



Hardwood Pulpwood Markets: Demand Trends and Bioenergy Realities

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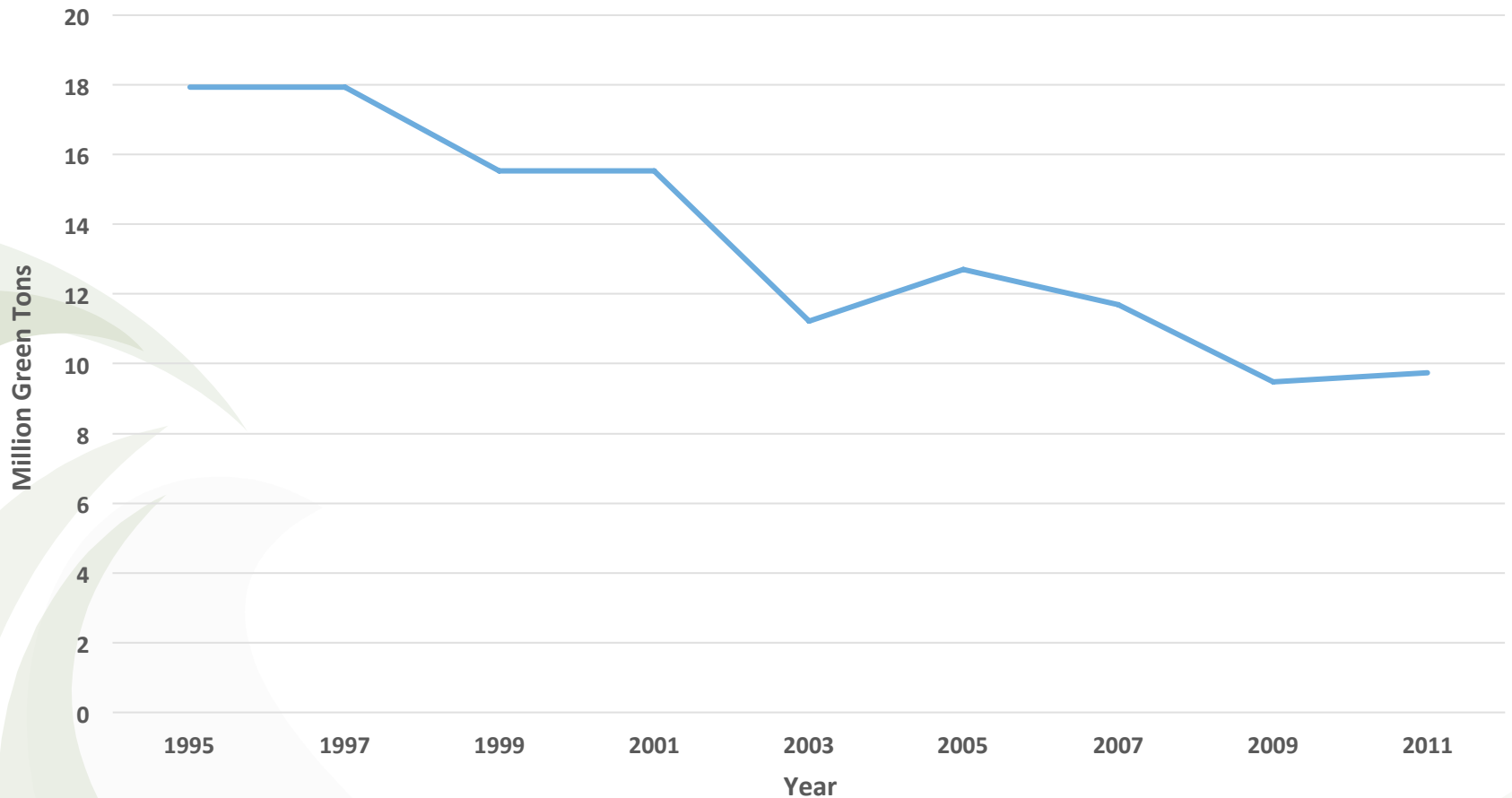
About Forisk Consulting

