PHASECHANGE SOLUTIONS

Buildings & Structures

Occupant Comfort & Energy Saving Solution

A healthier planet with

Green World Tek, LLC

Markets Served

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Green World
Tek, LLC

PHASECHANGE
SOLUTIONS

- Retail Spaces
- Corporate Offices
- Schools/Universities
- Municipal Buildings
- Healthcare Facilities

Agenda

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PHASECHANGE SOLUTIONS

- Problem
- Customer Pain Points
- BioPCM® Solutions
- Benefits
- National Labs/Universities/Utilities/3rd Party Research
- About PCS

Problem

The highest energy consumption - nearly 40% - in commercial and residential buildings comes from space heating/cooling. Maintaining internal temperature and comfort level is largely dependent on weather, occupant behavior, and type of space. Many buildings do not have enough thermal inertia that causes large temperature fluctuations.

Customer Pains

- Temperature instability in enclosures
- High energy and peak electricity costs
- Poor equipment life and efficiency
- Low occupant comfort “freezing office syndrome”

Customer Goals

- Achieve temperature resiliency
- Maintain HVAC consumption & costs
- Improve equipment integrity
- Meet sustainability goals

BioPCM® Solutions

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Biodegradable, non-toxic, non-corrosive, non-flammable

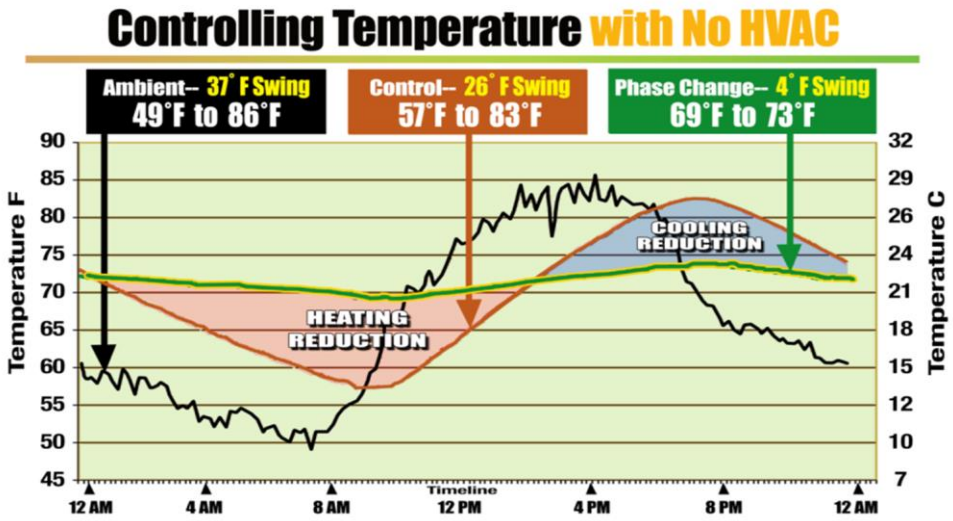
Attractive payback periods

Reduces carbon footprint

High thermal storage

Tunable -50°C to 175°C

Useful life >85 years



BioPCM® Solutions

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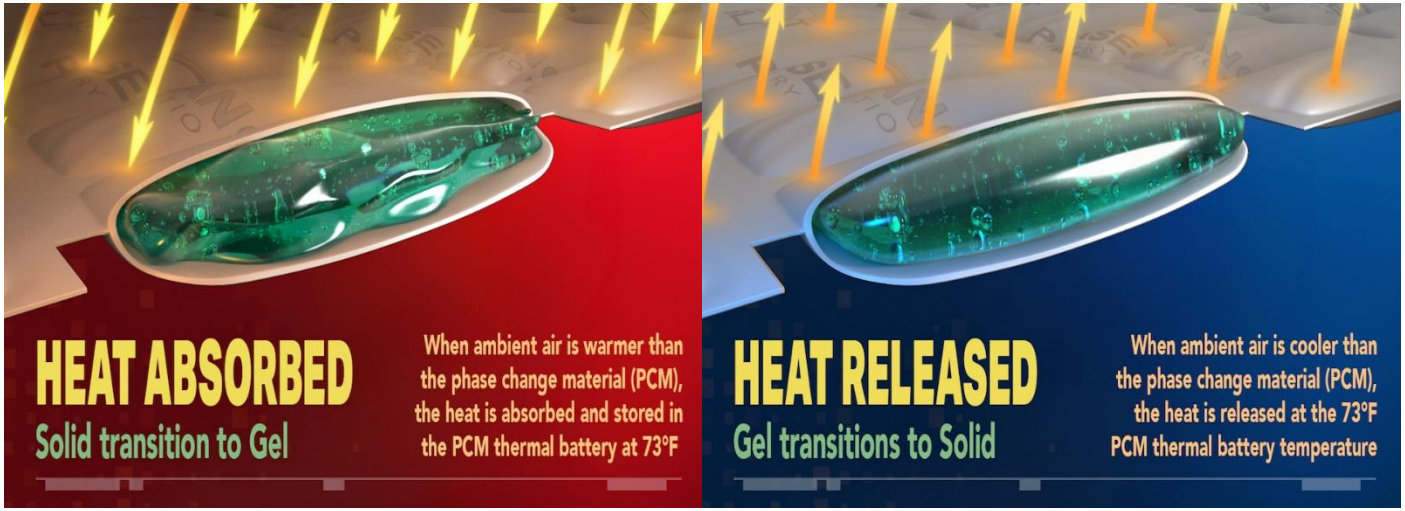
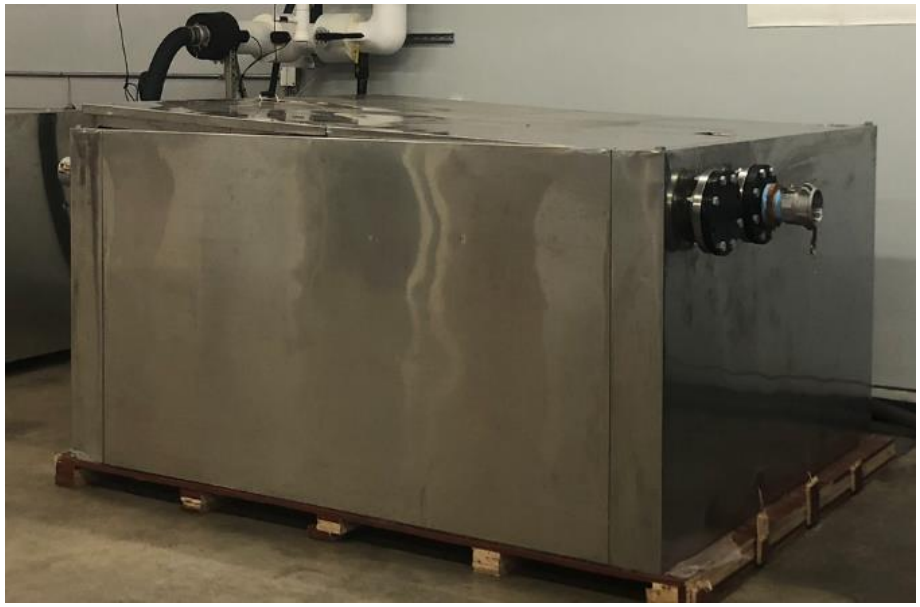
- BioPCM® between two rugged, multi-layer films of polymer and/or aluminum
- Placed above drop ceilings, in roofs, or stapled to exposed wall studs in retrofit or new construction
- Tear resistant & zero maintenance
- Tunable energy storage capacity & transition temperature
- Installation typically only few hours

Phase Change Solutions ENRG BLANKET powered by BioPCM

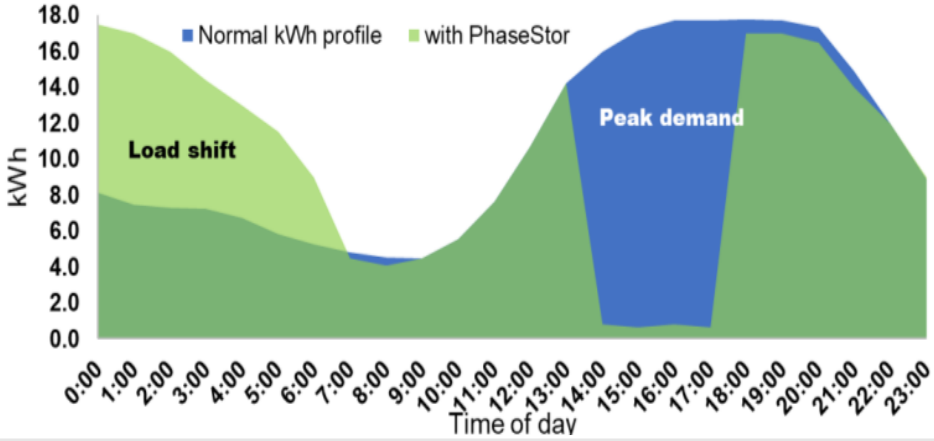


BioPCM® Solutions



PhaseStor
LATENT ENERGY STORAGE SYSTEM

- BioPCM® placed in modular PhaseStor® tank
- Heat exchangers containing process fluid are fully immersed in BioPCM®
- Energy is absorbed/released in form of latent heat when BioPCM® transitions
- Tunable energy storage capacity & transition temperature
- Stackable design
- Small footprint



