Chemtex - Proesa™

Advanced Bio-Fuels and Renewable Chemicals from Cellulosic Biomass

Bio-fuels and bio-based chemicals for North America

Prepared for: Department of Energy Biomass 2012
July 10-11, 2012

Chemtex

Chemtex Italy

Tortona, Rivalta

Founded 1947 as Rayon Consultants
Became **Chemtex** in 1958
Acquired by **Mitsubishi Corp** in 1989
Acquired by **M&G Group** in 2004

Chemtex China

Shanghai, Beijing

Chemtex USA

Wilmington (NC), Sharon C (OH)

- Annual Turnover: USD 300 MM
- Employees: 1000

Chemtex India

Mumbai, Bangalore

Chemtex is a global, technology-oriented Engineering Company that delivers innovative and value-added project solutions to the international markets.

PROESA™ – Technology Overview

Commercial scale, Development of Drop-in Fuels, Bio-chemicals

2006 - 2008 | **2009** | **2011** | **2012+**

Scouting, testing and development of technology on lab scale

Construction and tests on a continuous pilot plant

Construction of a Commercial

Crescentino Industrial Plant Status

Site Photos taken early Jan 2012

- The world's first industrial scale cellulosic ethanol plant
- Capacity: 13.4 (nameplate)/ 20 (design) mmgpy
- Start-up: Q3, 2012
- Currently on Budget and on Schedule

Project Alpha

- Chemtex is developing *Project Alpha* – a 20mmgpy cellulosic ethanol facility to be built in Eastern NC.
- The project is based on using dedicated EPA approved energy crops including Miscanthus, Switchgrass, "soft" hardwoods and potentially Arundo Donax and High Biomass sorghum - grown on low productivity/ marginal land.
- Overall 300,000 dry tons per year of feedstock annually sourced from 25,000 acres in the surrounding area
- The project is Phase 1 of a cluster opportunity – similar available land in the region is sufficient to support additional 200-250 mmgpy added ethanol capacity or equivalent bio-chemicals.
- 100 acres of nursery for energy grasses planted with support of North Carolina Biofuels Center
- Best management practices for energy crops published by State taskforce supporting our project

