

Syntroleum®

Development of Low Cost, Bio-Based
Phase Change Material for
Building Envelopes

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DOE Building Envelopes
Technology Roadmap Workshop

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Objective: Develop manufacturing process that achieves step-reduction in cost of PCMs for building envelopes

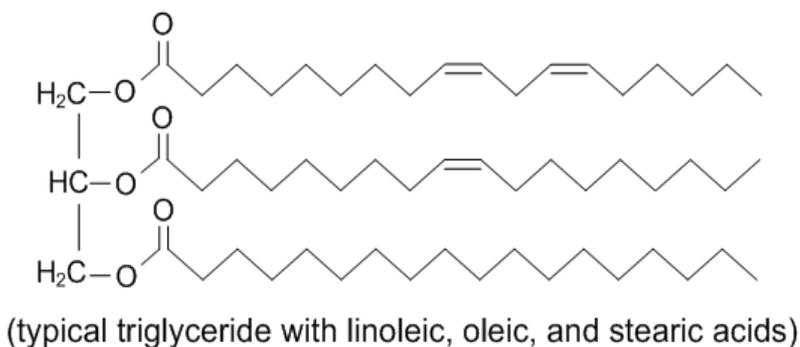
Scope of Work:

- Demonstrate low cost production route:
 - octadecane-rich paraffin via direct hydrogenation/deoxygenation of fats, oils, and greases
 - “encapsulation” of paraffin using standard plastic pelletizing equipment
- Evaluate PCM pellets in building envelope field tests

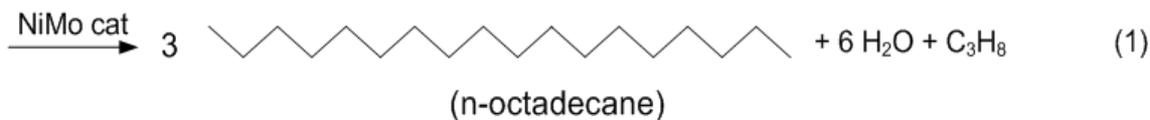
Costs: \$1.26 million total, 20% cost share (60% spent)



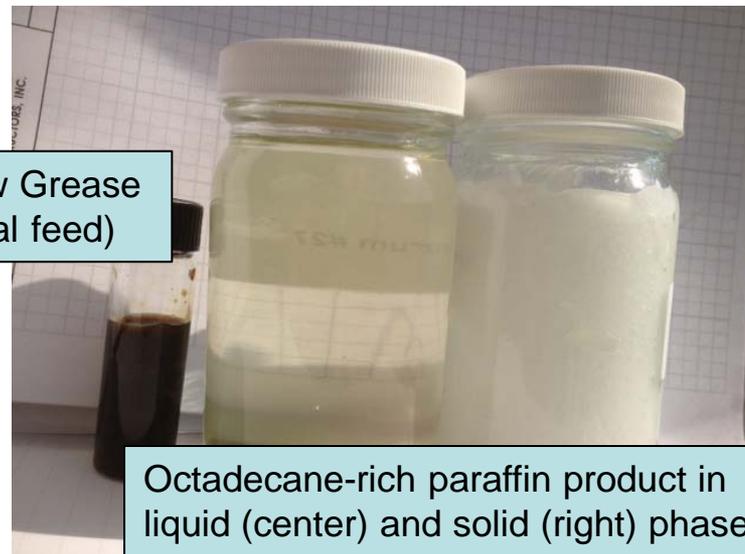
Conversion of fats and oils to octadecane-rich paraffin demonstrated at pilot plant and commercial scale



+ 15 H₂



Yellow Grease
(typical feed)



Octadecane-rich paraffin product in liquid (center) and solid (right) phase

Paraffin melting point **21-22 °C**, heat of fusion **160-170 J/g**

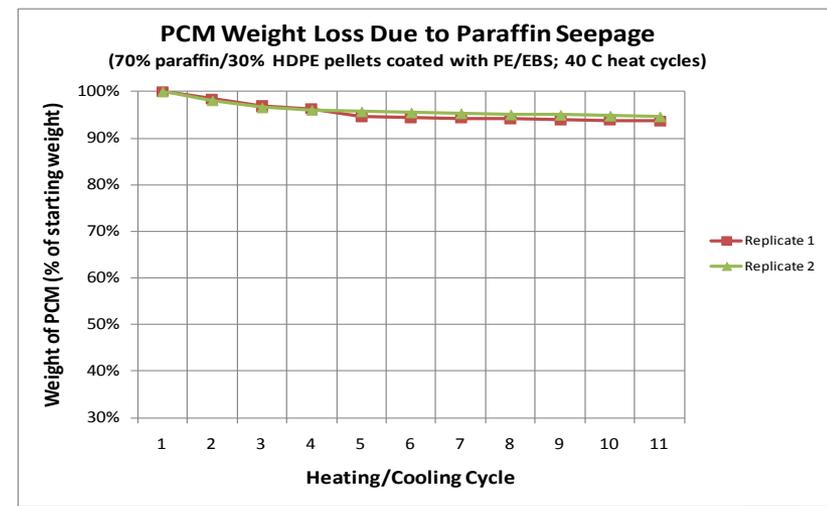
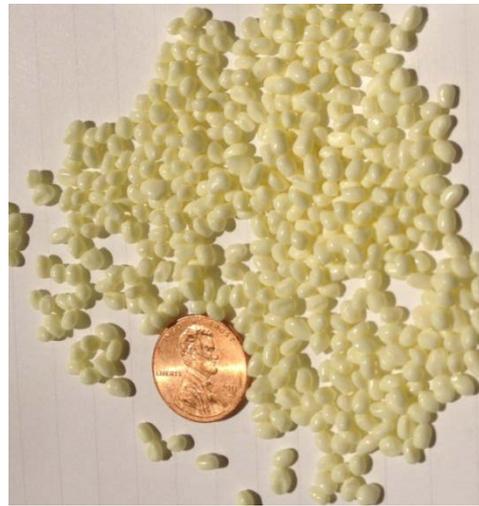
Octadecane concentration of up to **90%** without fractionation, higher with distillation of lighter paraffins (C14-C16)



