

National Capital Area Chapter
US Association for Energy Economics
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Challenges of Integrating Biofuels Into the Existing Infrastructure

Shirley Neff, President and CEO
Association of Oil Pipe Lines
sneff@aopl.org



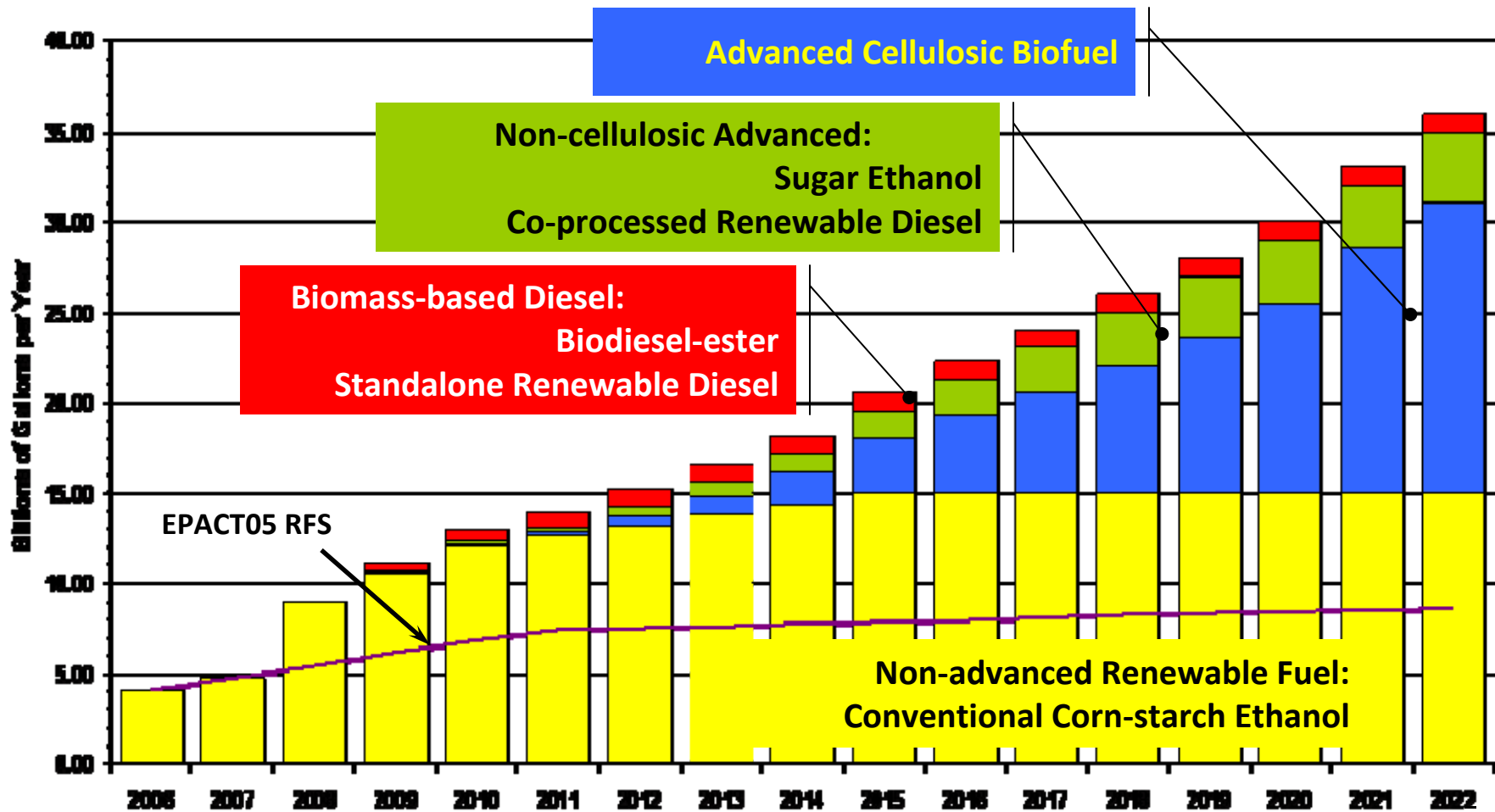
Renewable Fuels Standard (RFS)

- 2005 – RFS mandate imposed- 4 bil. gal./year (bgy) in 2006, increasing to 7.5 bgy in 2012.
- 2007 – Corn ethanol production capacity already at 9 bgy.

