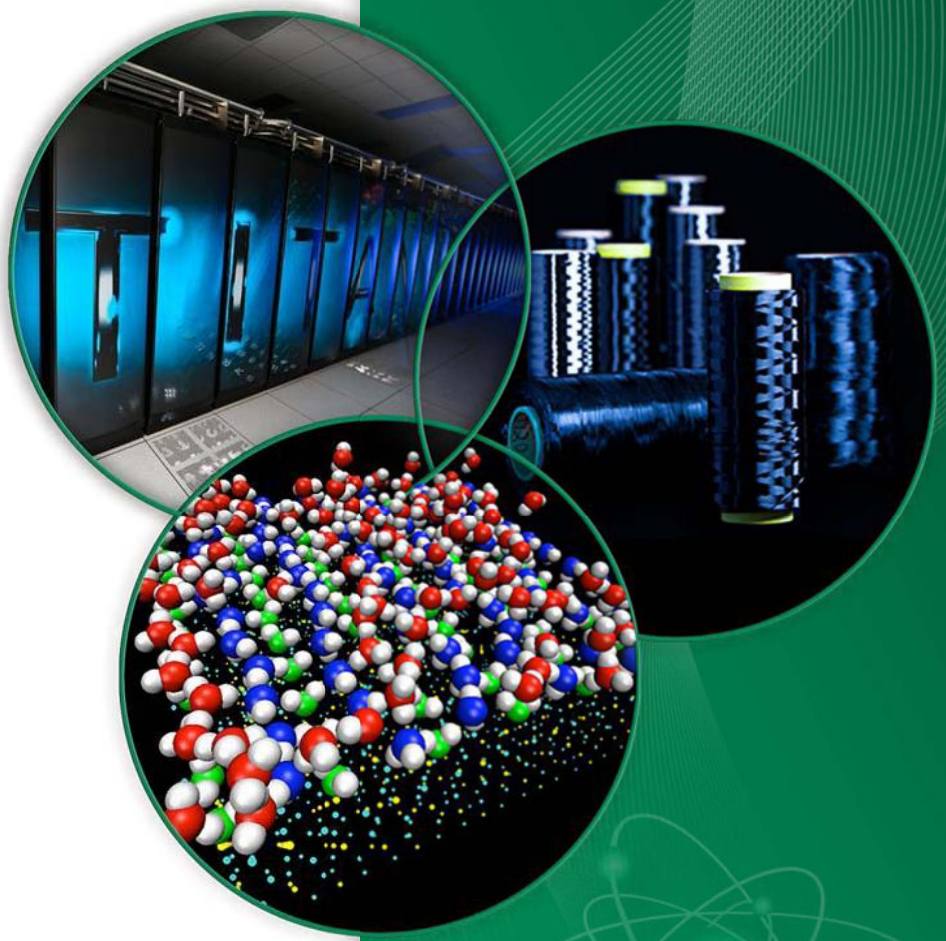
The 2016 Billion-ton Report: overview and implications for jet fuels



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Alternative Aviation Fuel Workshop

Macon, Georgia

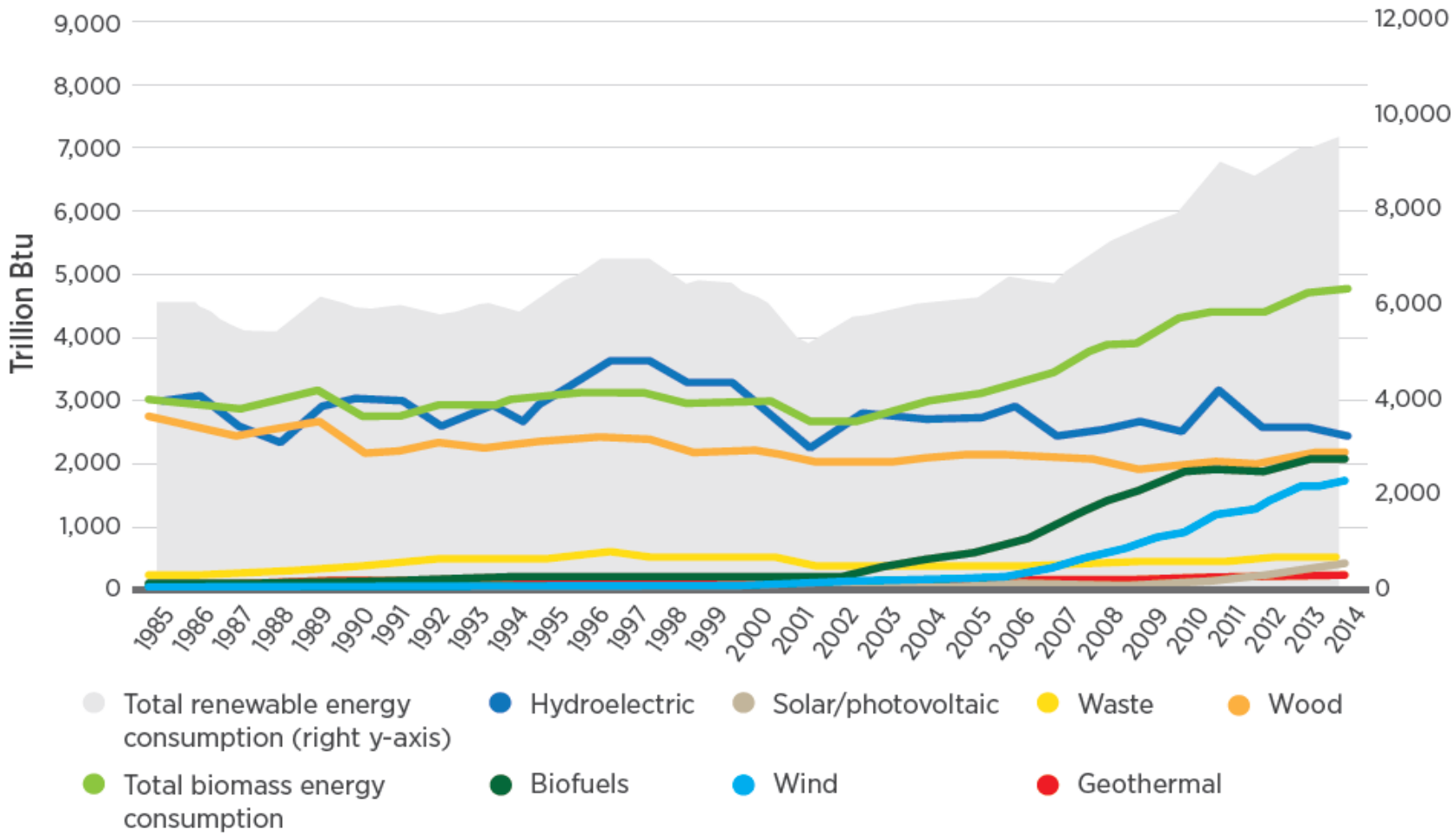
Disclaimer: Comments presented are my own and neither constitute nor imply policy of the U.S. Department of Energy.