Supply Chain Structure

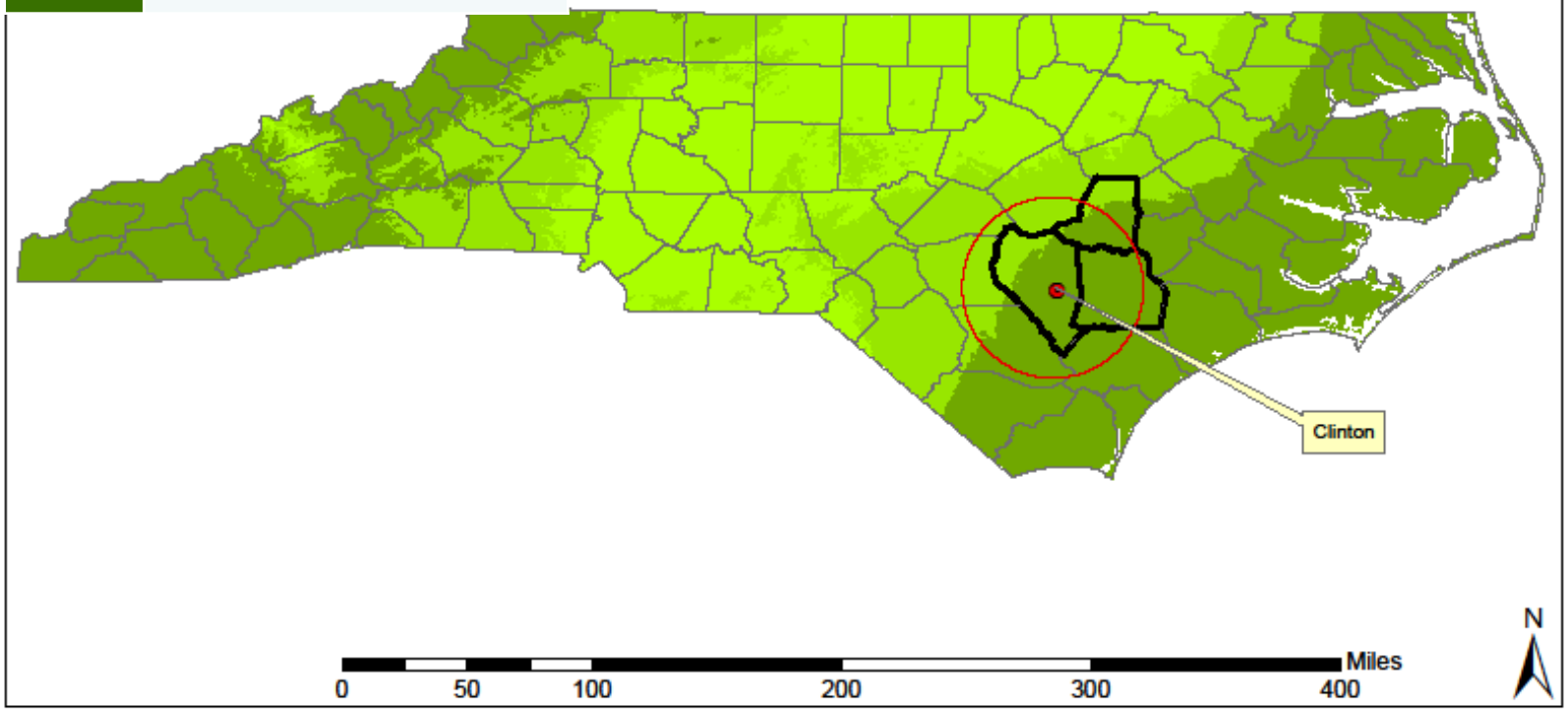
Supply chain steps	Nursery / propagation material	Plantation management	Harvesting	Transport / logistic to plant's gate
Players involved	• Large Farmers • Service provider • Suppliers of plantlets	• Farmers	• Third parties	• Logistic service providers
Activities	• Plant and manage nursery • Collect propagate material • Plant material in final plantations • Produce micro propagated material (external suppliers only)	• Make land available • Prepare fields for planting • Irrigate, fertilize, treat weeds	• Harvest plantations • Chop / bale biomass, as needed	• Transport biomass to plant

Potential growth map – Switchgrass

	Potential yield (DT/ac)
+	5.4 – 6.1
+ +	6.1 – 6.7
+ + +	6.7 – 7.3
+ + + +	7.3 – 7.9

Expected yield in the 35 miles radius

7.4 (DT/ac)

