



# Solstice Foam Blowing Agents

UNIDO Russia – September 2015

**Honeywell**

Focused on **solutions** for the most **challenging problems** faced by customers around the globe



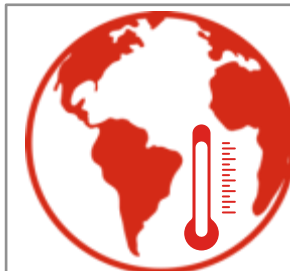
**Energy efficiency** and clean energy generation



Productivity and connectivity



Safety & Security of people, plants, assets, and data



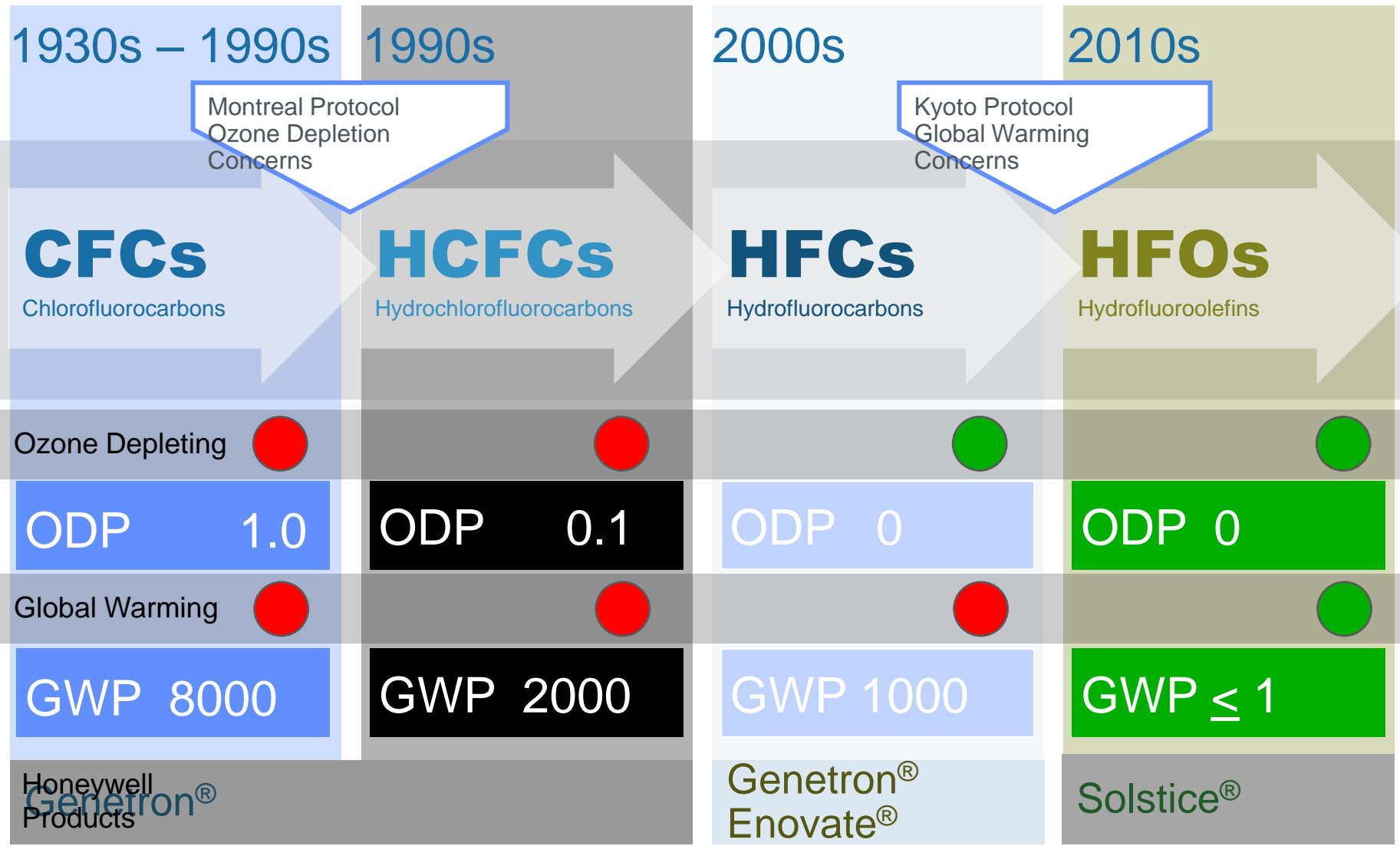
**Greenhouse Gas Emissions / Climate Change**

PMT and all Honeywell businesses, products and services address these major global issues.