Outline

- Overview of report
  - Motivation for a third assessment
  - What is new from 2005 and 2011 assessments
  - High level results
- Implications for aviation biofuels
  - Farmgate/forest landing
  - Delivered

Biomass is largest source of domestic renewable energy

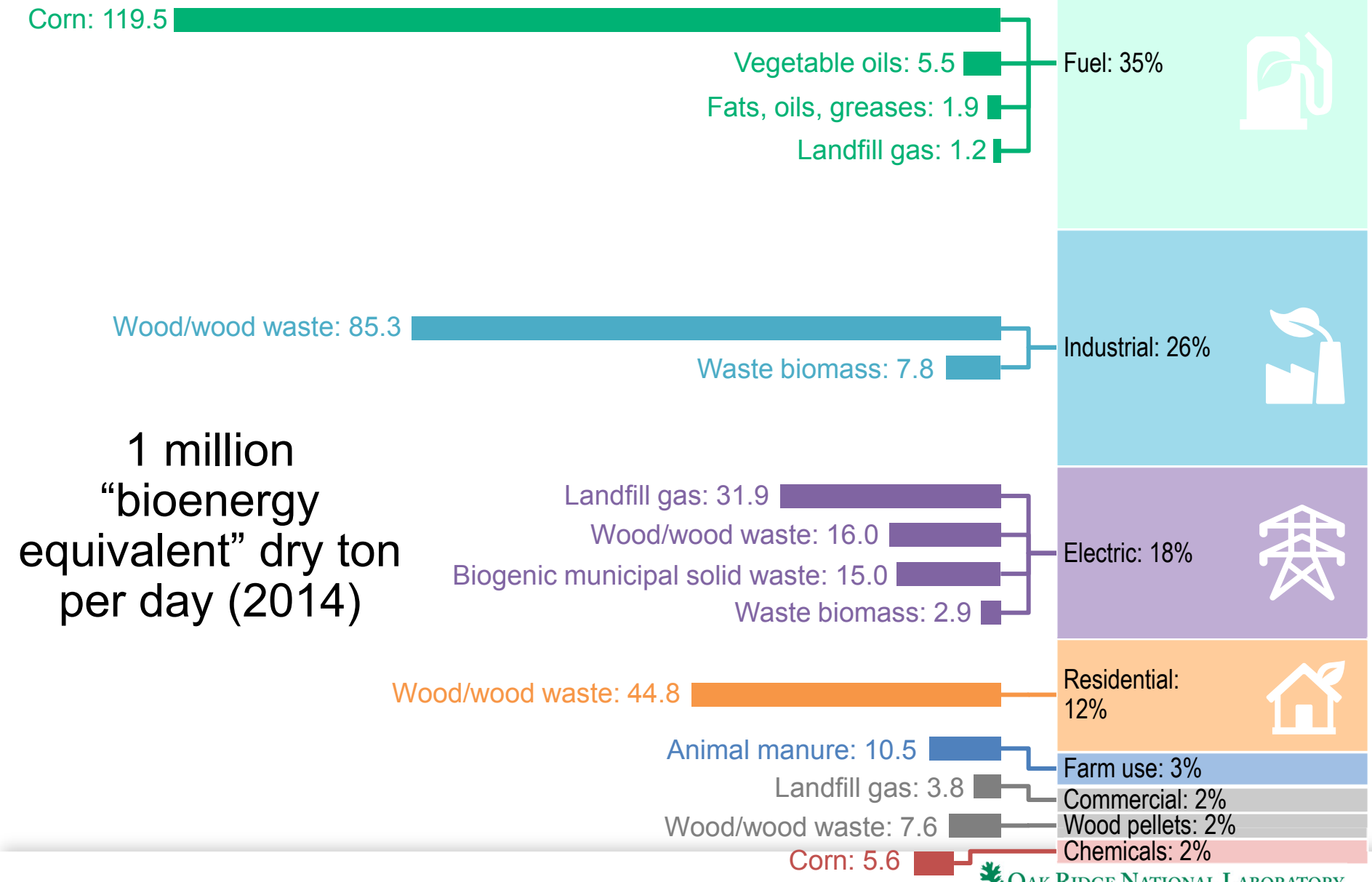
Figure 2.2 | Primary renewable energy consumption by source and total consumption (1985–2014)



Source: Data from EIA (2015d).

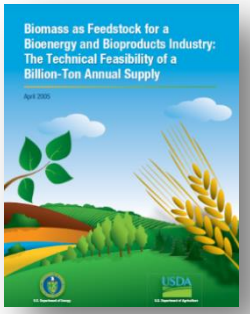
How biomass is currently used

(million tons per year)



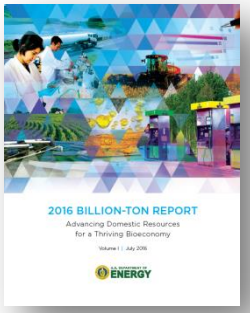
Motivation

- Enormous U.S. domestic biomass potential
  - 2005 and 2011 reports identified > 1 billion ton annual supply
- Understanding and quantifying biomass supply fosters commercialization to increase
  - Energy security,
  - Energy independence, and
  - Environmental stewardship
- Sustainable production is critical to long-term viability of technology for clean energy



