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# L-Ketals – Renewable Platform Chemicals



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Adding Value Through Green Chemistry  
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# Trends that Support Bio-based Chemicals

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Regulations forcing reformulation and redesign

*Increased scrutiny on material health*

Access to new functionality

*Differentiated performance that is enabled by new structures*

Opportunity for better long term economics

*Promise of delinking from fossil fuel-based economics*

Emphasis on carbon footprint reduction and sustainability

*At all points in the Supply Chain*

Brand owners seeking to enhance green image

*Consumer seeking more responsible offerings*



# Segetis Technology Platform: L-Ketals

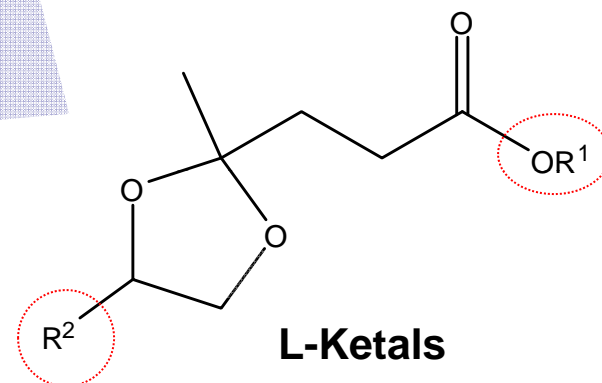


Vegetable Oil



Hemi cellulose  
(C5 sugars)

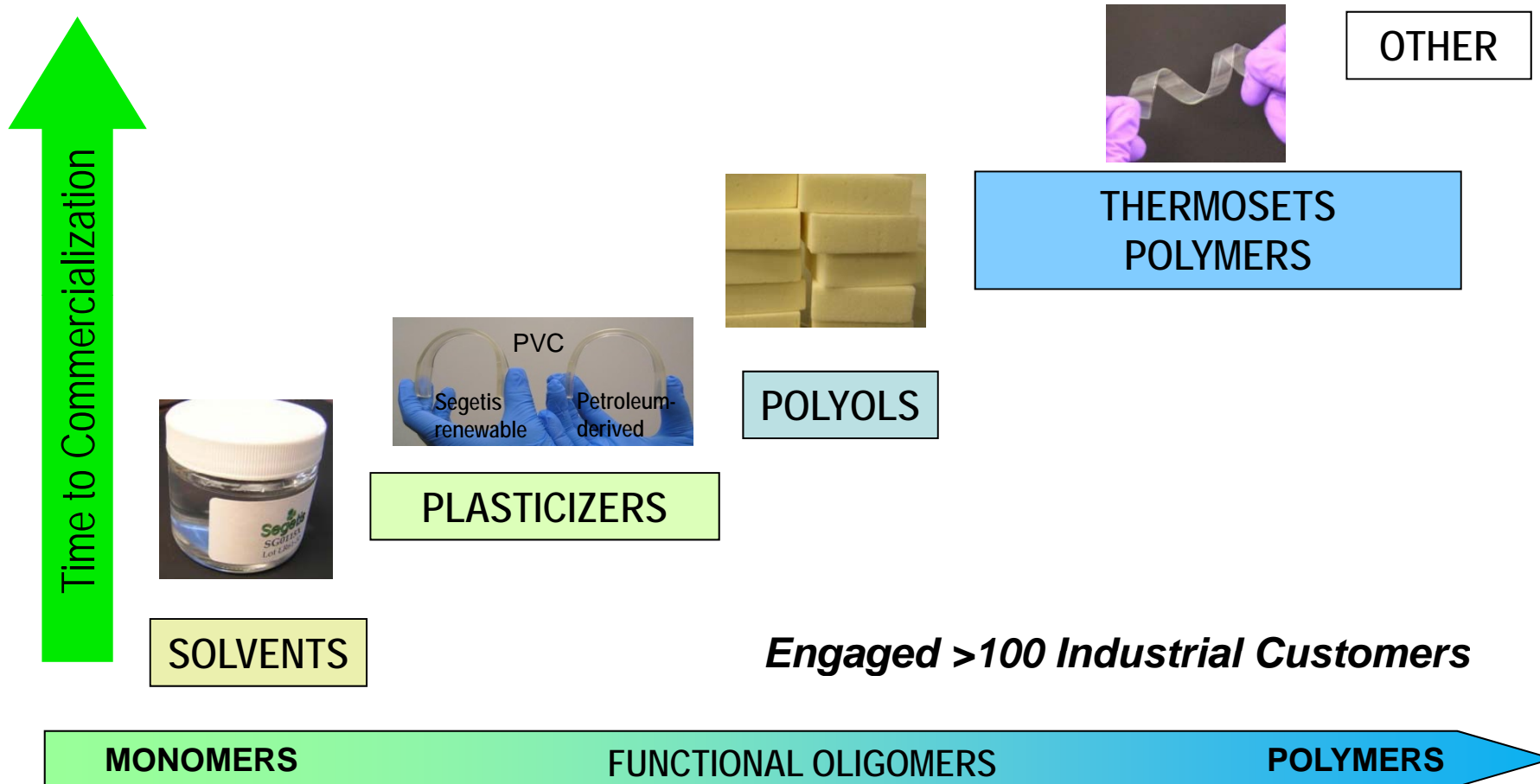
Cellulose or Starch / Sugar  
(C6 sugars)