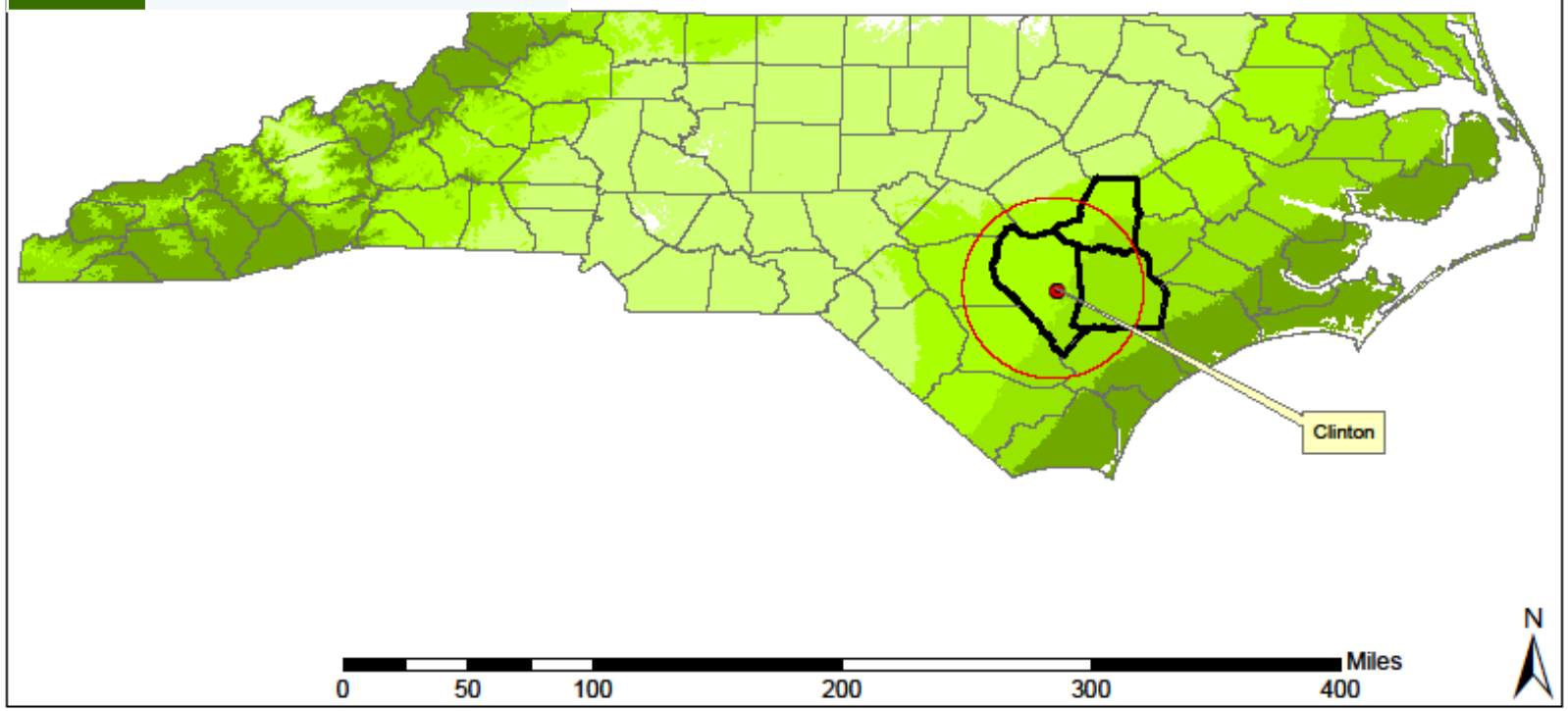


Potential growth map – Miscanthus

	Potential yield (DT/ac)
+	4.7 – 5.8
+ +	5.8 – 6.8
+ + +	6.8 – 7.8
+ + + +	7.8 – 8.8

Expected yield in the 35 miles radius

6.8 (DT/ac)