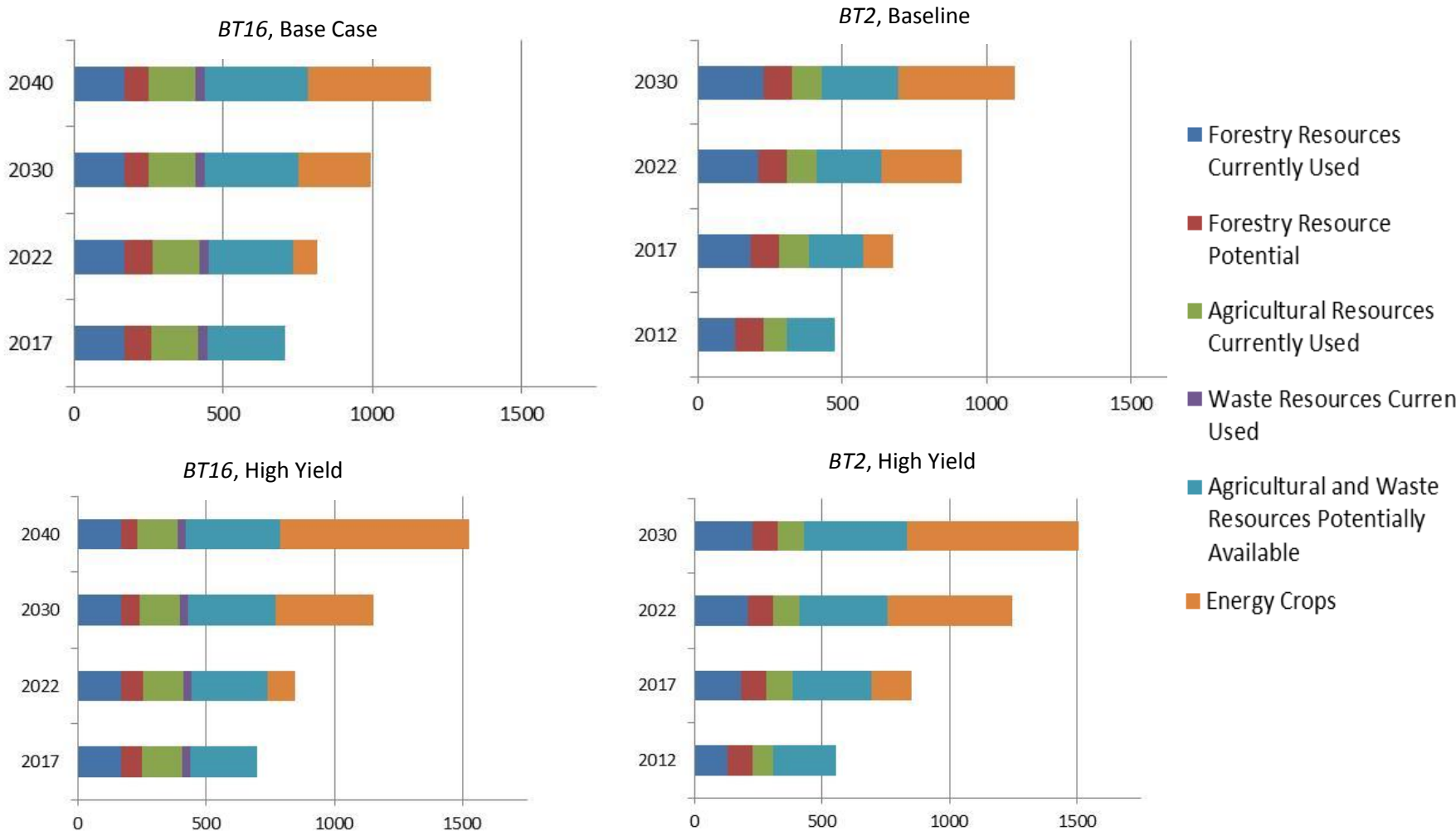
2005 BTS

2011 BT2



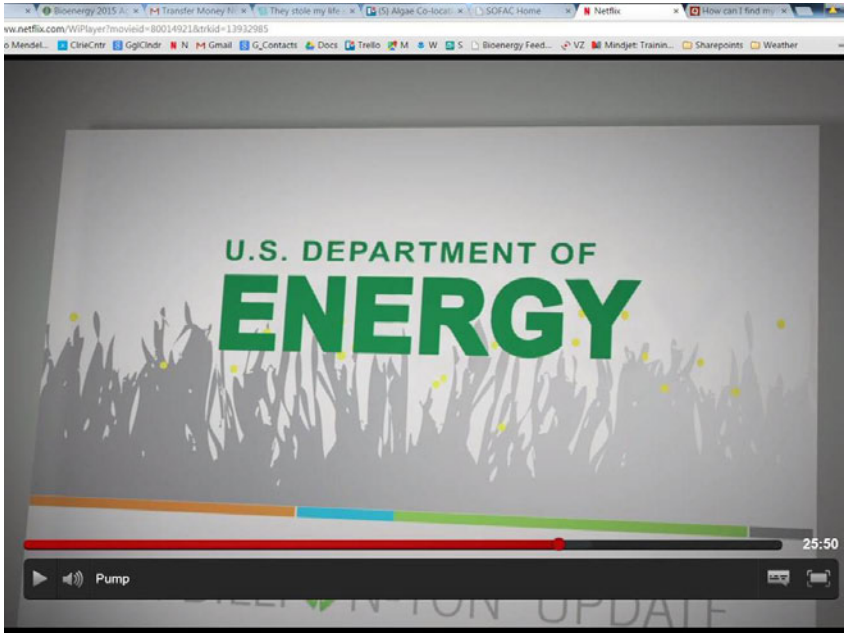
2016 BT16

Similar potential as 2011 BT2



Why a third assessment?

- Update to latest available economic and agricultural baseline
- Expand to new feedstocks
- Examine availability of delivered feedstocks



Pump (2014) documentary screenshot

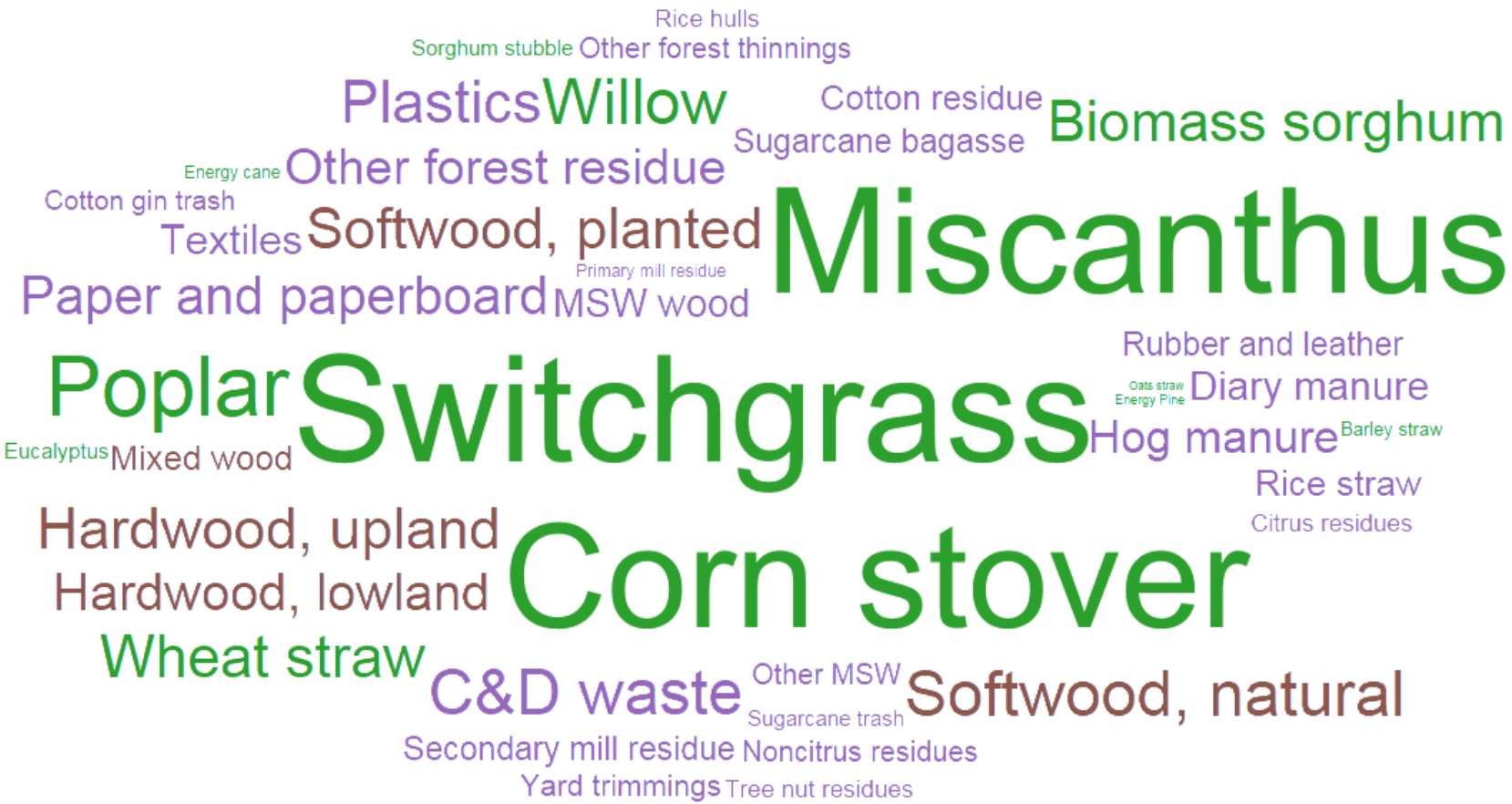
Preamble

- Potential new feedstocks exclude policy and end use
- Prioritizes food, forage, feed, fiber, and export to ensure social sustainability
- Economic supply curve approach
- Underlying conservative assumptions with environmental sustainability considerations
- Two volumes: resource assessment and environmental sustainability effects of select scenarios
- Multi-lab/agency effort

What's new in the third assessment?