- Forisk provides management consulting and educational services to senior management and investors in the forest industry and timberland investing sectors.
- Founded in 2004.
- Key products:
 - *Forisk Forecast*
 - *Wood Bioenergy US*
 - *US Timberland Owner List*
- Books:
 - *Wood for Bioenergy* (Forest History Society)
 - *Forest Finance Simplified* (Forisk Press)

Topics

- Forest industry hardwood pulpwood demand.
 - Current trends in AR, LA and MS.
- Screening bioenergy projects.
 - Mandates don't produce power.
- Wood bioenergy projections.
 - Potential hardwood pulpwood demand in AR, LA and MS.

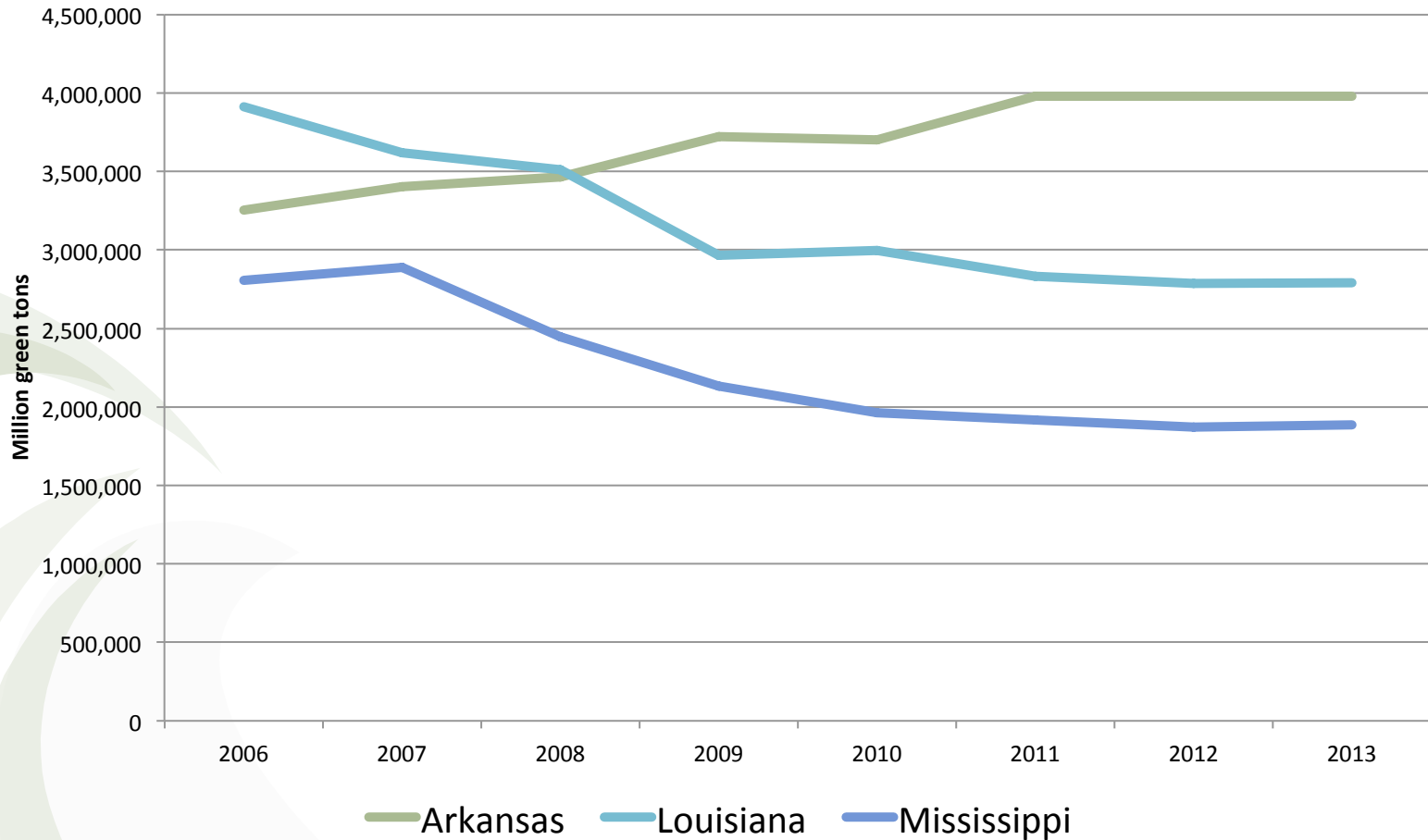
Hardwood Pulpwood Removals: AR/LA/MS 1995 – 2011