# Fluorine Products Generations of New Products



Поколения фторсодержащих продуктов



**Honeywell innovation to achieve environmental breakthroughs**





Производство энергоэффективных вспенивателей с низким ПГП призвано ответить на вызовы, связанные с изменениями климата.

**Globally, another transition is in progress, this time to address climate change. Low Global Warming and Energy Efficient **blowing agent** production is ready to serve this transition – and commercialization is accelerating globally.**

# Solstice<sup>®</sup> LBA and GBA Large Scale Plants

Solstice<sup>®</sup> LBA и GBA : Крупномасштабные производства

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- Q2 2014 start-up for Solstice<sup>®</sup> LBA
- Q4 2014 start-up for Solstice<sup>®</sup> GBA
- Planning underway for 3<sup>rd</sup> and 4<sup>th</sup> plants

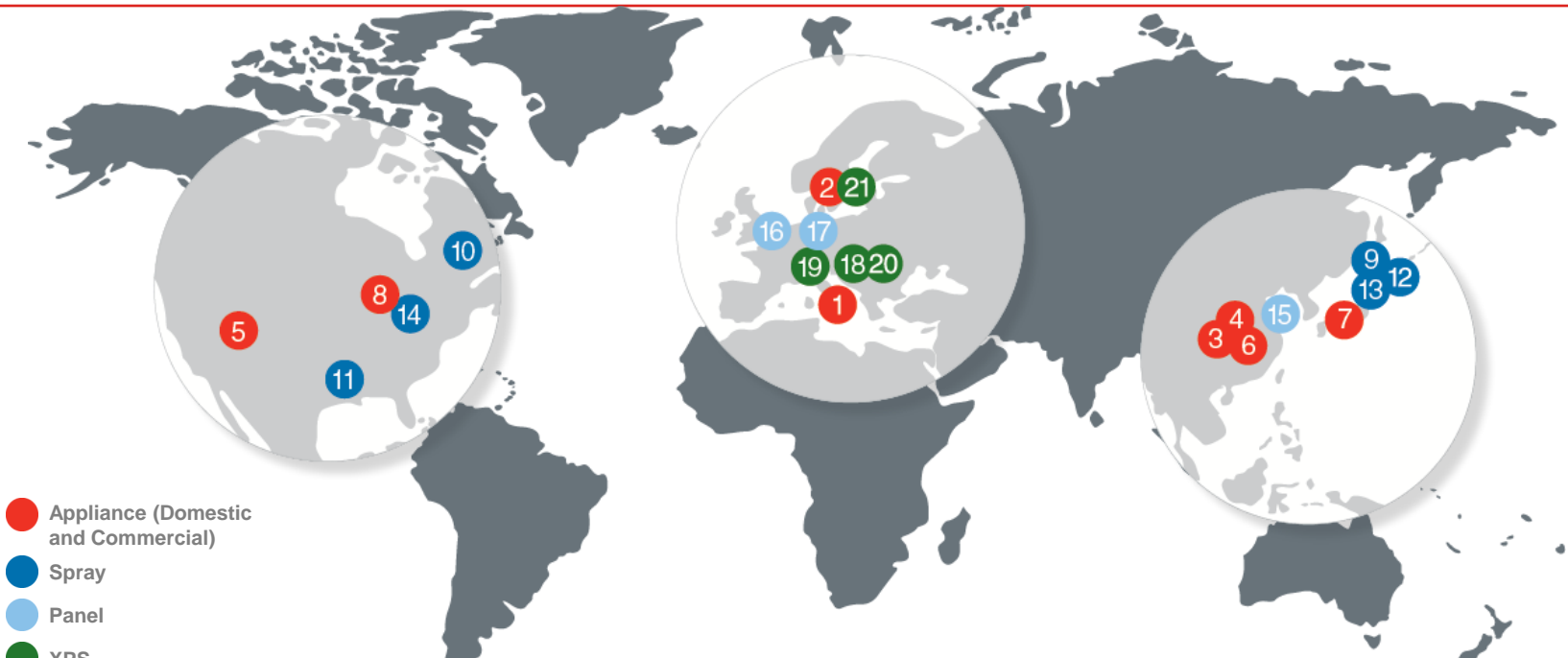
- 2-й квартал 2014 г. : Начало производства Solstice<sup>®</sup> LBA
- 4-й квартал 2014 г. : Начало производства Solstice<sup>®</sup> GBA
- Идет проектирование еще 2-х заводов

**Commercial Solstice<sup>®</sup> plants up and running**

# Solstice LBA and GBA Adoptions Accelerating Globally

Ускорение перехода на Solstice® LBA и GBA по всему миру

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1 **AFINOX**

2 **FESTIVO**

3 **Haier**

4 **Hisense**

5 **HOSHIZAKI**

6 **Midea**

7 **Commercial Appliance OEM**

8 **Whirlpool**

9 **Spray Foam Manufacturer**

10 **ELASTOCHEM**  
Specialty Chemicals Inc.