- Expanded currently used analysis (previous slide)
- Assessment by feedstocks, expansion of energy crop supply and addition of algal feedstocks
- Delivered supply analysis
- Volume 2 to focus on sustainability effects of specified scenarios from Volume 1

Major terrestrial biomass sources, 2040

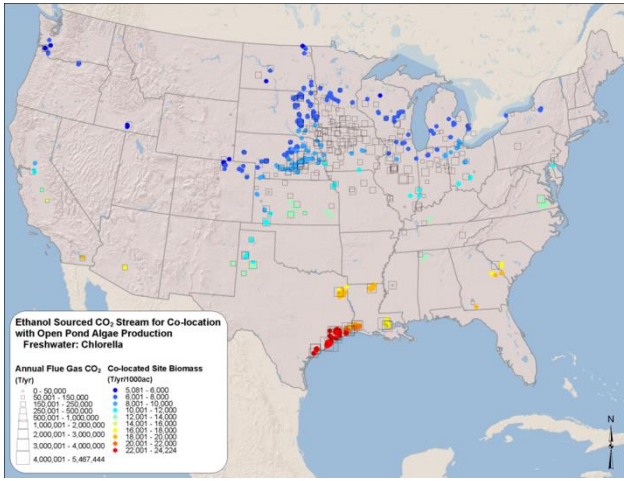


Base case scenario, 2040, $60 per dry ton or less

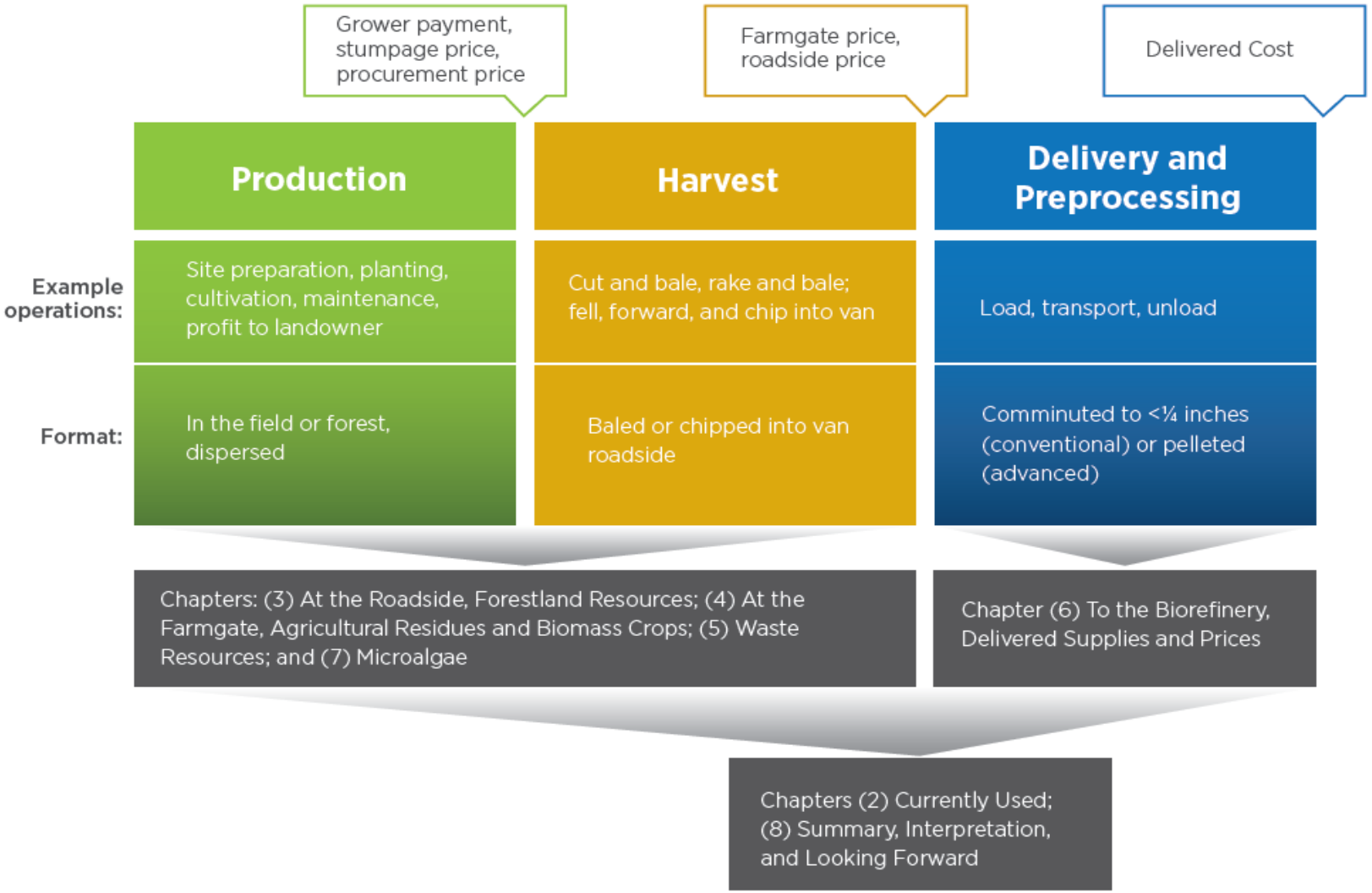
Microalgae resources analysis

- Co-location near CO2 facilities
- Freshwater and saline culture
- Open ponds/raceways
- Lined and unlined ponds
- Present and future productivities

Scenario	Ethanol plant	Coal EGU	Natural gas EGU	Million tons	Prices per dry ton
Present productivities, freshwater	12	19	15	<46	$719–$2,030
Present productivities, saline	10	54	21	<86	$755–$2,889
Future productivities, freshwater	13	10	0	<23	$490–$1,327
Future productivities, saline	11	12	0	<24	$540–$2,074