White House and Congress agree on dramatically increased volume, *Energy Infrastructure and Security Act (EISA)*, 36 bgy by 2022 with set asides for specific fuels.

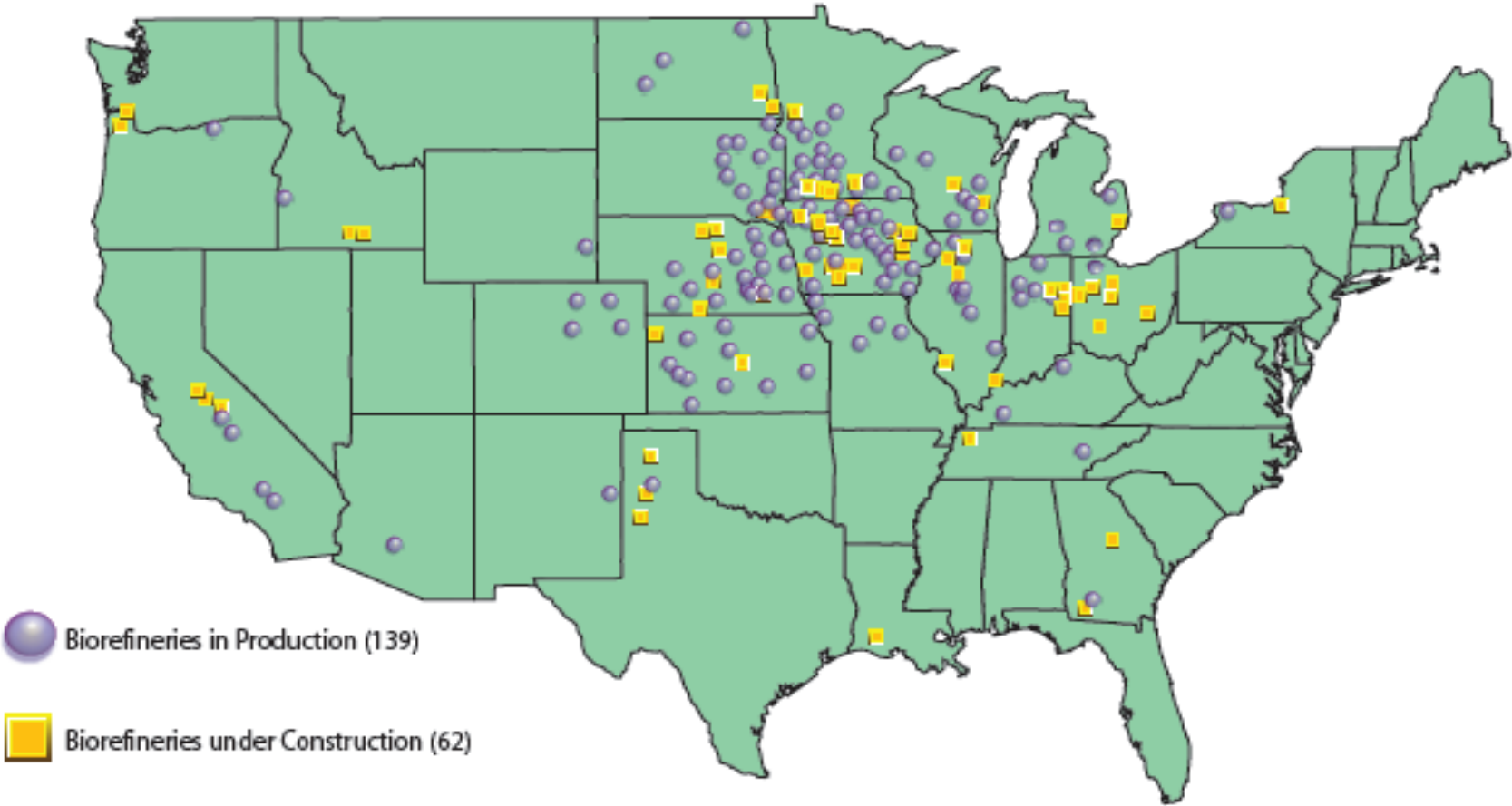
- State mandates ranging from specific blend amounts to jobbers/marketers pressing for unblended fuels at terminals