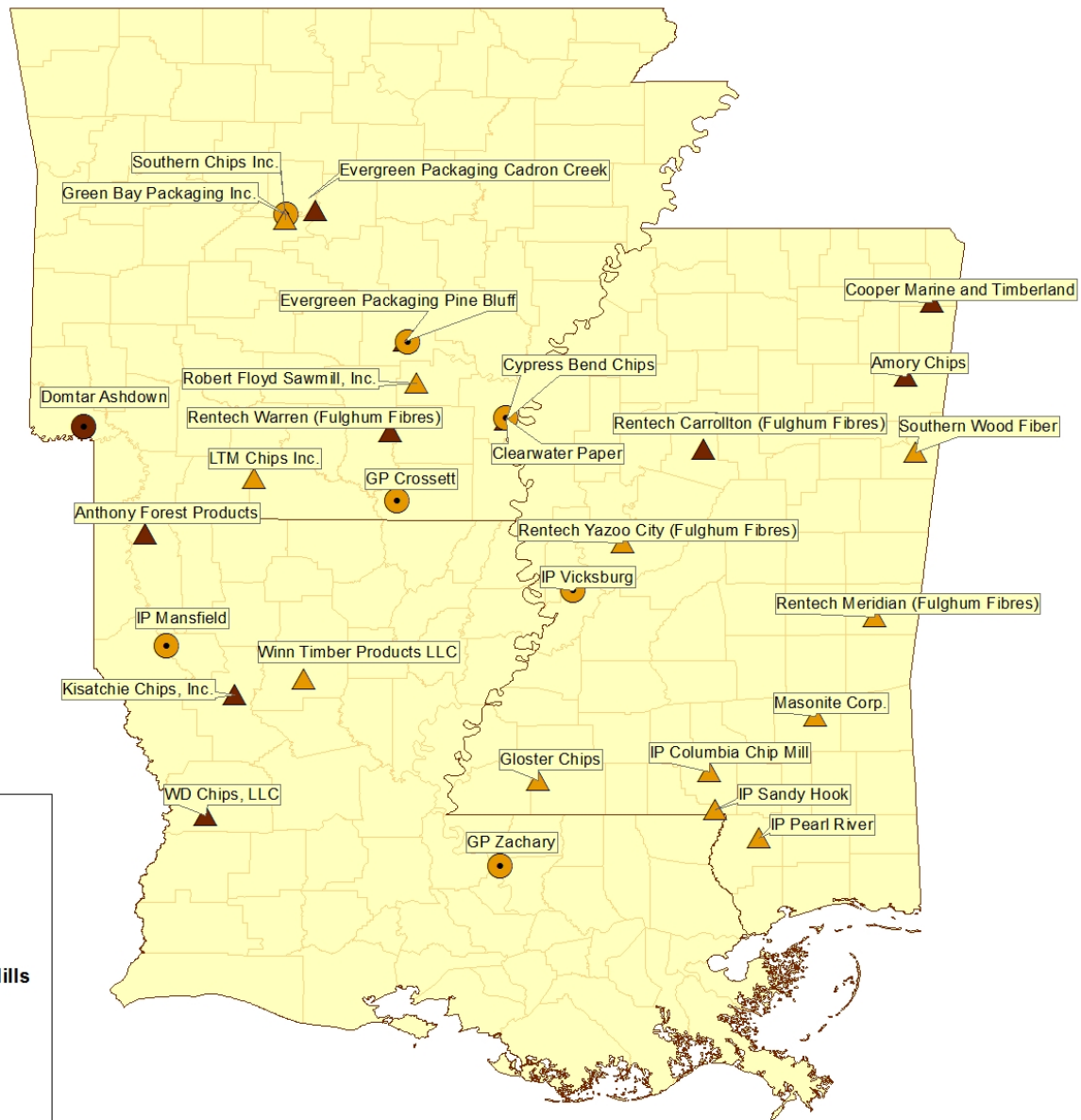
Source: USFS (TPO)

