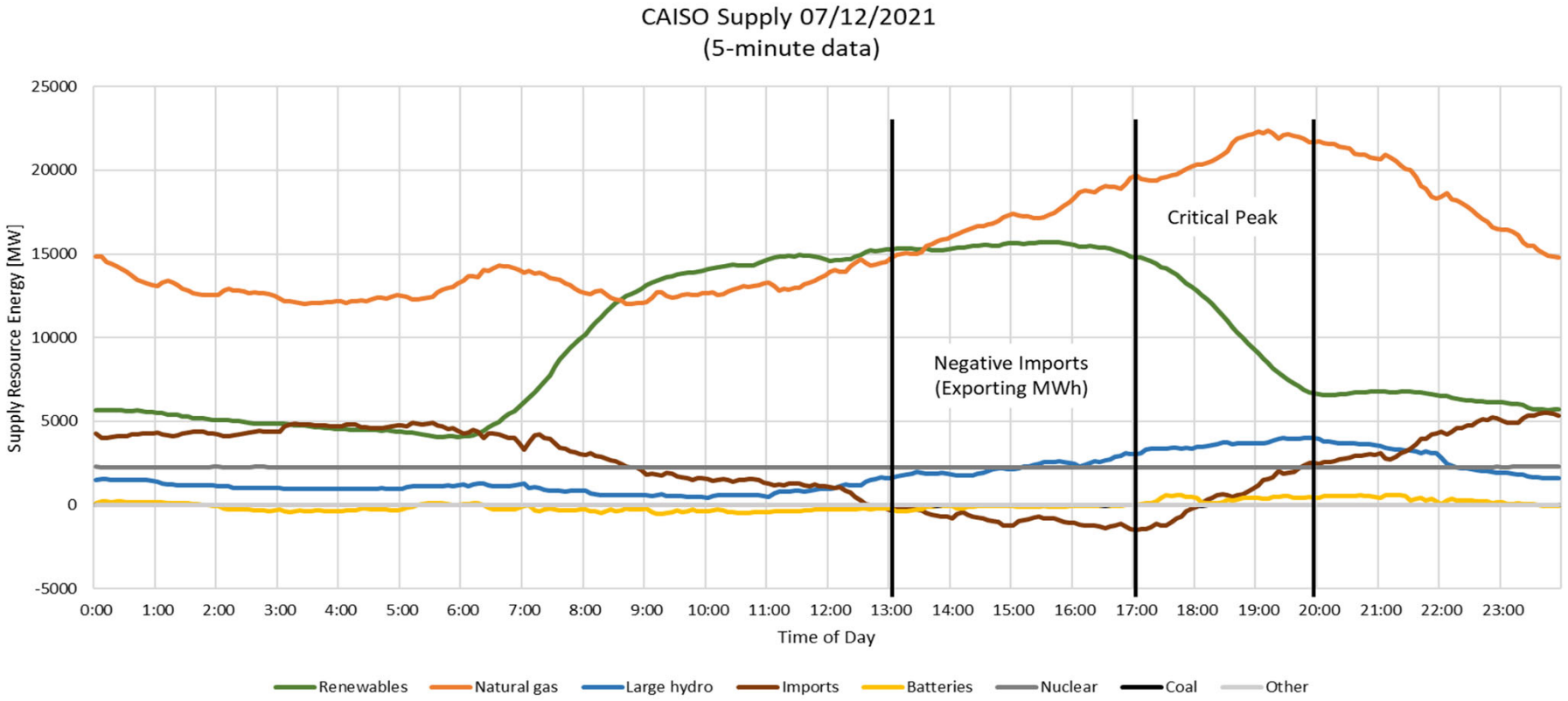
- Importance and value of energy efficiency is changing
  - Temporal value
  - Locational value
- Duck curve problem
- Retrofit projects must change
- Solution is to use:
  - EE to enable DR
  - DR to enable thermal energy storage
  - Retrofitted homes in Thermal Energy Storage System