EISA Renewable Fuel Standard (2007-2022)



Source: API

Current Biorefineries



Source: Renewable Fuels Association
01.24.08

Ethanol Blends

- **E10 is gasoline containing 10% ethanol by volume for use in conventional (non-flexible fuel) vehicle and engines – in use since 1970's**
- **E 85 is gasoline containing 85% ethanol for use in flex fuel vehicles (FFVs)**
- **E10+ (higher level blends) vehicle and engine compatibility, emissions
DOE currently testing E15 and E20**
- **Higher level blends:**
 - Legacy fleet – existing vehicles
 - New policy on FFV's similar to Brazil
 - Continuing opposition for off road vehicles and boats (even E10 opposed) – likely requirement for segregated unblended fuel

Gasoline/Ethanol Movements within the U.S.

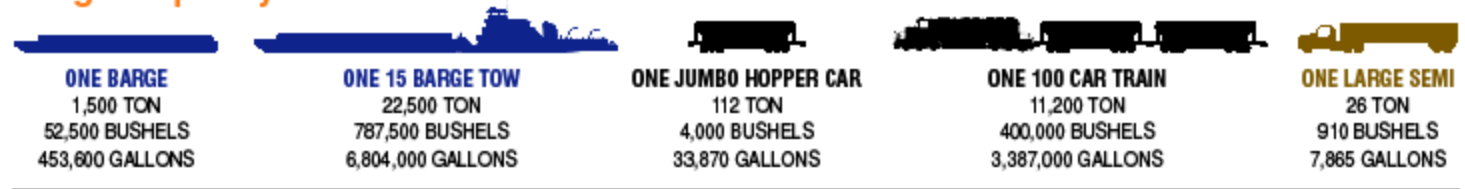
- About 1.7 mbd of gasoline are shipped from Gulf Coast refineries to Midwestern and East Coast markets primarily by pipeline.
- Most ethanol movements are in the opposite direction of current pipeline flows. Mode of shipment currently:
 - Rail = 60%
 - Barge < 10%
 - Trucks > 30%, and the final mile
- As the market scales up the mode of transportation will have a major impact on congestion.

Compare...