11 **LAPOLLA**

12 **Pufem**

13 **TOYO TIRES**  
*driven to perform*

14 **WDG**

15 **CIMC**

16 **Kingspan**

17 **UNIT45**

18 **ABRISO**

19 **AUSTROTHERM**  
Dämmstoffe

20 **fibran**  
XPS

21 **JACKON**  
INSULATION

**Bringing LGWP solutions to many application across the globe**

HONEYWELL CONFIDENTIAL



# Sustainable Solutions for Foam Applications

Надежные решения для производства пеноматериалов

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Refrigerator / Freezer



Insulated Metal Panels



Spray Foam



Extruded Polystyrene



One Component Foam



Froth / Refillable Foam



**Solstice® LBA**  
GWP = 1  
Non-ODP  
VOC-Exempt  
Non-Flammable  
**Replaces**  
245fa, 365mfc,  
141b, HC

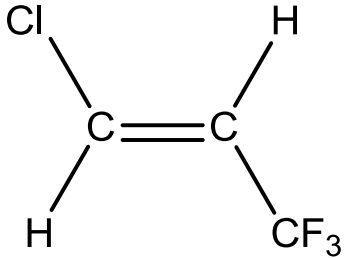
**Solstice® GBA**  
GWP < 1  
Non-ODP  
VOC-Exempt  
Non-Flammable  
**Replaces**  
22, 142b, HC,  
141b, 134a,  
152a, CO2

***Solstice LBA and GBA: Sustainable Solutions for Foam Applications***

# Comparative Physical Properties – Solstice LBA

Сравнительные физические свойства Solstice® LBA

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• **(E) 1-chloro-3,3,3-trifluoro-propene**

• **Trans isomer**

	Solstice LBA	245fa	365mfc	Cyclopentane
Mol. Weight	130	134	148	70
Boiling Point				
°C	19	15.3	40.0	49.3
°F	66	59.5	104	120.7
Flashpoint				
°C	None	None	<-27	-7
°F	None	None	-17	19
LFL / UFL (Vol % in air)	None	None	3.6-13.3	1.5-8.7
ODP	0 <sup>(1)</sup>	0	0	0
GWP, 100 yr	1 <sup>(2)</sup>	1,030 <sup>(3)</sup>	910	<25 <sup>(5)</sup>
OEL <sup>(4)</sup> (PEL)	800	300	1,000	600

1. No impact on ozone layer depletion and is commonly referred to as zero, Reference: Preliminary report: Analyses of tCFP's potential impact on atmospheric ozone; Dong Wang, Seth Olsen, and Donald Wuebbles Department of Atmospheric Sciences University of Illinois, Urbana, IL
2. Global Warming Potentials and Radiative Efficiencies of Halocarbons and Related Compounds: A Comprehensive Review; Hodnebrog et. al., Reviews of Geophysics, April 2013
3. 2007 Technical Summary. Climate Change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
4. Workplace Environment Exposure Committee / Manufacturers' literature
5. UNEP Rigid and Flexible Foams Technical Options Committee 2010 Report

Note: Physical properties are one of a mosaic of attributes that must be assessed to determine the suitability of any material as a blowing agent.