Note: data for 1997 and 2001 incomplete; data shown is for previous year

Hardwood Pulpwood Demand: AR/LA/MS 2006 – 2013



Source: Center for Forest Business, UGA



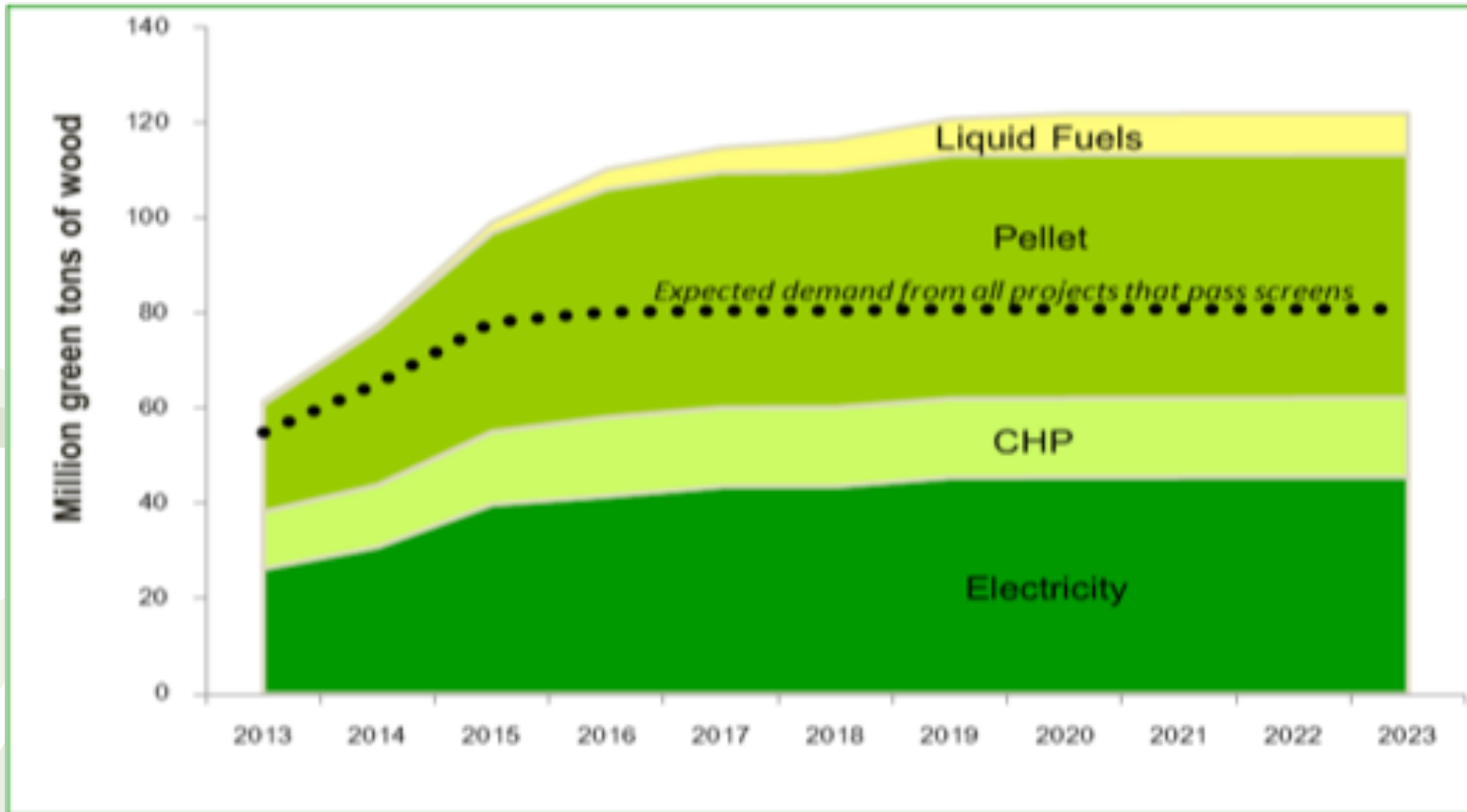
Sources: Forisk Consulting, Forest Industry Shapefiles (UGA)