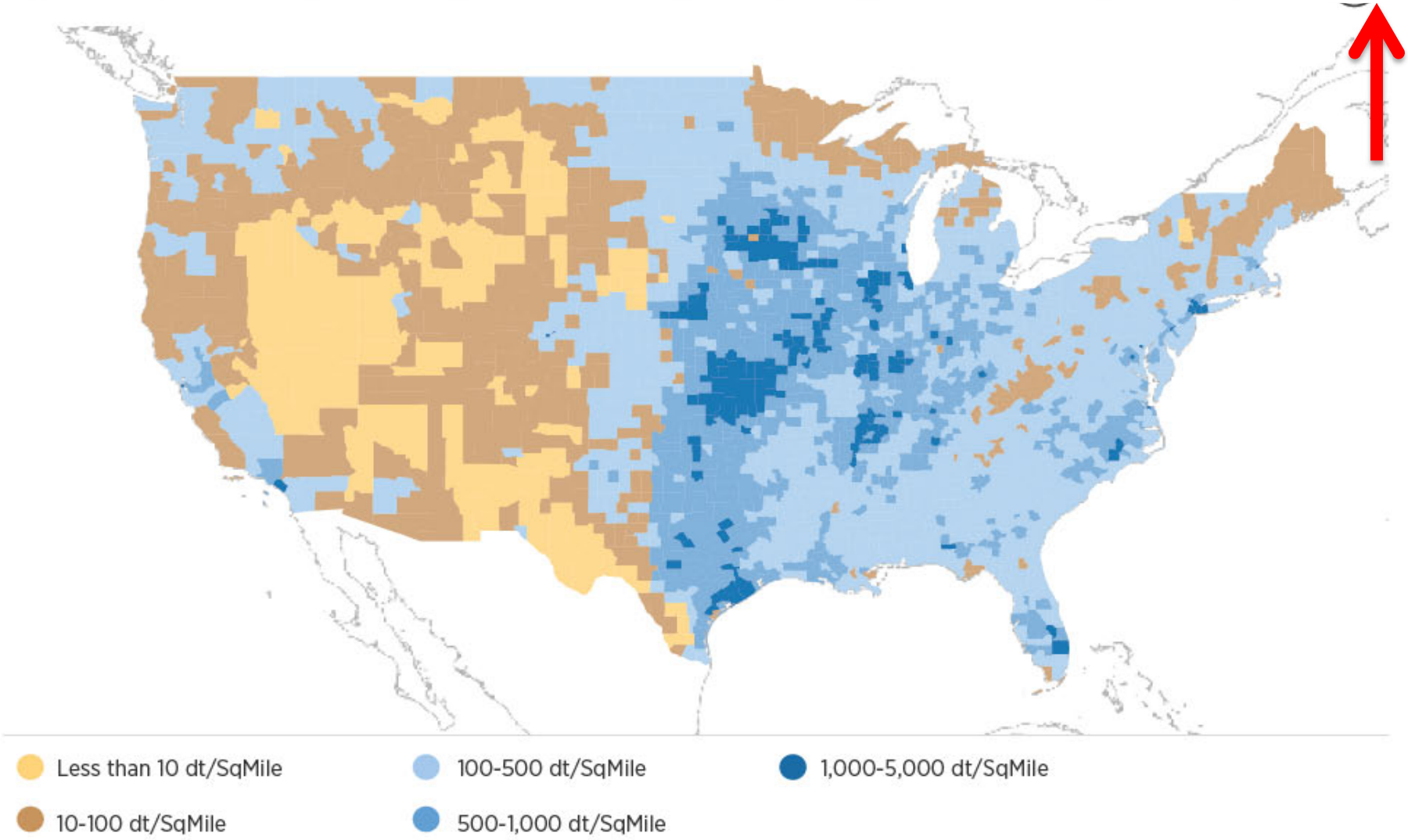


Schematic of biomass supply chain



Grand Map

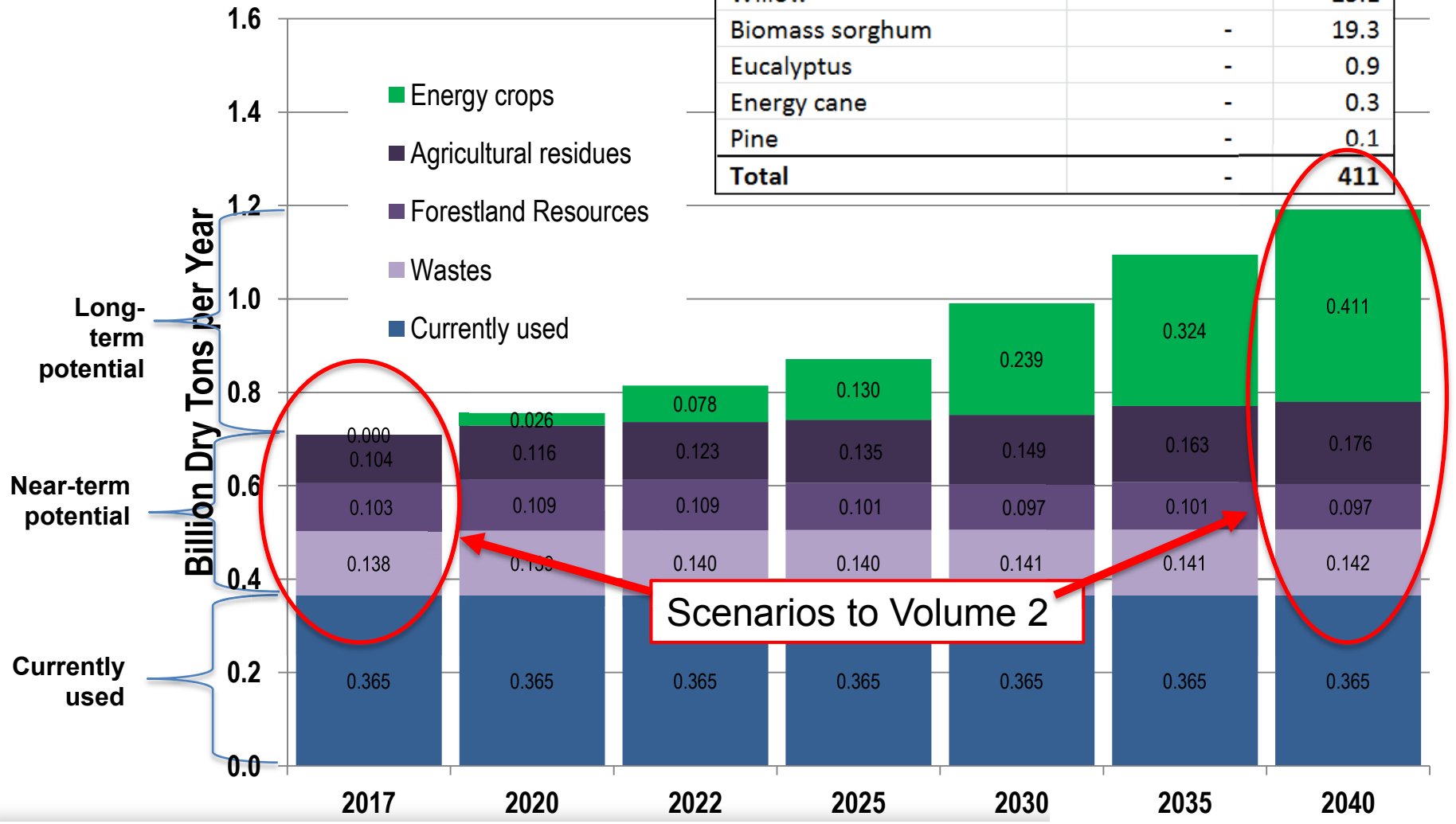
Figure ES.4 | Combined potential supplies from forestry, wastes, and agricultural resources, base case, 2040[10]