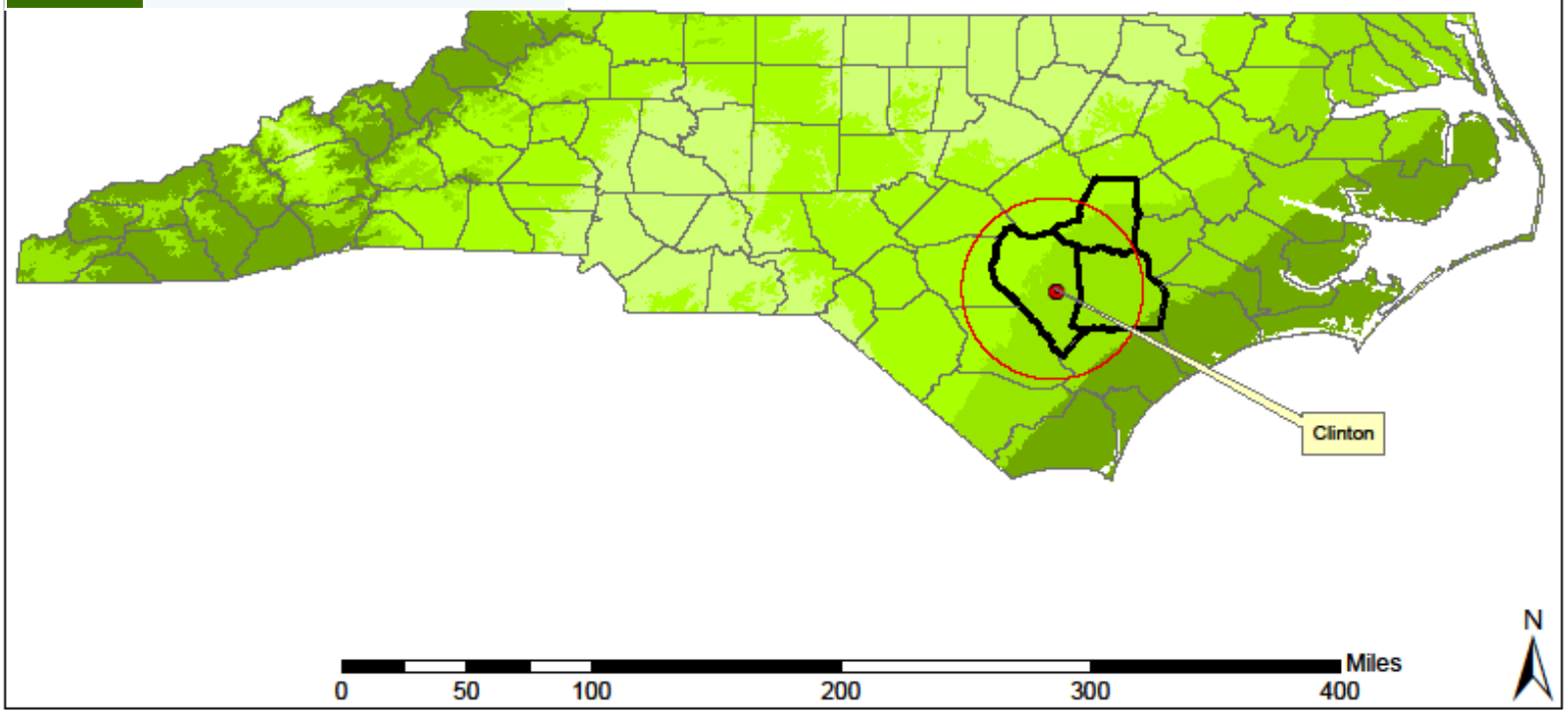


Potential growth map – Arundo donax

	Potential yield (DT/ac)
+	11,5 – 13,2
+ +	13.2 – 14.5
+ + +	14.5 – 15.9
+ + + +	15.9 – 17.6

Expected yield in the 35 mile radius

15.0 (DT/ac)