Bioenergy Projects: Screen for Success

- Technology
 - Does the project rely on proven or unproven technology?
- Status
 - Is the project under construction or operating?
 - Is the project on hold or is the plant shut down?
 - Has the project received/secured/signed **two or more** of:
 - Financing
 - Air quality permits
 - EPC contracts (Engineering, Procurement & Construction)
 - Power purchase agreements for electricity facilities
 - Interconnection agreements for electricity facilities
 - Wood supply agreements
 - Location



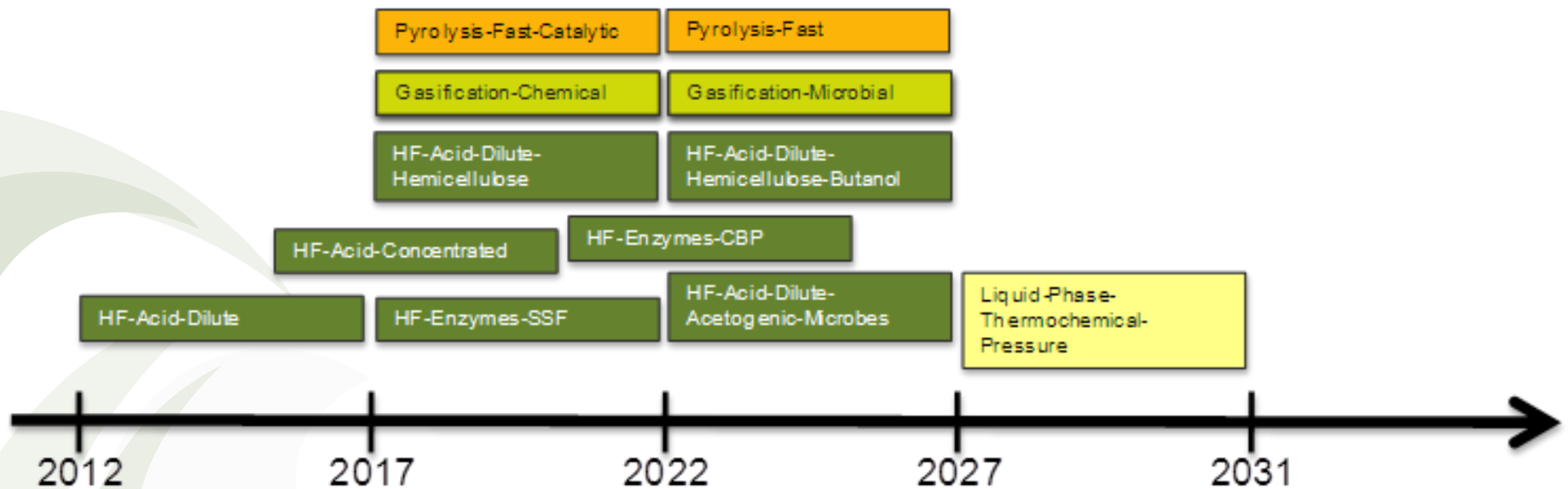
Bioenergy Demand: US Case Study



- Projects: 442 → Expected: 290 (66%)
- Wood demand: 122.6 MM → Expected: 80.9 MM (66%)

In 2011, Forisk evaluated 36 liquid fuel projects across three US regions.