http://bioenergykdf.net/billionton

Current and Potential, Base Case at $60/dt

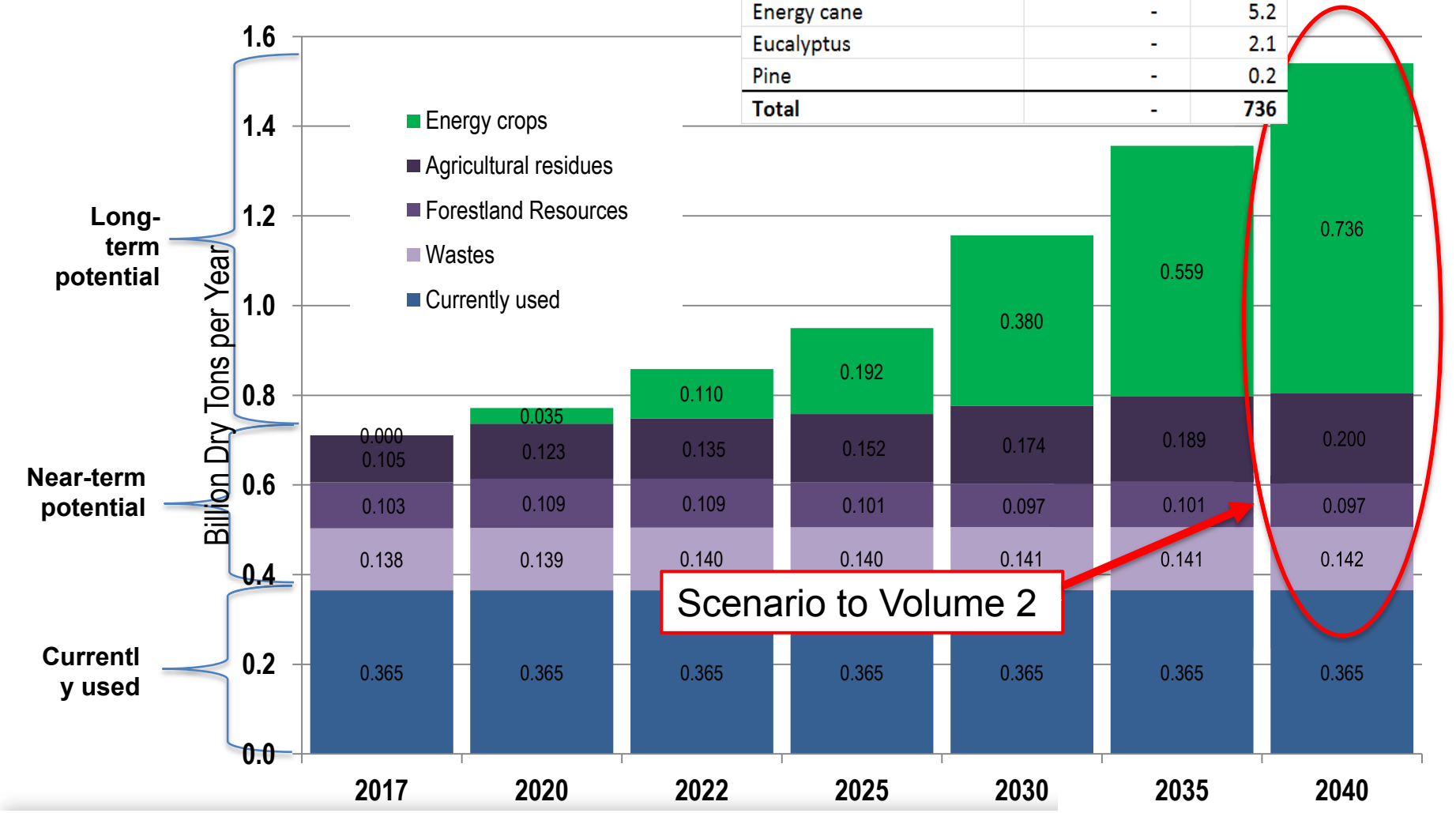
Energy crops	2017	2040
	(million dry tons)	
Switchgrass	-	160.5
Miscanthus	-	160.0
Poplar	-	44.9
Willow	-	25.1
Biomass sorghum	-	19.3
Eucalyptus	-	0.9
Energy cane	-	0.3
Pine	-	0.1
Total	-	**411**



Currently used at market prices, potential supplies up to $60/dt (2014$)

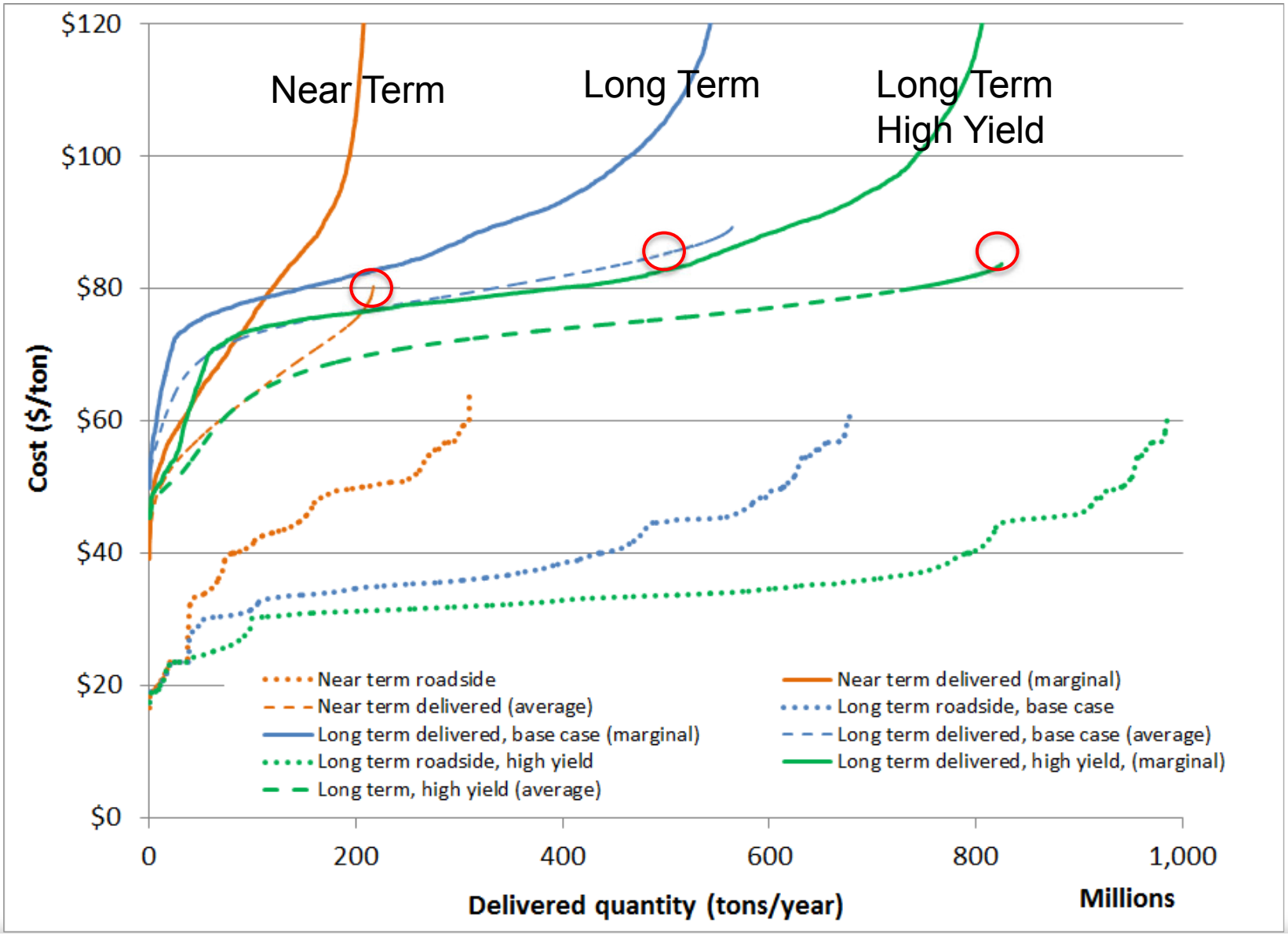
Current and Potential, High Yield Ag. at $60/dt

Energy crops, High yield	2017	2040
	(million dry tons)	
Miscanthus	-	369.6
Switchgrass	-	188.7
Poplar	-	74.5
Willow	-	65.1
Biomass sorghum	-	30.8
Energy cane	-	5.2
Eucalyptus	-	2.1
Pine	-	0.2
Total	-	**736**