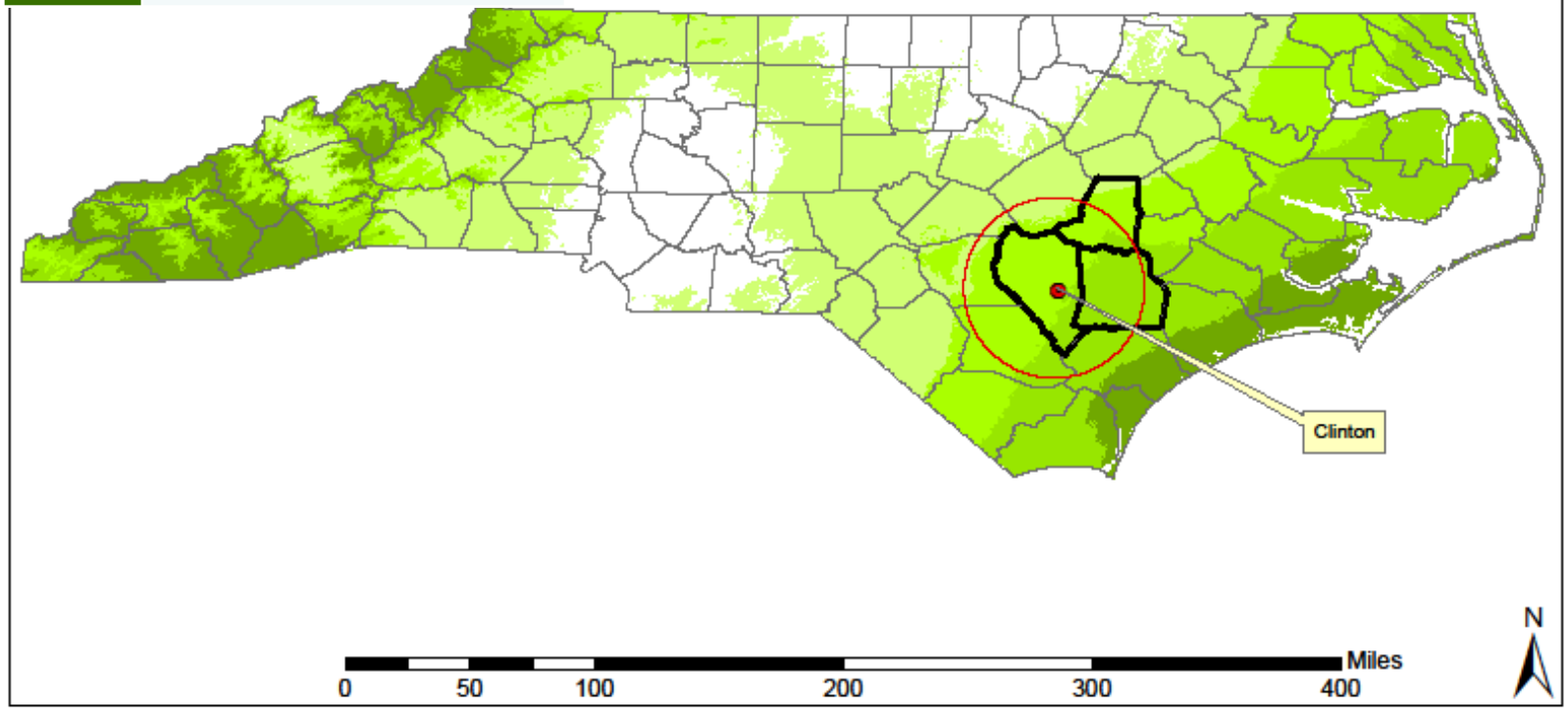


Potential growth map – Sorghum

	Potential yield (DT/ac)
+	5.3 – 6.4
+ +	6.4 – 7.5
+ + +	7.5 – 8.6
+ + + +	8.6 – 9.7

Expected yield in the 35 miles radius

7.5 (DT/ac)



Agronomic Assumptions Used for Production Plan

Full production

Main assumptions

CROP	Sourcing of propagation material	Species	1° year [DT/ac]	2° year [DT/ac]	3°year [DT/ac]	4°year [DT/ac]
Arundo Donax	In-house	Perennial	**4.5***	**11.2****	**16**	**16**
Switchgrass	Commercial	Perennial	**0**	**2.8***	**7****	**10**
Fiber Sorghum	Commercial	Annual	**10**	**10**	**10**	**10**
Rye	Commercial	Annual	**2**	**2**	**2**	**2**
Miscanthus	Semi-Commercial	Perennial	**0**	**2.8***	**7****	**10**

* = 28% of full production
** = 70% of full production

Optimal Mix of Biomass

(Assuming EPA approval of Arundo Donax and Fiber Sorghum)

Crop	Months of supply	Volume of supply [DT/ac]	Land use [ac]	Harvest time	Harvest type	Use Timing
Arundo	4	100,000	6250	Nov to Feb	Chopped	Nov to Feb
Switchgrass	2	50,000	5000	Jan-Feb	Baled	Apr-May
Miscanthus	2	50,000	5000	Jan-Feb	Baled	Jun-July
Fiber Sorghum	3	75,000	7500	Aug to Oct	Chopped	Aug to Oct
Rye straw	1	25,000	12500	Mar	Chopped	Mar

Biomass – Targeted Planting schedule

(Assuming EPA approval of Arundo Donax and Fiber Sorghum)

