

CatCost: Better Cost Information for Catalyst R&D



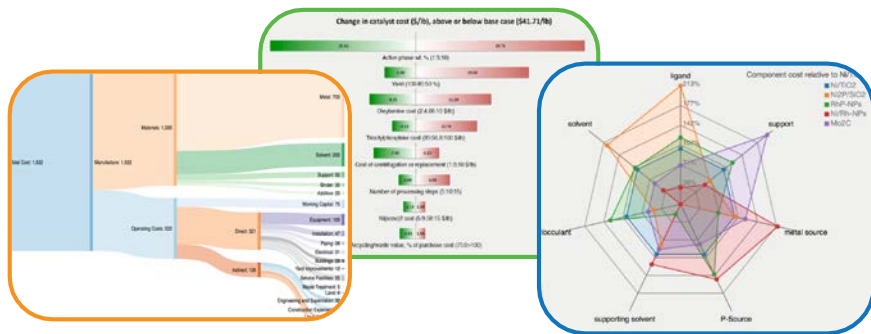
Developed at NREL and PNNL with guidance of industry experts

Problem: High commercialization risk

- Catalyst cost is a major contributor to commercialization risk for catalytic processes
- Up to 10% of capital cost and $\pm 10\%$ uncertainty in MFSP for biomass conversion
- **No publicly available tools to evaluate cost**

Solution: “CatCost” Catalyst Cost Estimation Tool

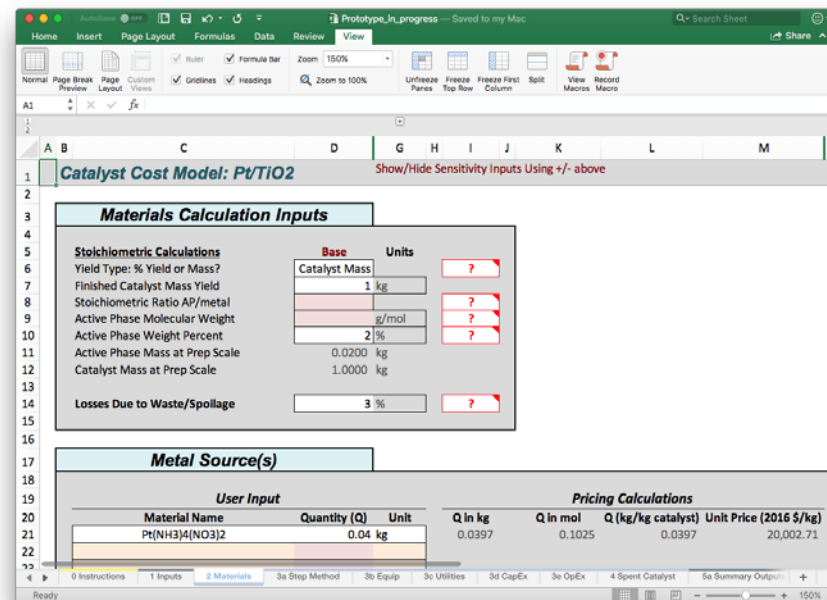
- Enables early-stage comprehensive cost analysis
- No process design / TEA experience needed
- Improves cost-responsiveness of catalyst R&D



Free and public release
Fall 2018

catcost.chemcatbio.org

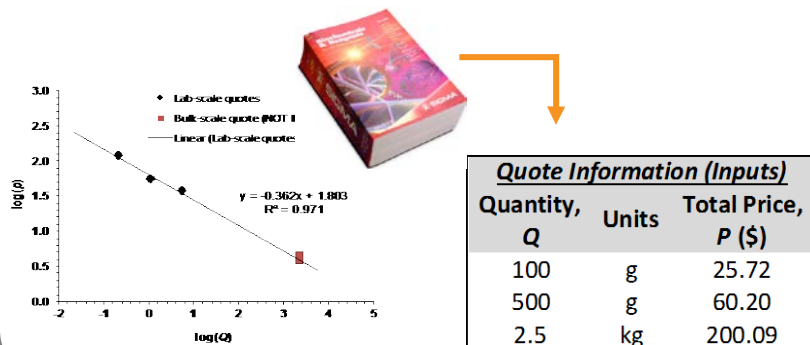
Excel- and web-based versions available



CatCost: Estimation Methods

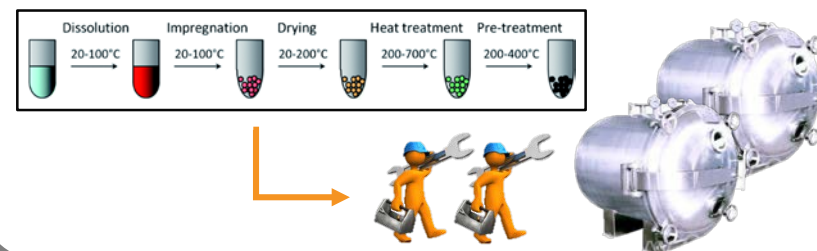
1. Raw Materials Pricing

- Built-in library of common materials
- Guidance for obtaining quotes
- Extrapolation from lab-scale prices