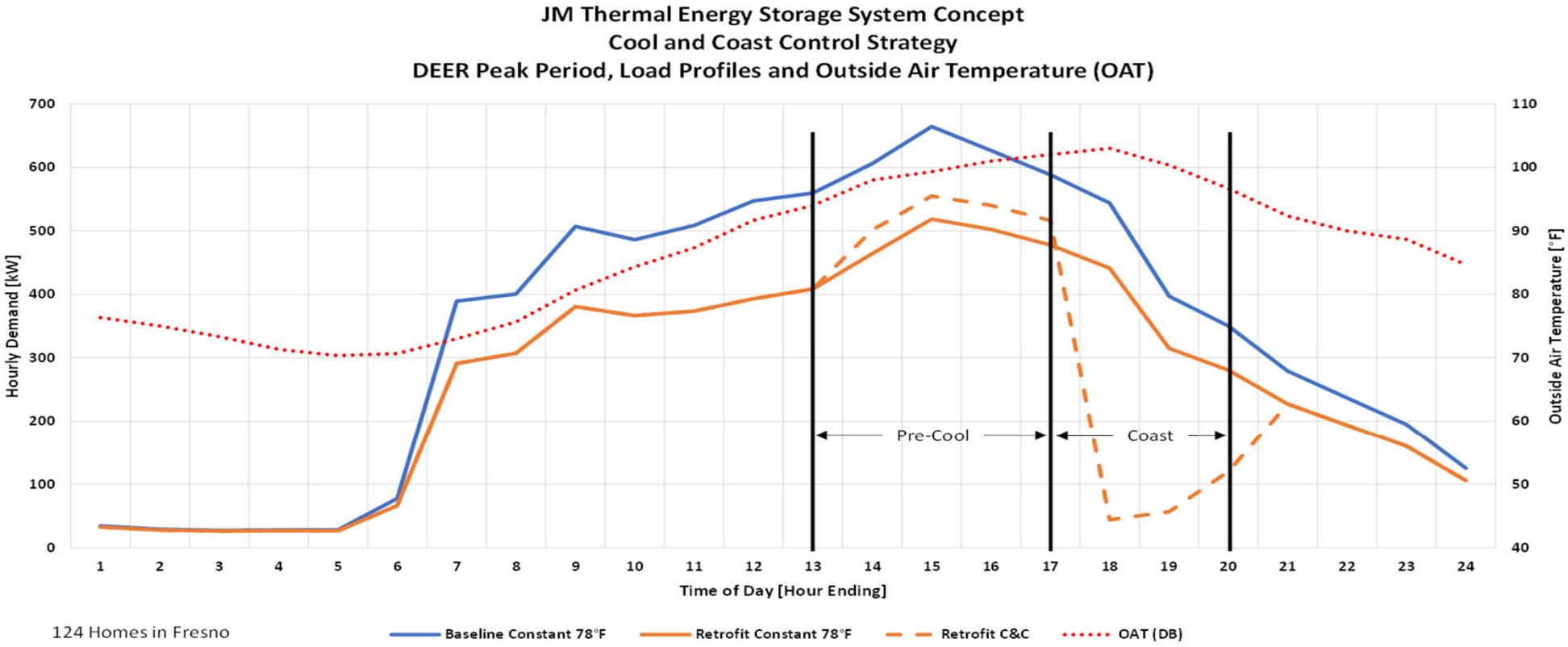
JM Thermal Energy Storage System



Thermal Energy Storage System

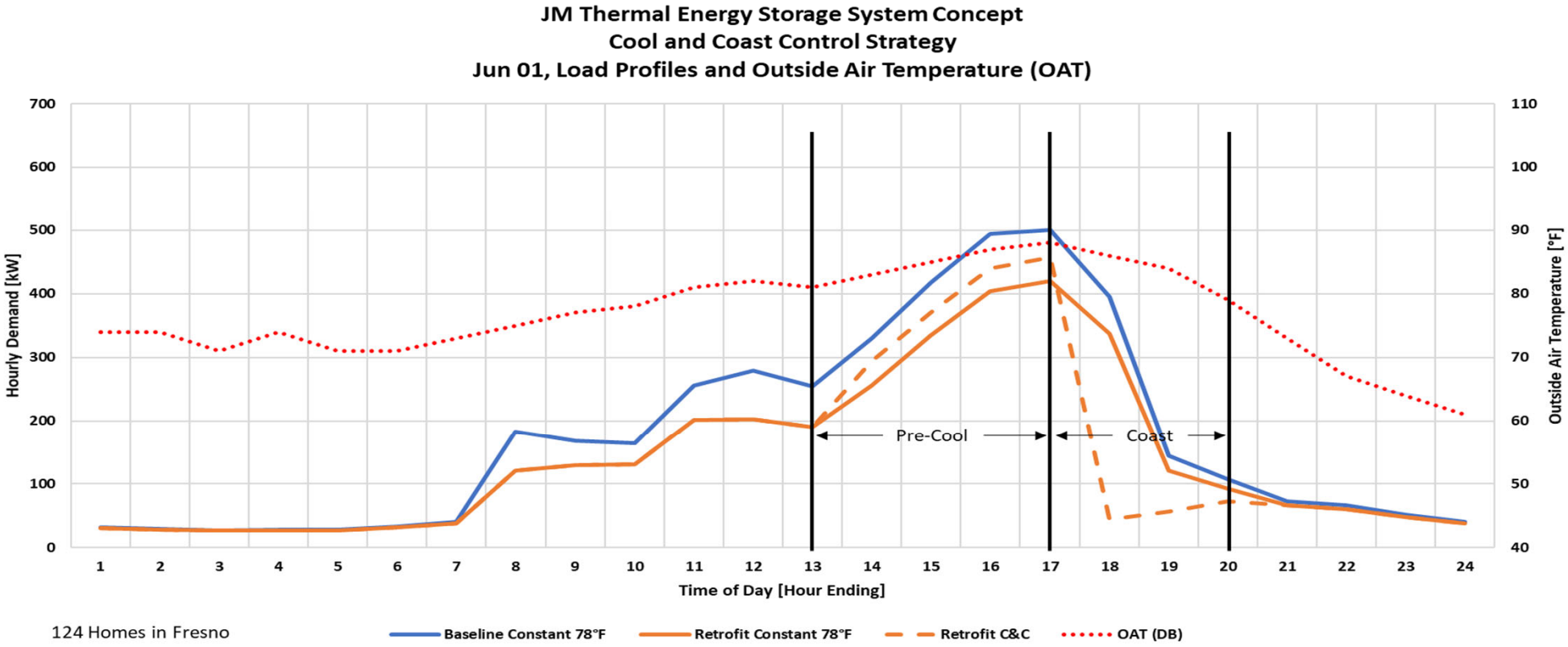


JM Thermal Energy Storage System*