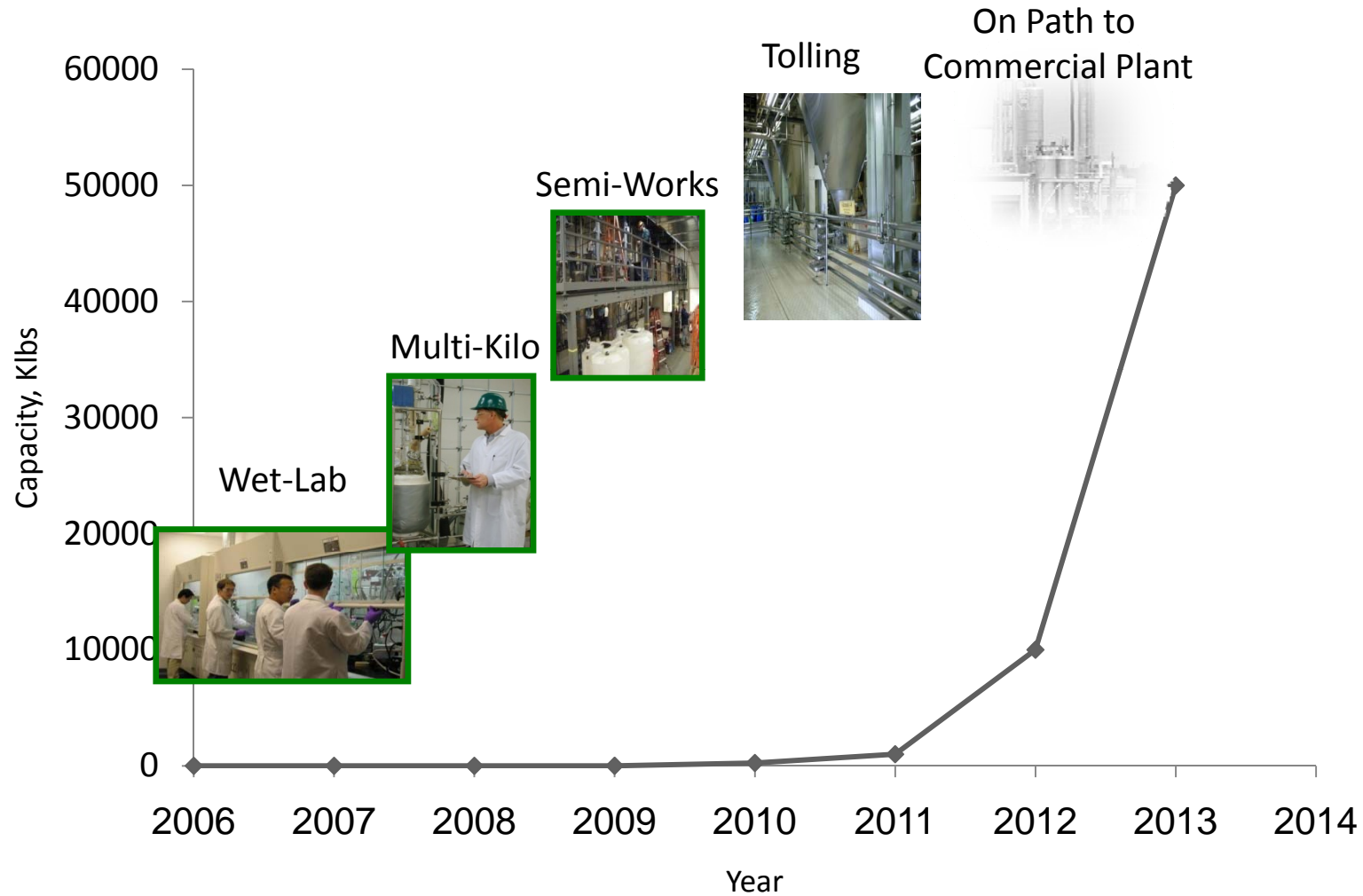
## L-Ketals

Readily extended using standard catalysts and reaction conditions to produce a wide range of **bio-based** ester technologies.

# Segetis L-Ketal Material Systems










# Rapid Growth with Plans to Accelerate












# Plasticizers – No Compromise on Performance

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	<b>Compatibility</b>	Miscible with many resin families across a wide loading range
	<b>Efficiency</b>	Comparable to superior efficiency in vinyl and bioplastics
	<b>Mechanicals</b>	No compromise on final material properties
	<b>Permanence</b>	Very low migration and high resistance to extraction by polar and non-polar solvents
	<b>Multi-use</b>	Well rounded performance allows formulation simplification
	<b>Renewable Materials</b>	Renewable carbon based replacement for phthalates and benzoates
	<b>Portfolio Breadth</b>	Family of ketal based plasticizers across a wide molecular weight range

# Solvents – Safe, Broad Solubility

	<b>Broad solvency</b>	Near-universal solvent
	<b>Low, tunable volatility</b>	Non-VOC, non-flammable, CARB LVP-exempt
	<b>Efficient coupling</b>	Brings together multi-component formulations Excellent cleaning properties
	<b>Low surface tension</b>	Promotes cleaning and wetting

<i>Application</i>	<i>Solvency</i>	<i>Tunable Volatility</i>	<i>Coupling</i>	<i>Surface tension</i>
Cleaners				
Coatings				

 = key attribute in application



# Product Safety and Regulatory

Segetis solvents are US TSCA listed with Canadian DSL and REACH underway

Safety Testing on Segetis solvents at 100% concentration

End Point	Segetis Solvents
AMES	* No mutagenic response or toxicity
BCOP Eye Irritation	Classified as “mild” by <i>In vitro</i> score