New plantation established
acres

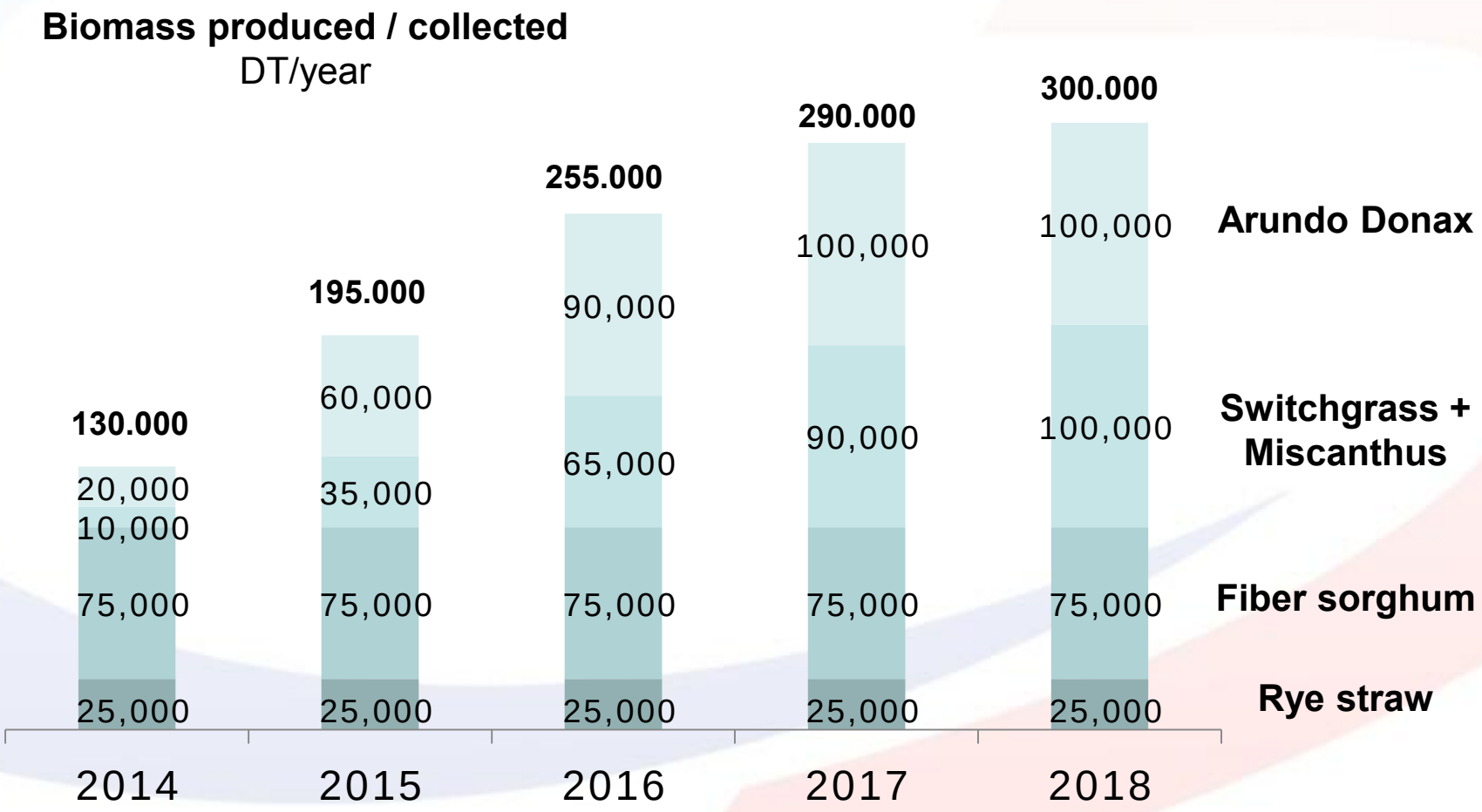
Crop	2013	2014	2015	2016	Total
Arundo Donax	525**	3,955	1,770	-	6,250
Switchgrass	1,700	1,700	1,600	-	5,000
Miscanthus	1,700	1,700	1,600	-	5,000
Fiber sorghum	7,500	7,500	7,500	7,500	7,500
Rye*	12,500	12,500	12,500	12,500	12,500