*US Patent Nos.: 9,951,967 B2; 10,302,328 B2

JM Thermal Energy Storage System



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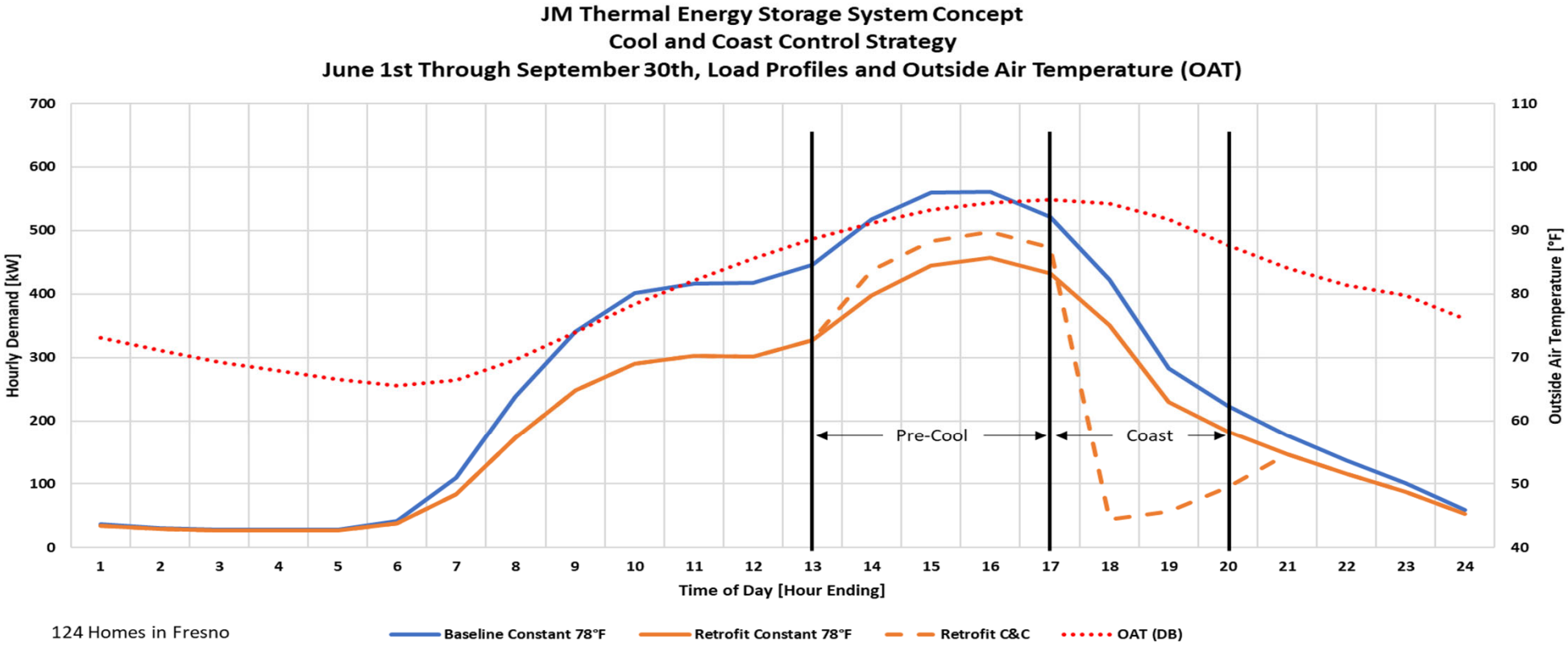