Benefits

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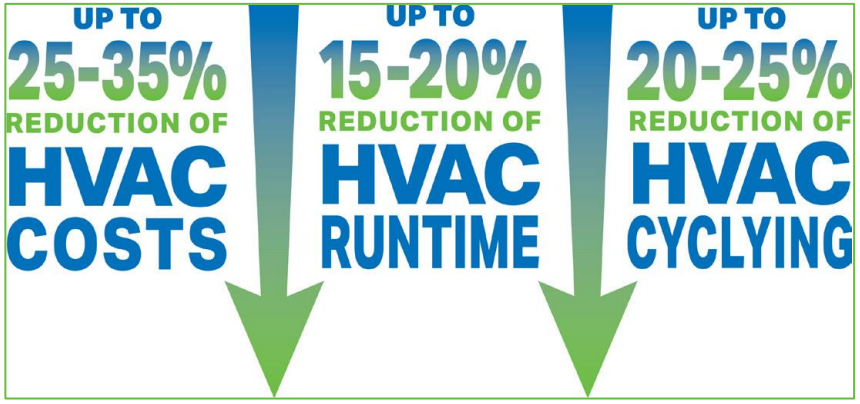
- Improves occupant comfort
- Thermal buffer regulates temperature
- Reduces carbon footprint

- Improves HVAC energy savings
- Reduce operational costs

- Provides peak-load shifting
- Increase HVAC equipment life



Typical ENRG Blanket® results:

- 30% decrease HVAC energy consumption
- 8% total building savings
- 19% kW demand reduction

National Labs/Universities/Utilities/ 3rd Party Research

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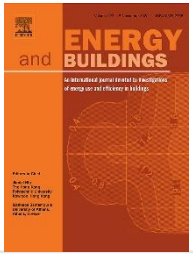
OAK RIDGE National Laboratory

GSA

SOUTHERN CALIFORNIA EDISON®
Energy for What's Ahead®



- PCM material in wall reduced
  - Heat flow through wall by 40%
  - Load reduction by 20%
- PCM material along with a system of innovative elements in new building reduced
  - Energy use by 40%
- PCM material reduced in commercial buildings
  - HVAC Peak Capacity by 25%
  - Cooling energy by 2-14%
  - Heating energy by 30-50%
- PCM material in simulated building reduced
  - Heat flux by 17.55%

National Labs/Universities/Utilities/ 3rd Party Research

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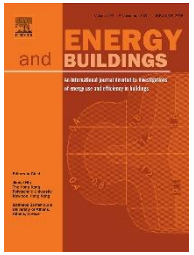
- PCM material reduced in commercial freezers
  - Energy consumption by 30-39%



- PCM material in simulated home reduced
  - Peak temperatures by 1°C
  - Energy consumption by 15%

- PCM material in residential attics reduced
  - Heat gains & losses by 90%

- PCM material reduced in new commercial building
  - Energy consumption by 25%
  - Peak Demand by 14%

About PCS

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PHASECHANGE SOLUTIONS

Pioneering and inspiring innovation in smart materials for a sustainable future.

Phase Change Solutions is a global leader in the development and supply of phase change materials

BioPCM® has helped maintain optimum temperatures and saves energy in a range of industries: transportation of perishables and pharmaceuticals, buildings and structures, telecom and data centers

Nearly 100 total patent filings, including over 30 issued and non-expired patents