EpiDerm Skin Irritation	ET <sub>50</sub> 2.8-9.3 h
HRIPT	No response in any subject
Biodegradability	* Ultimately Biodegradable
Aquatic Toxicity	Algae and Daphnia 48 h EC <sub>50</sub> = 386 mg/L (Most Sensitive Species)

\* Preliminary testing results. Final reports expected mid-October

Modeling data available for acute fish toxicity, oral and inhalation mammalian toxicity  
No Segetis materials were modeled to be persistent, bioaccumulative or toxic.





# Enhanced Sustainability Profile

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CRADLE



TO

GATE



- 3<sup>rd</sup> Party LCA modeled “field to product” comparison vs similar petrochemicals (plasticizer and polyol)
- In comparison to petro-based alternatives
  - 2 gallons of gasoline saved per gallon of Segetis product
  - 7 tons of CO<sub>2</sub>-equivalents saved per ton of Segetis product
- Similar result expected vs. Glycol Ethers for solvent use

# Segetis Path to Commercialization

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Ramp commercial sales in 2011

*Significant growth opportunity in target markets*

Partner to develop levulinic acid supply chain

*Strategic feedstock and financing partnerships*

Prepare for full scale roll-out

*Target 2013 for commercial scale implementation*



# Addressing Unmet Market Needs

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Performance without compromise

Cost-competitive

Scalable, Reliable, Reproducible

Safe and Sustainable

Compatible with existing infrastructure

Environmentally sound end-of-life options

***Segetis technologies address all of these issues***





**THANK YOU**

*[www.segetis.com](http://www.segetis.com)*

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