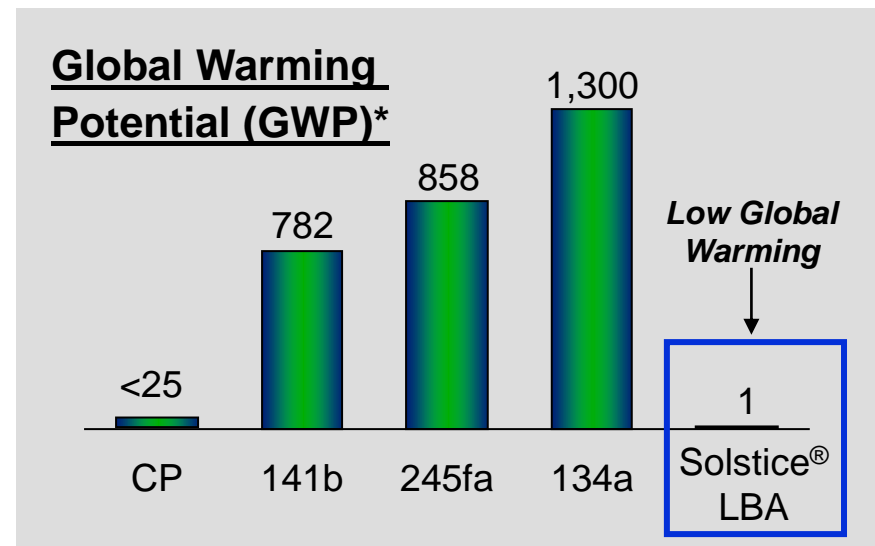
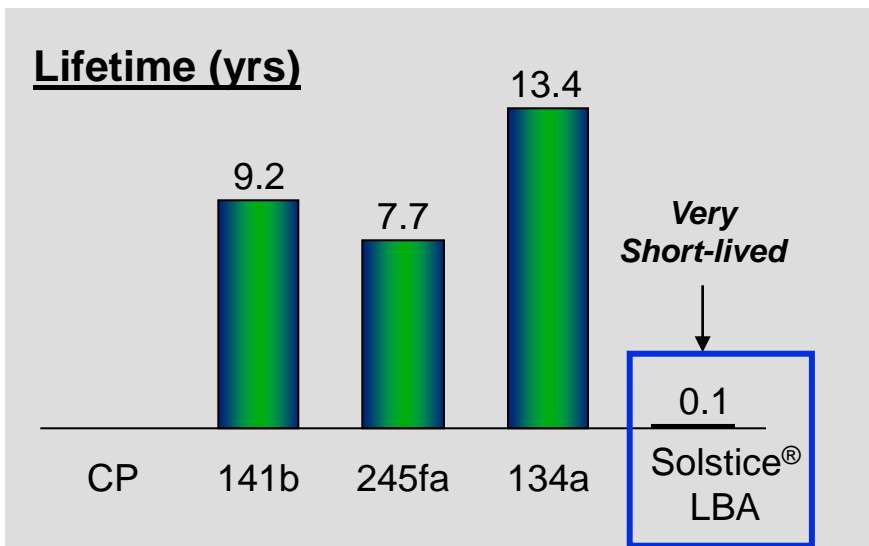
**Solstice LBA Has Excellent Blowing Agent Properties**



# Safe for Users and the Environment

Безопасность для пользователей и экологии

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**FLAMMABLE**

- Cyclopentane
- 365mfc

**Higher Cost/Risk**

**NOT FLAMMABLE**

- 141b
- 245fa
- 134a
- Solstice LBA

**VOC/ High POCP**

- Cyclopentane

**Permitting Issue  
Higher Cost**

**NOT VOC/Low POCP**

- 141b
- 245fa
- 134a
- 365mfc
- Solstice LBA

\*Source: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press. (ex cyclopentane, which is from the UNEP Foams Technical Optionc Committee 2010 Report

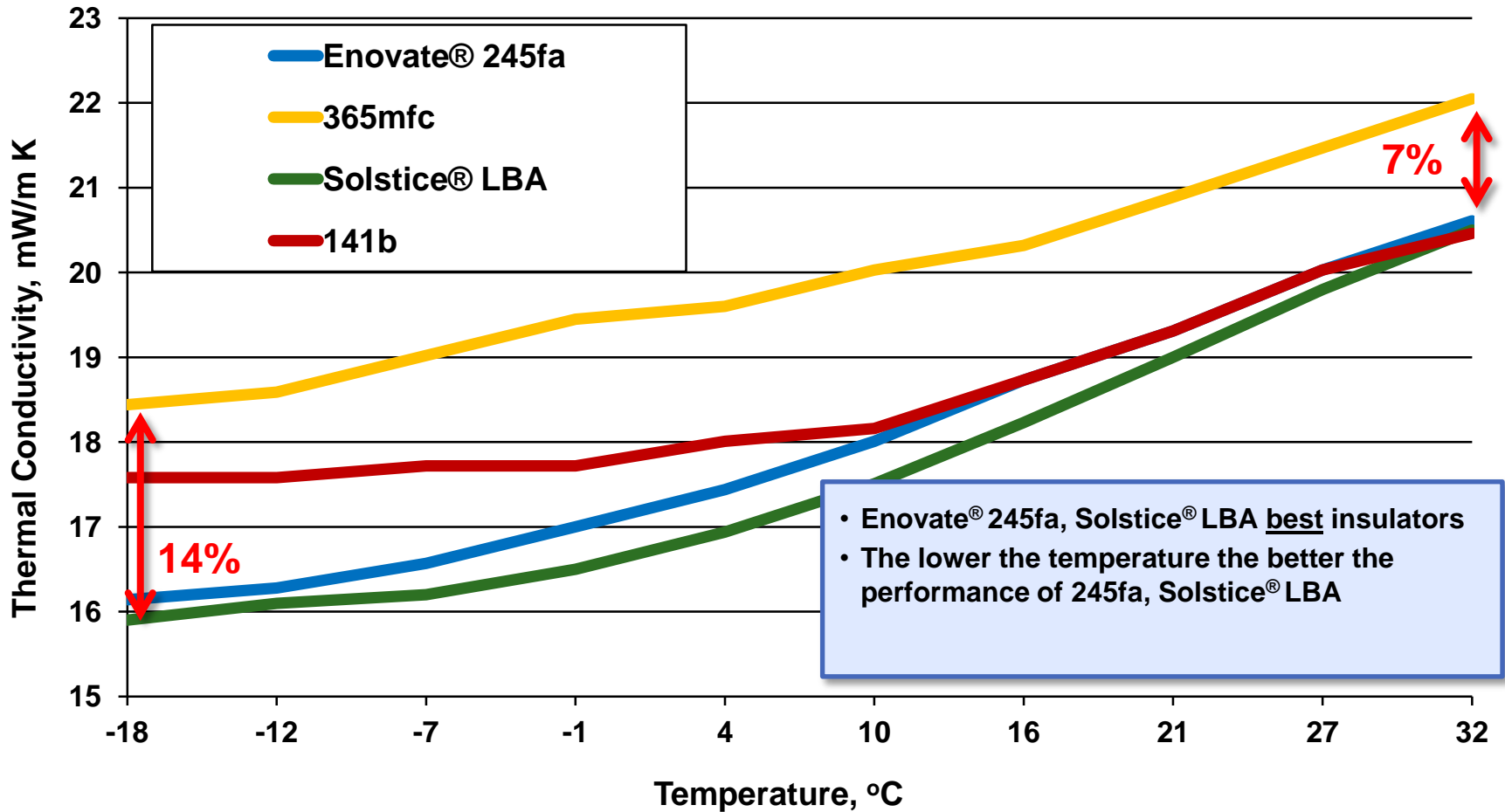
**Superior Safety and Environmental Performance**