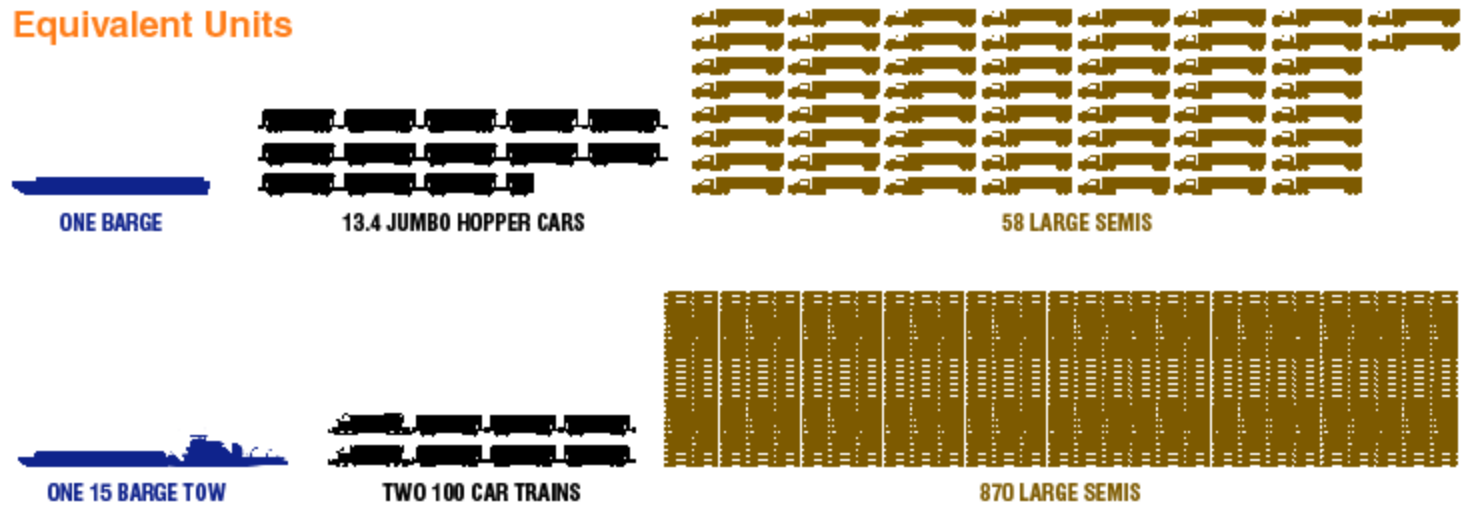


Source: Iowa Department of Transportation - 800 Lincoln Way - Ames, IA 50010 - 515-289-1520