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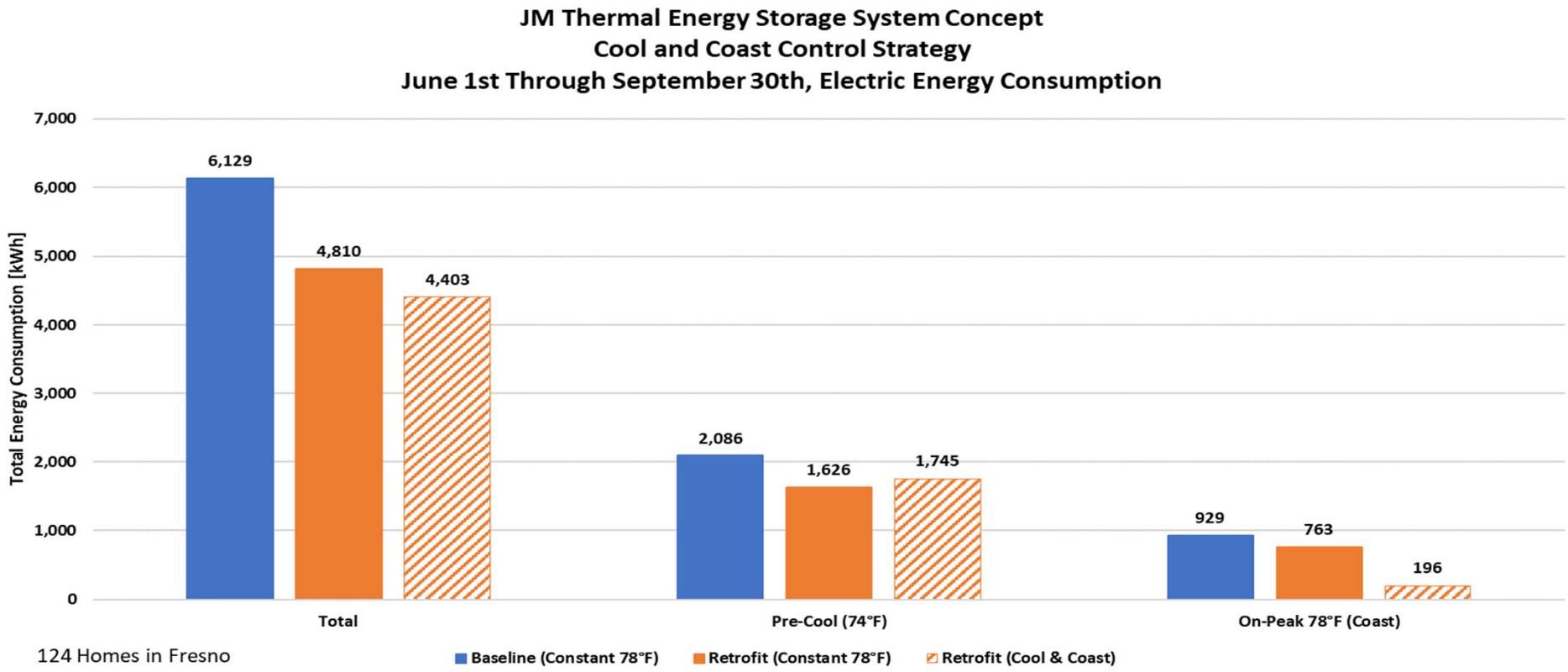

JM Thermal Energy Storage System