# Solstice LBA vs. High GWP Blowing Agents

Solstice LBA в сравнении со вспенивателями с высоким ПГП

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Lower Thermal Conductivity = Better Insulation



k-factors will vary by formulation

**Enovate® 245fa, Solstice® LBA are best in low temperature insulation**

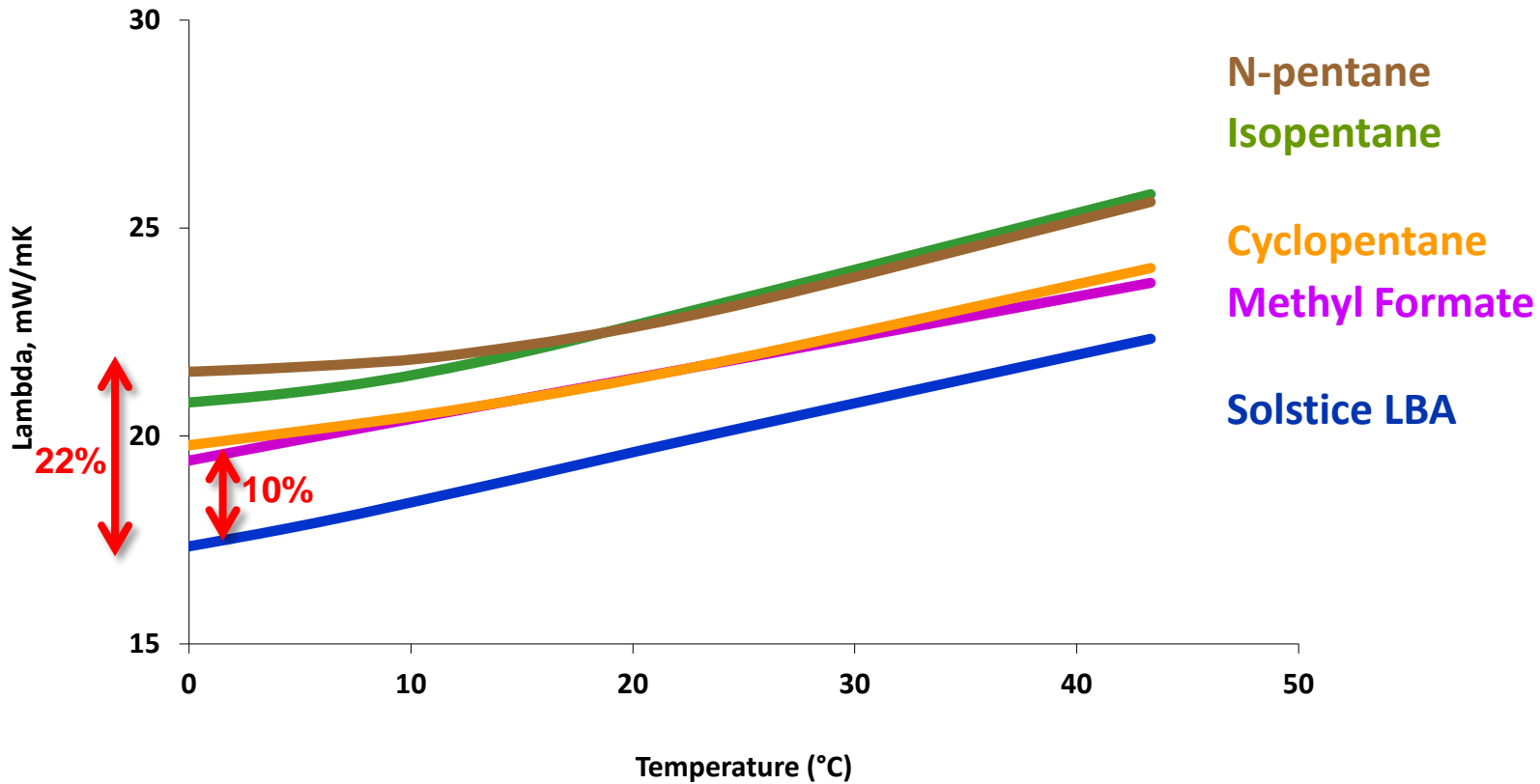
# Solstice LBA and Other LGWP Blowing Agents