* already planted for nitrogen uptake porposes

** To be established in 2012 and 2013, net of nurseries to be eradicated (see detailed chart)

Targeted Production Plan

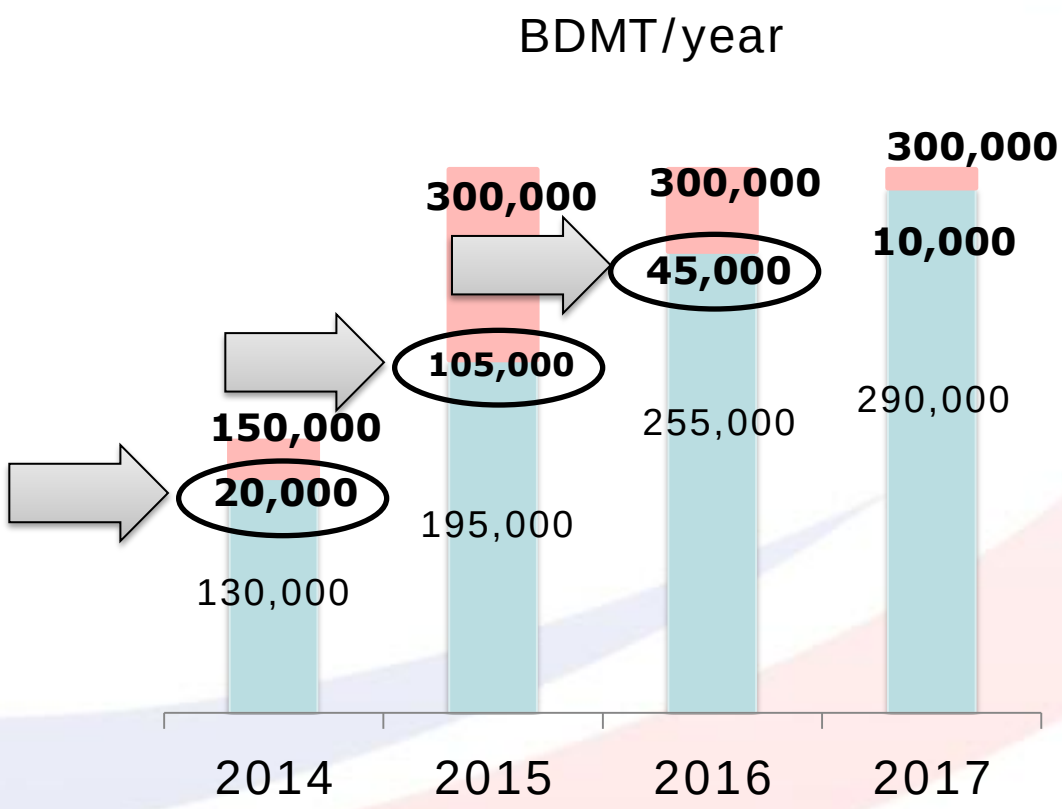
(Assuming EPA approval of Arundo Donax and Fiber Sorghum)



Biomass gap to be filled in the short term

Volume of transitional feed stock

- Soft hardwood chips
- Coastal Bermuda grass



BCAP Assistance

- **Project Area just received support from BCAP program for approximately $4mil to support establishment of 4,000 acres of Freedom™ miscanthus (Repreve Renewables) and switchgrass**
- **Incentivizes rapid sign up of farmers**
- **Provides Due Diligence for the farmer / legitimacy to the project**
- **Minimizes biomass shortfalls**
- **Insures no environmental impact**

Key Elements in Structuring The Supply Chain

- **Leveraging on high yielding perennials allows long term economic sustainability in the region**
- **Low yielding land and no competition with row crops is key**
- **Agricultural residues and soft hardwood used on opportunistic bases**
- **Matching environmental remediation with establishment of energy grasses**
- **Start contracting with large strong farmers that are seen as opinion leaders ASAP**
- **Supported by the commitment of a large multinational company**
- **Collaboration and strong support form state and local partners (North Carolina Biofuel Center, FSA, USDA, NC State and other State Agencies)**