PCS was most recently recognized as a 2020 Global Cleantech 100 company and one of ten Bloomberg BNEF Global Pioneer award winners for 2020

phasechange.com

Thank You

Appendix

*can be updated with most current numbers

Solution

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ENRG BLANKET™

Available in 12"(~350 mm), 16"(~410 mm) and 24"(~610mm) widths

Melting Point * [°C/°F]	21°C / 70° F				23°C / 73° F				25°C / 77° F				27°C / 80° F				29°C / 84° F			
Heat Storage ** [J/g]	175-250				175-250				175-250				175-250				175-250			
M Value	27	51	75	91	27	51	75	91	27	51	75	91	27	51	75	91	27	51	75	91
Weight per Square Foot (lb)	0.51	0.71	0.86	1.27	0.51	0.71	0.86	1.27	0.51	0.71	0.86	1.27	0.51	0.71	0.86	1.27	0.51	0.71	0.86	1.27
Weight per Square Meter (Kg)	2.5	3.5	4.2	6.2	2.5	3.5	4.2	6.2	2.5	3.5	4.2	6.2	2.5	3.5	4.2	6.2	2.5	3.5	4.2	6.2
Total unit thickness (in)	.25	.5	.75	1	.25	.5	.75	1	.25	.5	.75	1	.25	.5	.75	1	.25	.5	.75	1
Total unit thickness (mm)	6.4	12.7	19.1	25.4	6.4	12.7	19.1	25.4	6.4	12.7	19.1	25.4	6.4	12.7	19.1	25.4	6.4	12.7	19.1	25.4

ENRG BLANKET™ is available with custom melt temperatures between (-50-150°C or -60-300°F) with M-Values ranging from 20-200

Current Partners & Case Studies performed

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PHASECHANGE SOLUTIONS

Banking

CHASE

WELLS FARGO

FIRST NIAGARA

First Citizens Bank

Healthcare

Carolinas HealthCare System

MAYO CLINIC

KAISER PERMANENTE®

Industrial

ENNIS PAINT

1888 MILLS
Weaving a Better World

Taylor Guitars

Government

GSA

FORT BRAGG
NORTH CAROLINA

SIERRA ARMY DEPOT
HERLONG, CA

Education

UNIVERSITY OF WASHINGTON

HUNTSVILLE CITY SCHOOLS

Escondido Union School District

CleanTECH San Diego

Foodservice

Chick-fil-A

PEPSICO

Property Mgt.

CBRE
CB RICHARD ELLIS

JONES LANG LASALLE®

Hospitality (Hotel Wall Art)

LARSON·JUHL®

Portfolio Dashboard

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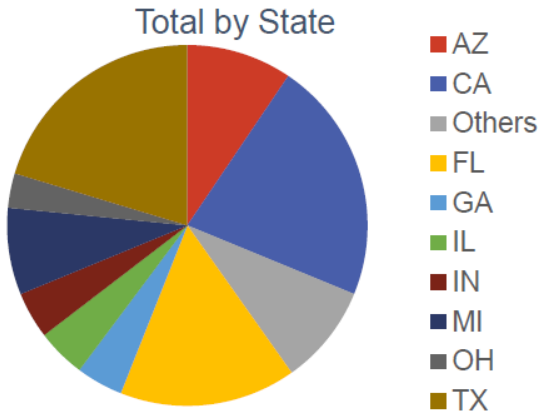
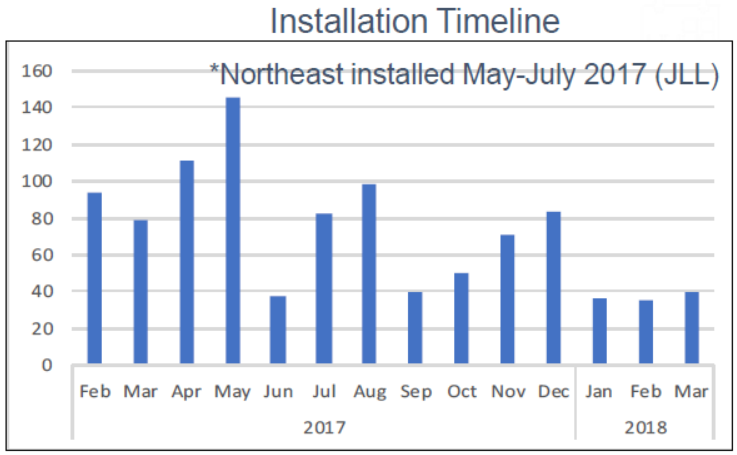
PHASECHANGE SOLUTIONS

Overview – Project Summary

Wave	Sites	Status	Timeline
1	204	Completed	Q1/Q2 2017
2	252	Completed	Q2 2017
3	167	Completed	Q2/Q3 2017
4	137	Completed	Q3/Q4 2017 - Q1 2018
5 & JPMC 50	244	Completed	Q4 2017 - Q1 2018
Northeast	197	Completed	Q2 2017