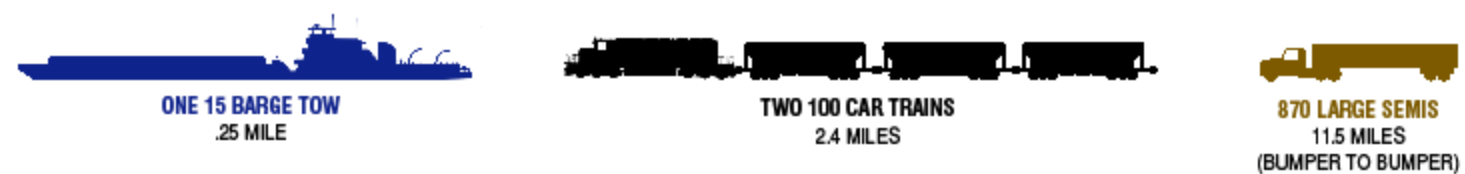
Cargo Capacity



Equivalent Units

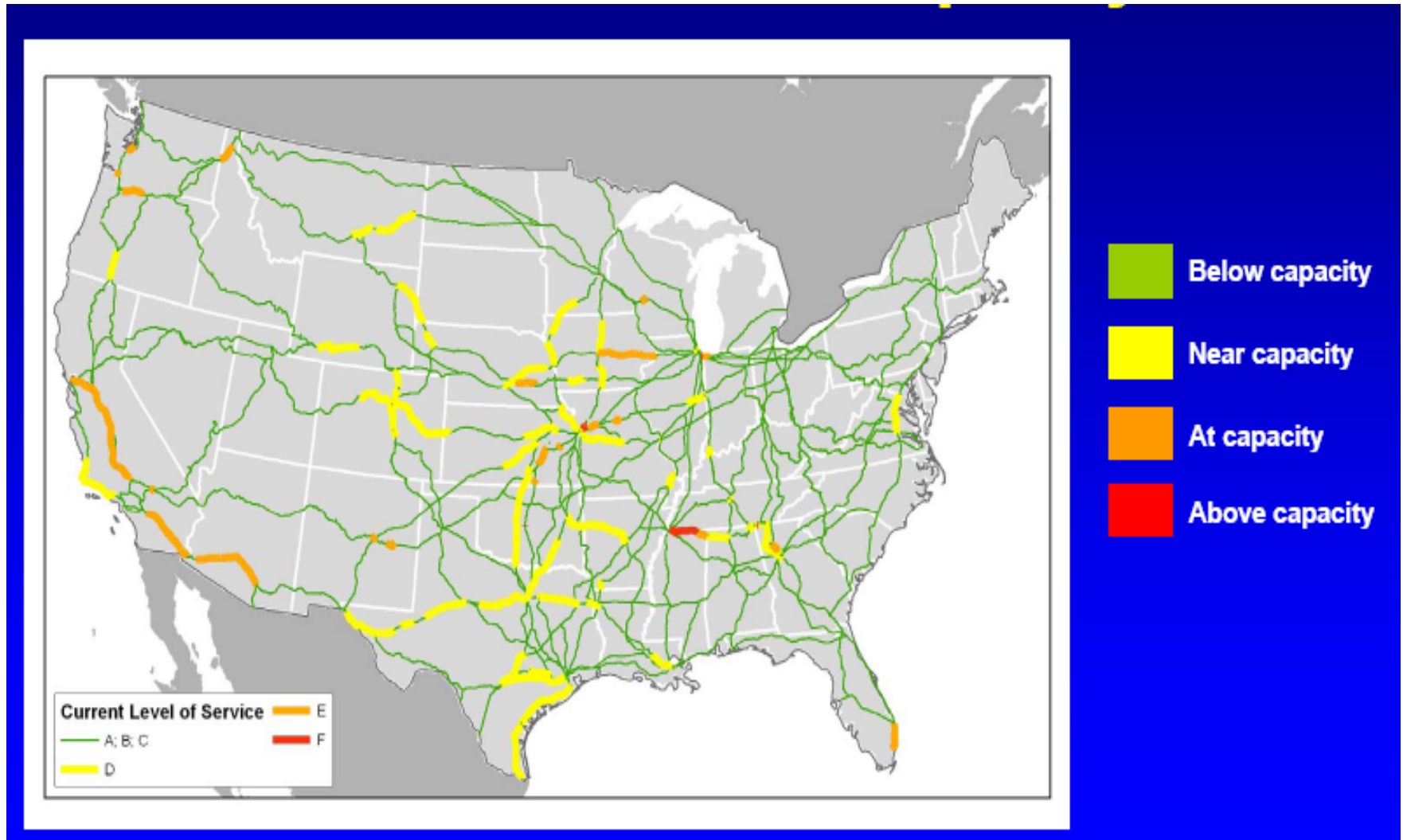


Equivalent Lengths



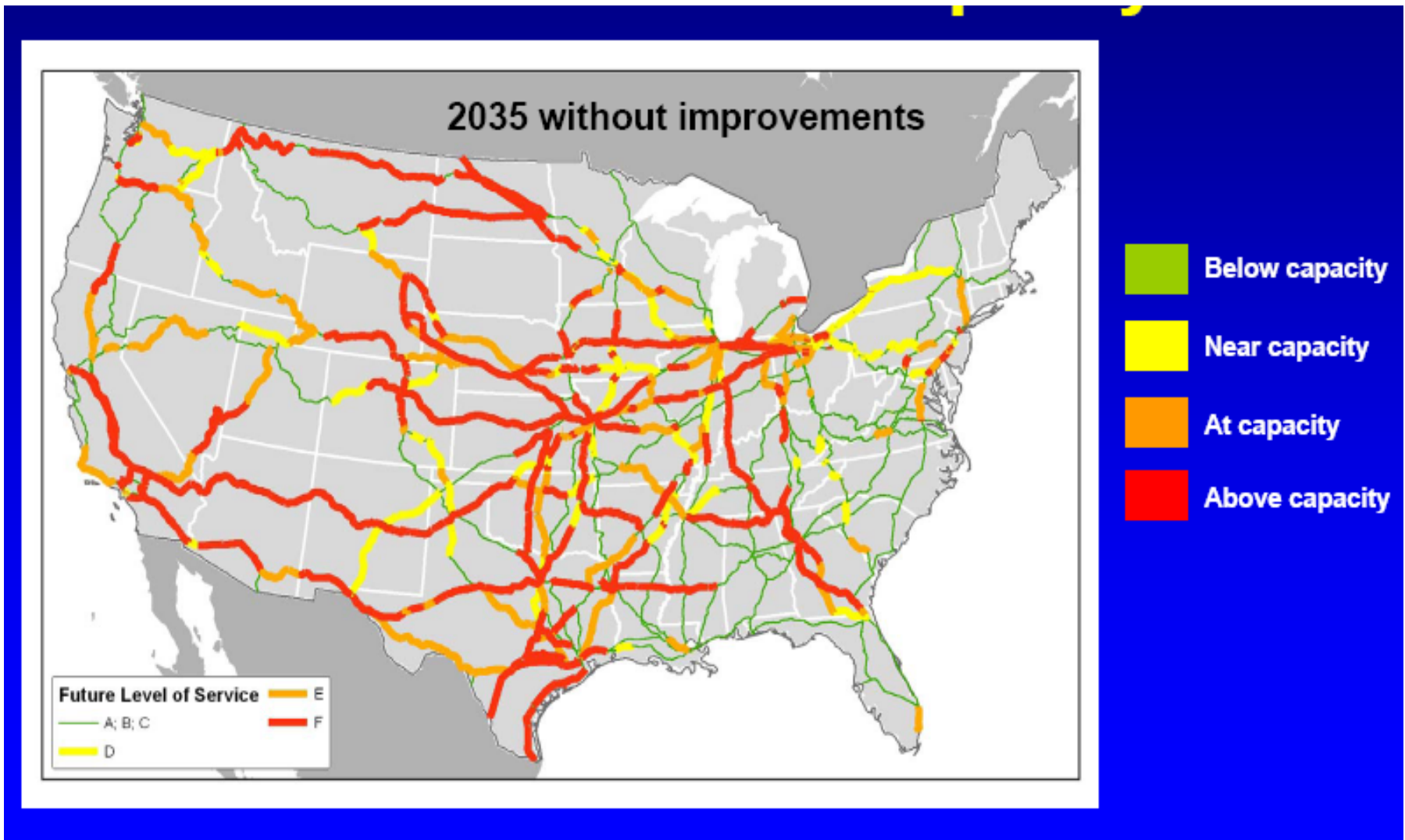
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Overall Rail Volumes/Capacity (2005)