Solstice LBA и другие вспениватели с низким ПГП

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## Initial Lambda

Solstice LBA Provides Lowest Lambda



**Solstice LBA provides lowest lambda, Even with Un-optimized Systems**

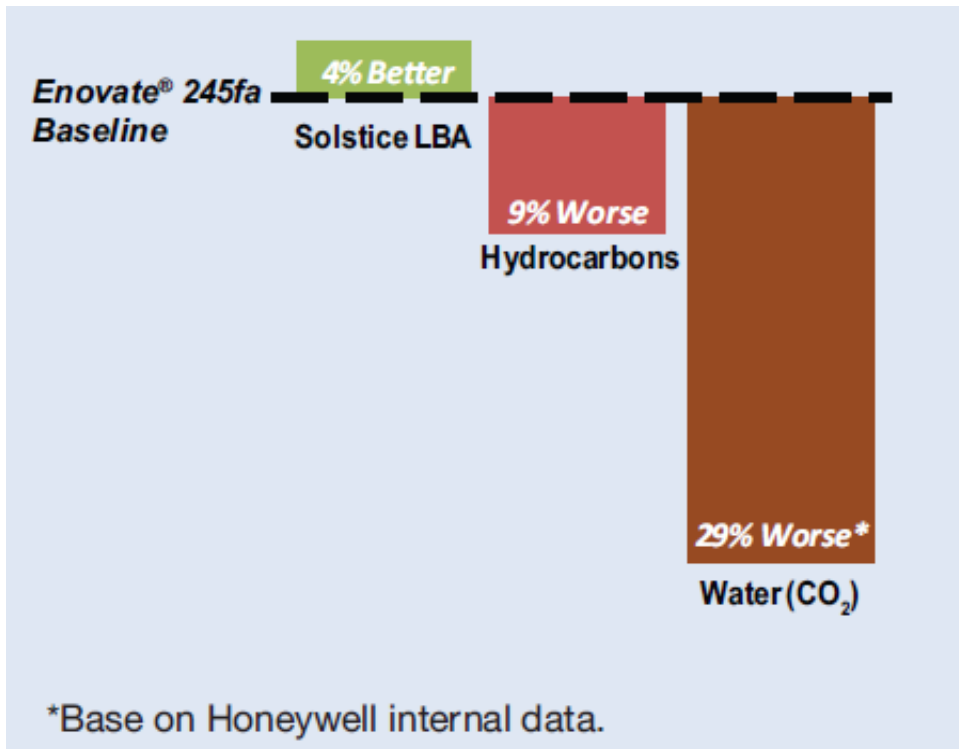


# Improved Insulation – Solstice LBA

Solstice® LBA: Улучшенная теплоизоляция

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## Improvement on R-value vs. alternatives Mean Temperature 4°C



## Additional Benefits

- Non-flammable = no capex
- Low density: ~35 vs. ~45Kg/m<sup>3</sup> (water)
- Good processing (solubility, flow)
- Good adhesion to liner or skin