ENRG Blanket™

- Approximately 1,200 sites installed with ENRG Blanket™
- Installed percentage of material (Target 55-65%)
- Installed above ceiling tiles
- Transition temperature of 73°F/ 22.8°C (±3°F operational range)
- ENRG Blanket capacity of 27-35 BTUs per square foot (latent heat)
- Measurement and verification with 3 methods

Positive impact on corporate energy consumption and sustainability, while providing new savings solution to further improve performance

Whole Building Comparison

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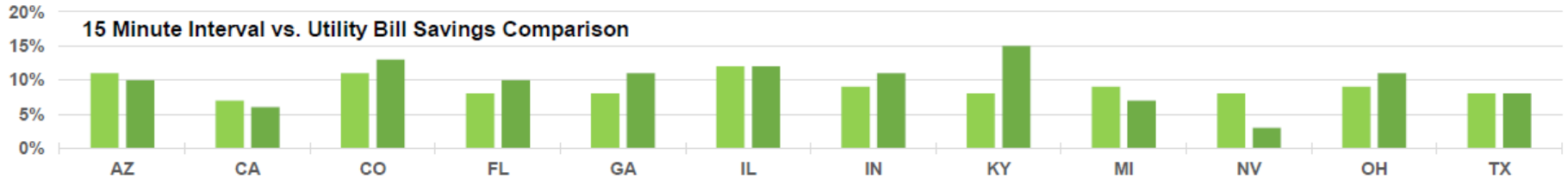
						MONTHLY BILLS		15 MINUTE DATA	
			Avg Annual kWh		% HVAC Savings	Total Building Savings	Annual $	Total Building Savings	Annual $
State	Count	$/kWh	Consumption	Install Sqft	Savings %	Savings %	Savings	Savings %	Savings
AZ	95	0.13	124,261	2333	35.8%	11.10%	$ 1,798	10.00%	$ 1,624
CA	218	0.19	116,733	2624	21.3%	7.30%	$ 1,616	5.70%	$ 1,251
CO	18	0.13	115,532	2473	34.5%	10.70%	$ 1,552	13.70%	$ 1,982
FL	159	0.1	115,431	2495	24.4%	7.60%	$ 915	10.40%	$ 1,261
GA	42	0.12	118,230	2490	25.3%	7.80%	$ 1,118	10.90%	$ 1,554
IL	44	0.08	152,728	2113	39.9%	12.40%	$ 1,582	12.10%	$ 1,551
IN	42	0.12	111,302	1952	28.4%	8.80%	$ 1,147	11.30%	$ 1,471
KY	13	0.11	111,504	1916	26.8%	8.30%	$ 1,062	14.50%	$ 1,851
MI	78	0.13	111,110	2063	30.0%	9.30%	$ 1,326	7.40%	$ 1,051
NJ	48	0.12	108,396	2442	34.9%	7.50%	$ 972	8.40%	$ 1,093
NY	138	0.17	113,302	2360	37.9%	7.70%	$ 1,475	9.40%	$ 1,811
OH	31	0.1	124,230	2133	38.6%	8.90%	$ 1,080	11.10%	$ 1,344
TX	205	0.08	156,550	2405	28.5%	8.30%	$ 1,083	7.60%	$ 994

Total Building Savings = 8.6% HVAC Savings = 31.0%



Equates to approximately $1,300 saved per site plus any gas savings

Specifications PhaseStor®

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Energy Storage Material:

Material:	Bio-Based Phase Change Material (BioPCM®)
Available Energy Storage Temperatures:	-58°F to 200 F
Thermal Energy Storage Per Unit:	40 ton.hr per unit for 33°F to 350°F; 60 ton.hr for -58°F to 31°F
Density of BioPCM®:	7.1 lbs./gal to 9 lbs./gal

PhaseStor® Specifications:

Tank OD (LxWxH):	82.9" x 75.4" x 48.8"
Tank Length (flange to flange):	89.2"
Tank Weight (empty):	3850 lbs.
PCM (lbs.):	4450 lbs. for 33°F to 350°F; 5650 lbs. for -58°F to 31°F
Tank Weight (filled with PCM):	8300 lbs. for 33°F to 350°F; 9500 lbs. for -58°F to 31°F

Structure of Tank:	double wall insulated and reinforced polypropylene
Type of Flanges:	ANSI B16.5 Class 150 slip-on flanges
Lid:	sealed (gasket) removable lid
Pressure Rate:	150PSI standard (220PSI available)

Recent Installs

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PHASECHANGE SOLUTIONS

Recent Installs