Produced several hundred pounds of pellets using commercial pelletizing equipment

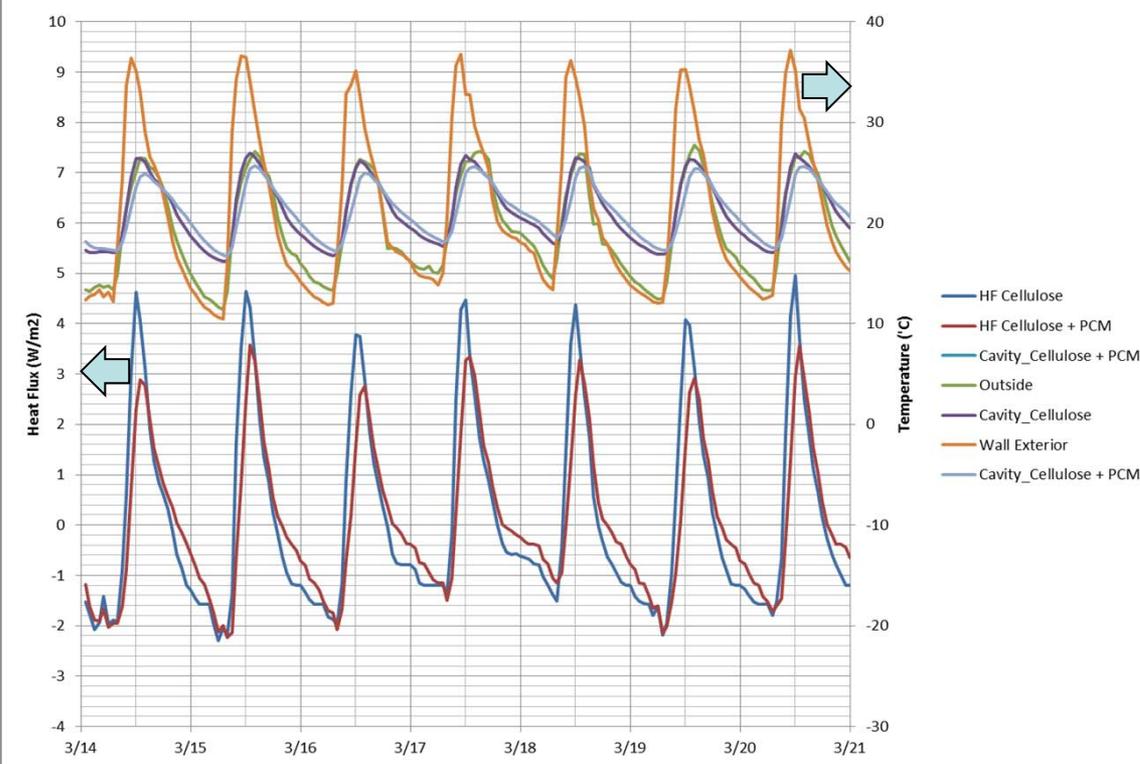
- Strand and under-water pelletizers
- 60-70% paraffin, 30-40% HDPE
- Silica/antimony flame retardant

Shape-stable pellet PCM properties: 90-100 J/g and 21-22 °C



Progress, cont'd

Insulation Temperatures and Heat Flux: March 14-21



PCM pellets added to cellulose insulation in wood frame wall cavity

Evaluation in progress at ORNL Natural Exposure Test Facility

Peak heat flux reduction 20-40% with daily phase change



Next Steps

- Produce and evaluate PCM pellets with higher melt point (24-25 °C instead of 21-22 °C) to ensure refreeze during hot summer nights
- Estimate annual energy savings and reduction in peak power demand for southern U.S.
- Engage building industry consultant on product introduction and marketing strategy
- Expect PCM pellet manufacturing cost to be 30-50% less than micro-encapsulated products on market today



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Backup Slides

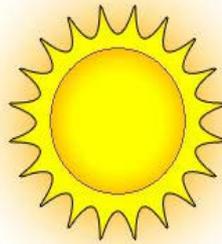


Algal oils

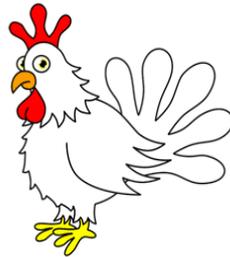
Seaweed oils

Tall oil
fatty acid

CO₂



CO₂



Seed oils

Yellow grease

Brown grease

Waste animal fats

***U.S. sources ~ 16 million ton/y
paraffin equivalent***



Paraffin Production



Dynamic Fuels Plant,
Geismar, LA

75 million gal/y capacity

Started up in Nov. 2010

50/50 JV between Syntroleum
and Tyson Foods

Currently all capacity
dedicated to fuels (mainly
renewable diesel)



Installation