### Дополнительные преимущества

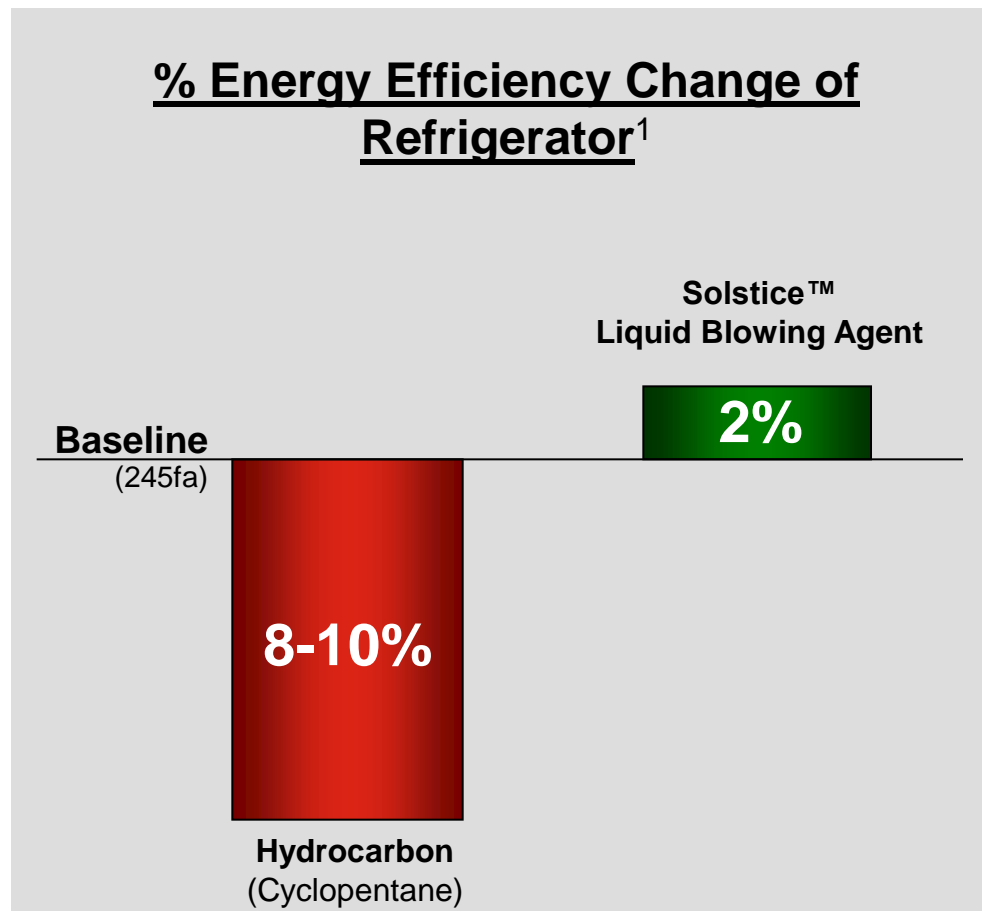
- Негорючий = отсутствие капитальных затрат
- Низкая плотность: ~35 vs. ~45Kg/m<sup>3</sup> (на водной основе)
- Высокая технологичность (растворимость, текучесть)
- Хорошая адгезия к субстрату

**Up to 10% improved insulation than pentane based foam**

# More Energy Efficient

Повышенная энергоэффективность

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- In refrigerator and panel trials, Solstice LBA saves energy:

- 10-12% more efficient than cyclopentane
- 2% more efficient than 245fa

На испытаниях в сегментах холодильного оборудования и сэндвич-панелей Solstice LBA продемонстрировало энергоэффективность

- на 10-12% выше, чем циклопентан
- на 2% выше, чем 245fa

**10-12% More Energy Efficient than Cyclopentane**

1) Commercial refrigerator trials; unoptimized formulation of Solstice L- BA; Cyclopentane vs. 245fa from AHAM trials

# Regulatory Status

Нормативный статус

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- **Global Regulatory Filings:**
  - **Current registrations:** US (SNAP and PMN), EU REACH (1,000MT), China (<100MT), Japan, Canada, S. Korea, others
  - **Registrations in Process:** China (1,000MT)
  - **No unique product safety registration requirements in:** India, Indonesia, Mexico, Brazil, S. America, Central America, M. East, Africa
- **VOC Exempt: August 2013**
  - US EPA Ground Level Ozone measure
  - **Akin to POCP in Europe**