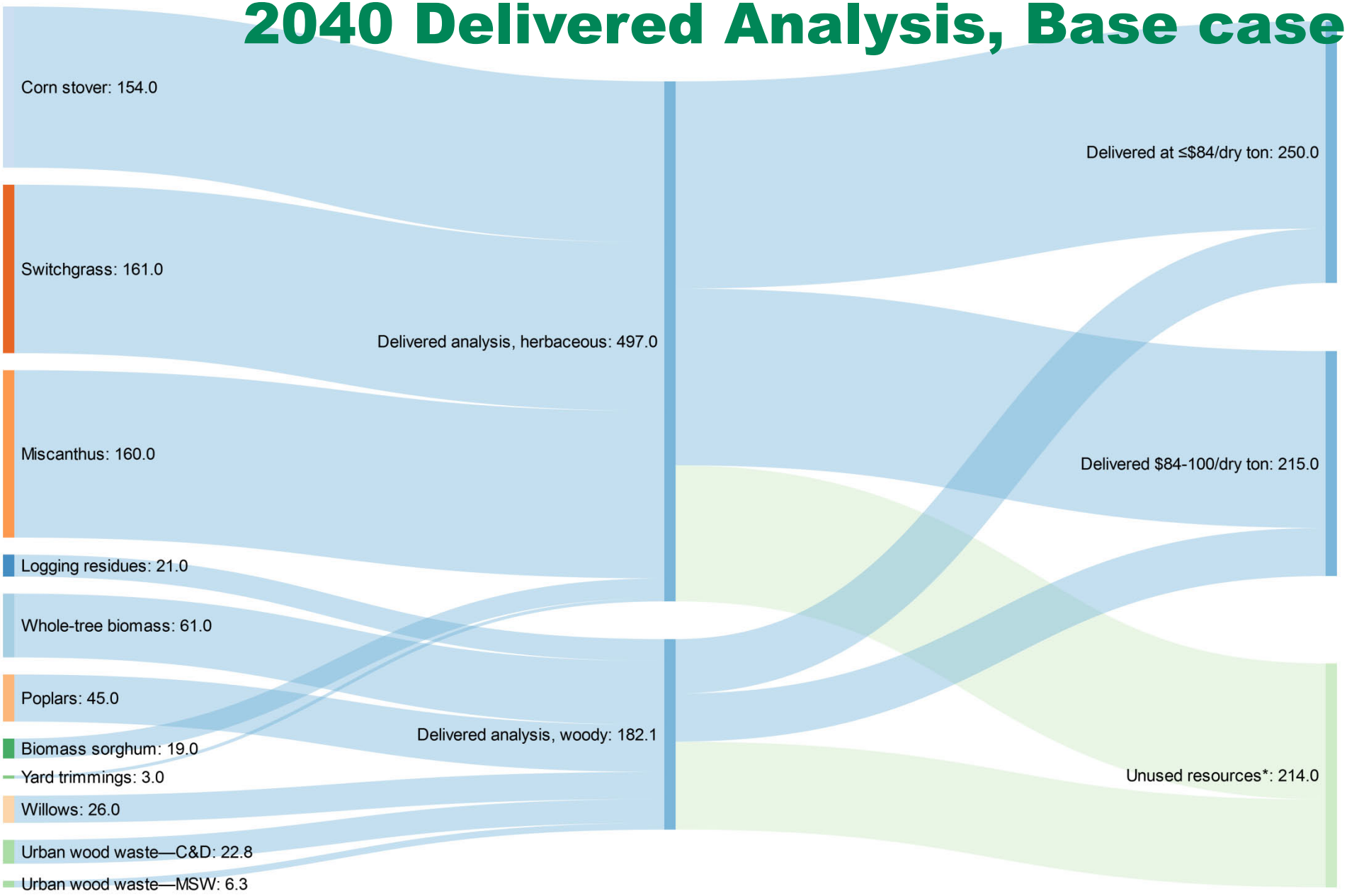


Currently used at market prices, potential supplies up to $60/dt (2014$)

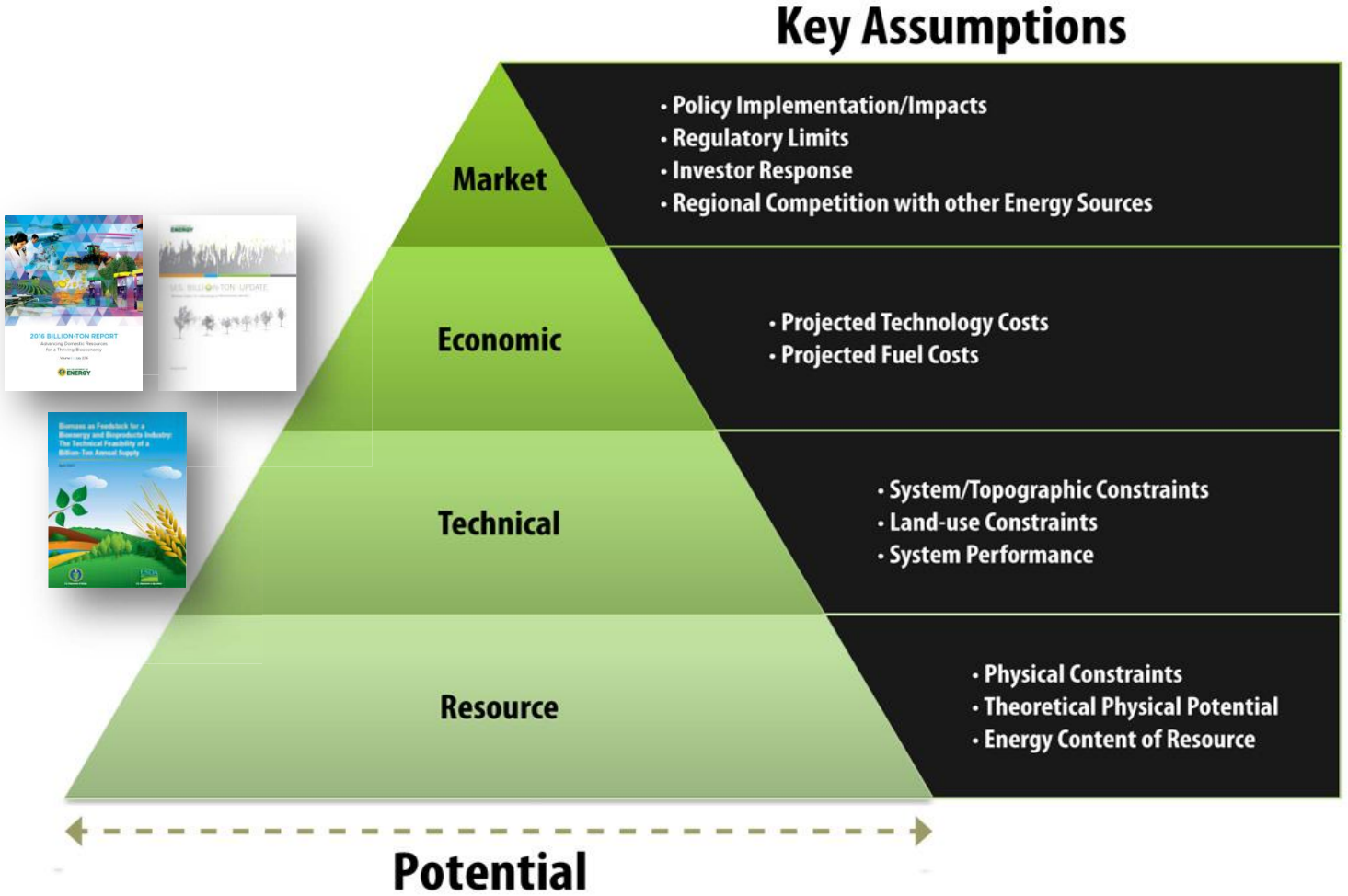
Delivered Scenario Analysis



2040 Delivered Analysis, Base case



What are the BT16's implications for advanced jet fuels? (1 of 2)