- Estimated commercial timeline for 12 technology types

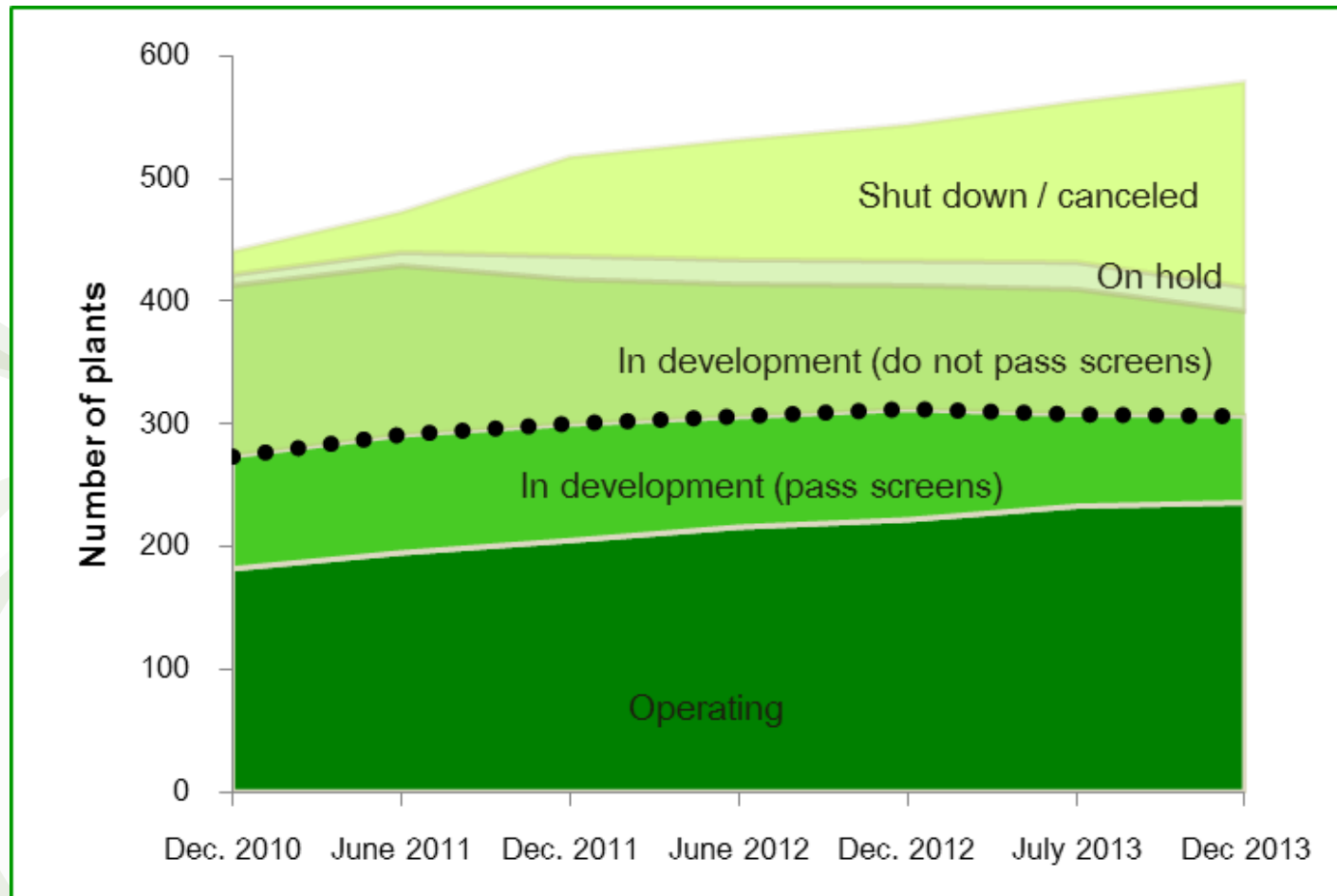


Where are these 36 projects today?