***Globally Registered for Commercial Sale***



# Summary

Заклучение

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- **Superior Energy Efficiency Performance**
  - 2-4% more energy efficient than 245fa
  - 8-10% more energy efficient than Cyclopentane
- **Strong environmental properties**
  - GWP of 1 (= CO<sub>2</sub>), non-ODP, VOC-exempt, non-flammable
- **Commercially available today**
  - Today: World class, large scale plant
  - **Commercial sales have begun globally in multiple applications**
- **Registered globally**
  - **Current registrations: REACH <1,000**, US, Japan, Canada, Mexico, Brazil, S. Korea, others
  - **Registrations in Process: China (>1,000mt)**
  - **No limitations on sales in:** India, Indonesia, Mexico, Brazil, S. America, Central America, M. East, Africa

**Превосходная энергоэффективность**

  - На 2-4% выше, чем у 245fa
  - На 8-10% выше, чем у циклопентана

**Высокая экологичность**

  - ПГП равный 1 (=CO<sub>2</sub>), не относится к ОРВ и ЛОВ, негорючий

**Коммерчески доступен уже сегодня**

  - Запущено крупномасштабное производство мирового класса
  - Коммерческие поставки по всему миру для различных областей применения

**Зарегистрирован:** ЕС, США, Япония, Канада, Мексика, Бразилия, Южная Корея и другие страны

**В процессе регистрации:** Китай (> 1000 т)

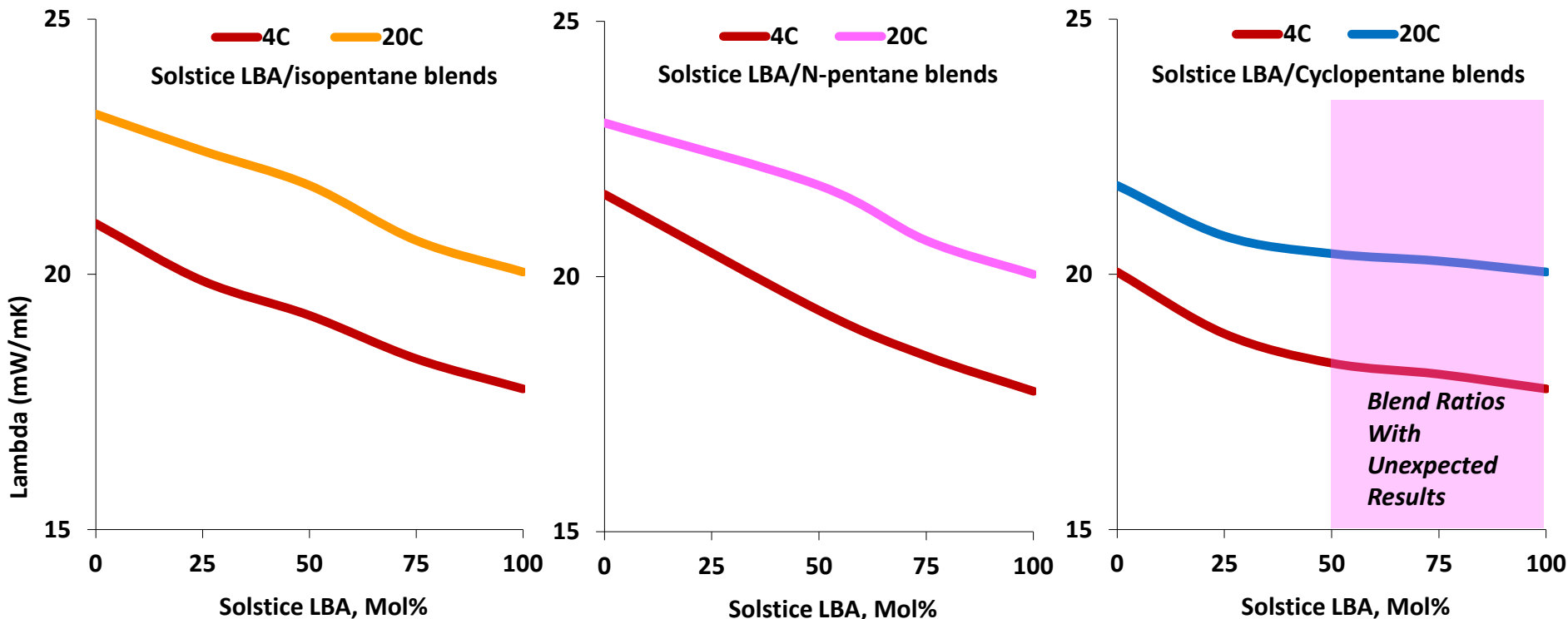
***High Performance & Sustainable Solution Exist Today***

# Appendix

# Solstice<sup>®</sup> LBA Blends with Pentanes

Solstice<sup>®</sup> LBA в смесях с пентанами

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**Solstice<sup>®</sup> LBA Cyclopentane blends are an ideal balance of performance and cost**