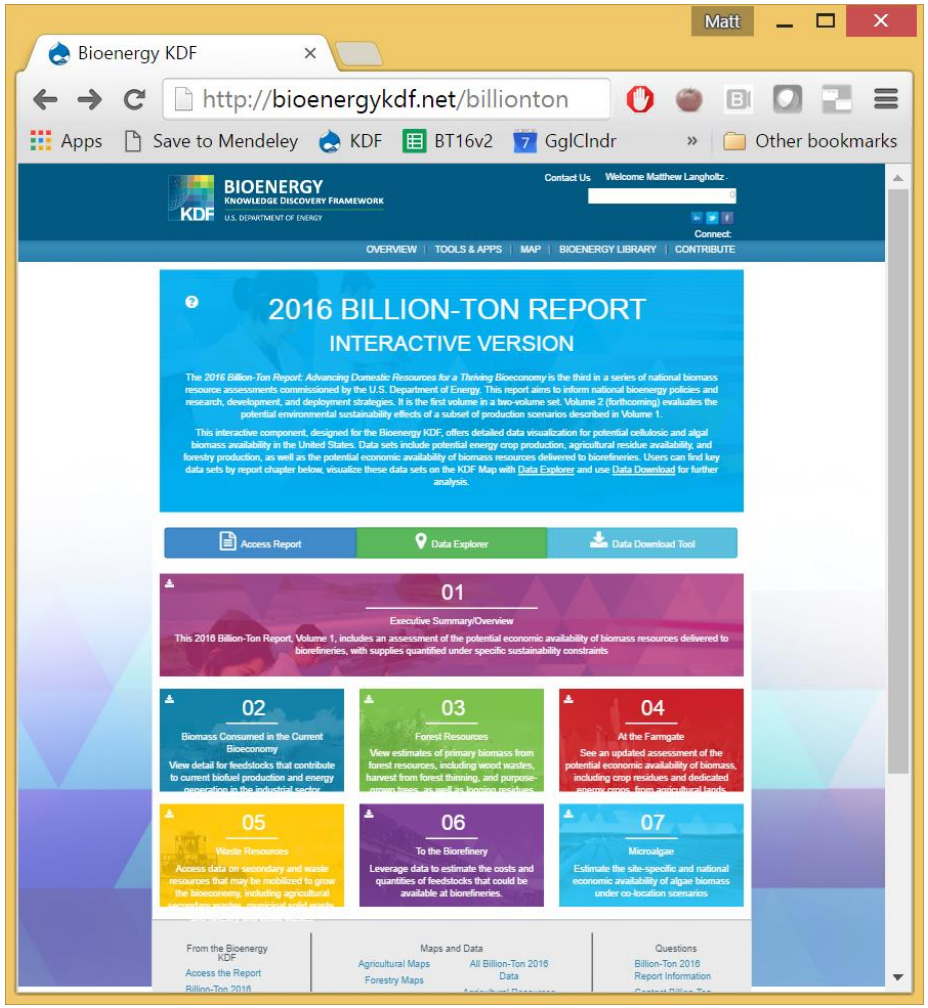
Adapted from Batidzirai, Smeets, and Faaij (2012), DOE-EERE (2006), and NREL (2011).

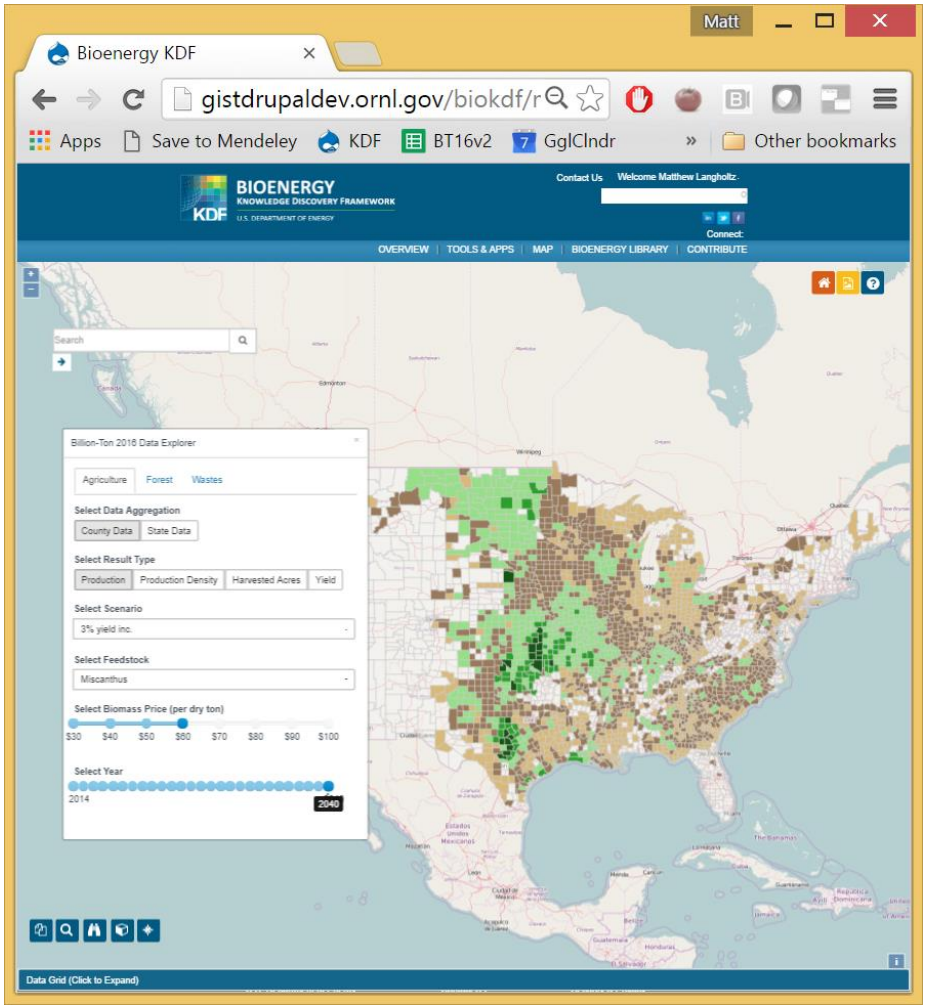
What are the BT16's implications for advanced jet fuels? (2 of 2)

- Not a "one-size-fits-all" resource assessment
  - Broad potential may not represent strategic potential for single pathway
- Acreage and supply as proxy for jet fuels crops
  - Annual energy crops
  - Perennial woody and herbaceous crops
- More analysis needed to assess adoption of new cropping models (oilseeds, double cropping, etc)
- Market effects may vary for feedstocks with existing uses

Interactive Resources

http://bioenergykdf.net/billionton





Thank you!

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