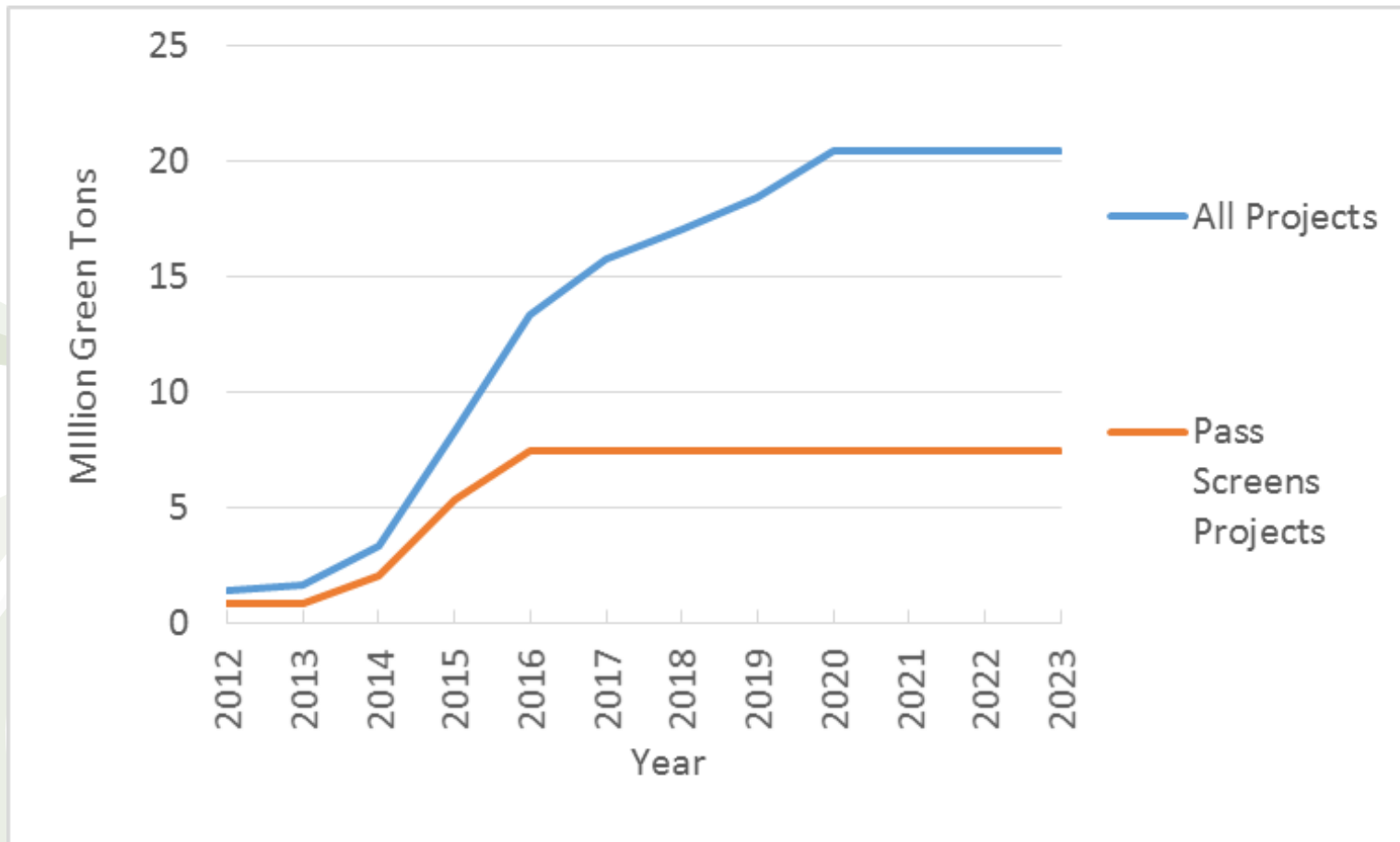
- Cancelled: 12
 - Includes one demonstration plant and 11 commercial plants
- Still in planning stages: 8
- Still under construction: 4
- Shut down: 3
- Operating pilot plants: 6
- Operating demonstration plant: 1
- Operating commercial plant: 1
 - KiOR: not operating at full capacity yet
- Sold and in the planning states: 1
 - LanzaTech purchased Range Fuels plant

Wood Bioenergy: Why do projects fail?

U.S. Bioenergy Plant Progress; Dec 2010 - Dec 2013



Total Wood Consumption by Bioenergy Plants in AR, LA, and MS



Hardwood Pulpwood Consumption by Announced Bioenergy Plants: AR/LA/MS