2. Detailed Process Templates for Common Catalyst Types

- E.g. metal/metal oxide, zeolite, MOFs, flow/batch nano, metal carbides
- Including equipment, labor, utilities, CapEx, OpEx (industry-standard methods)



3. A Simple “Step Method” to Supplement Process Templates

- All-in costs in \$/hr for typical unit ops. (e.g. Belt Filter, Reactor, Spray Dryer)
- Quick addition of new catalyst types or steps to existing process templates

4. Complete Spent Catalyst Value

- Including precious metals recycling, catalyst attrition, landfill/disposal costs

| Metals Reclamation Calculations | Base | Units |
|--|-----------|------------------|
| Catalyst solids after use | 0.98 | kg/kg catalyst |
| Metal content in fresh catalyst | 0.0200 | kg/kg catalyst |
| Metal losses during use (typical) | 10 % | |
| Metal losses during refining (typical) | 3 % | |
| Recoverable metal | 0.0175 | kg/kg catalyst |
| Recoverable metal, troy ounces | 0.5614 | oz t/kg catalyst |
| Spot price | 31,873.61 | \$/kg metal |
| Recoverable metal value | 556.51 | \$/kg catalyst |

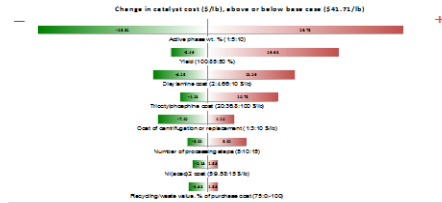
Integrating the best methods in catalyst cost estimation into a powerful analysis tool

CatCost: A Convenient and Powerful Tool for Researchers

Flexible for a Variety of Uses

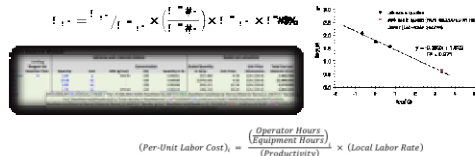
Cost Sensitivity Analysis

(assessing commercialization potential and risks)



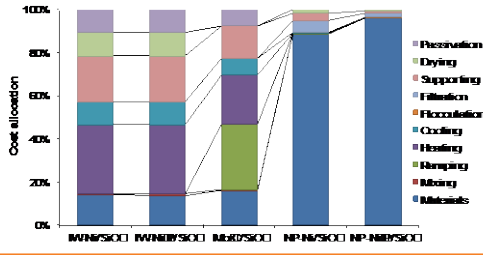
Cost Analysis Framework

(incorporation into TEA studies; LCA-compatible outputs, etc.)



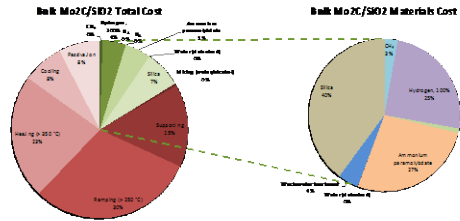
Comparison of Multiple Catalysts

(purchasing, deployment testing)

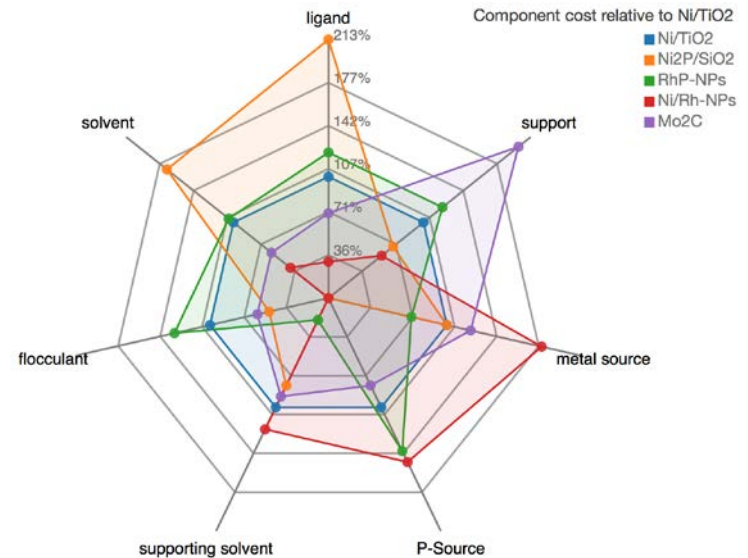


Component Cost Analysis

(directing R&D to areas of need)



- Built-in, industry-vetted analysis features
- Extensively reviewed by industrial experts
- Powerful visualizations
- Verified ($\pm 20\%$) with market cost data for high-volume commercial catalysts



Enabling better R&D decisions by providing catalyst researchers with actionable cost information

Free public release in the fall of 2018 at
catcost.chemcatbio.org

Contact the team at CatCost@nrel.gov



Acknowledgements

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