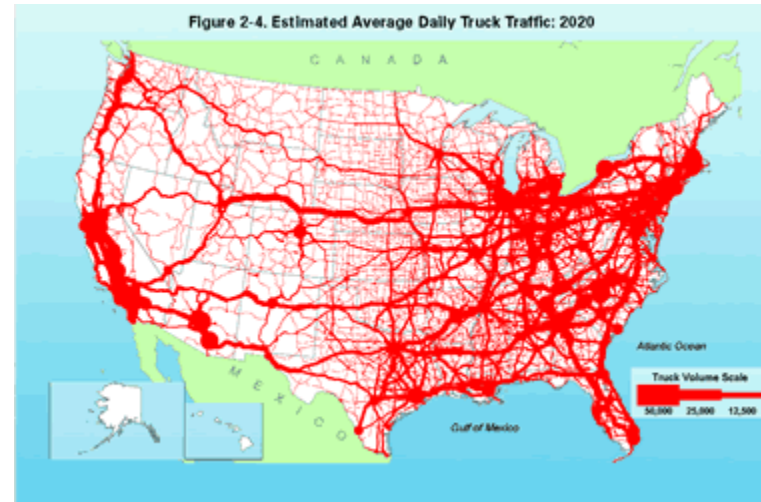
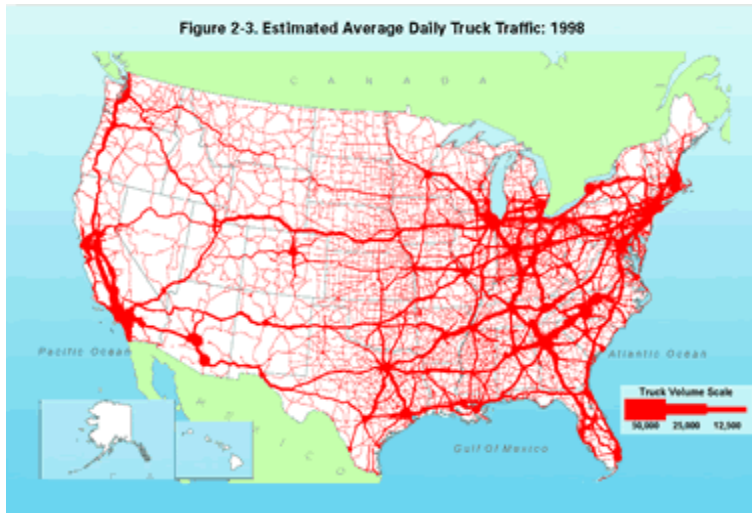


Source: http://www.aar.org/PubCommon/Documents/natl_freight_capacity_study.pdf

Investment Needed: \$148 billion over 28 years

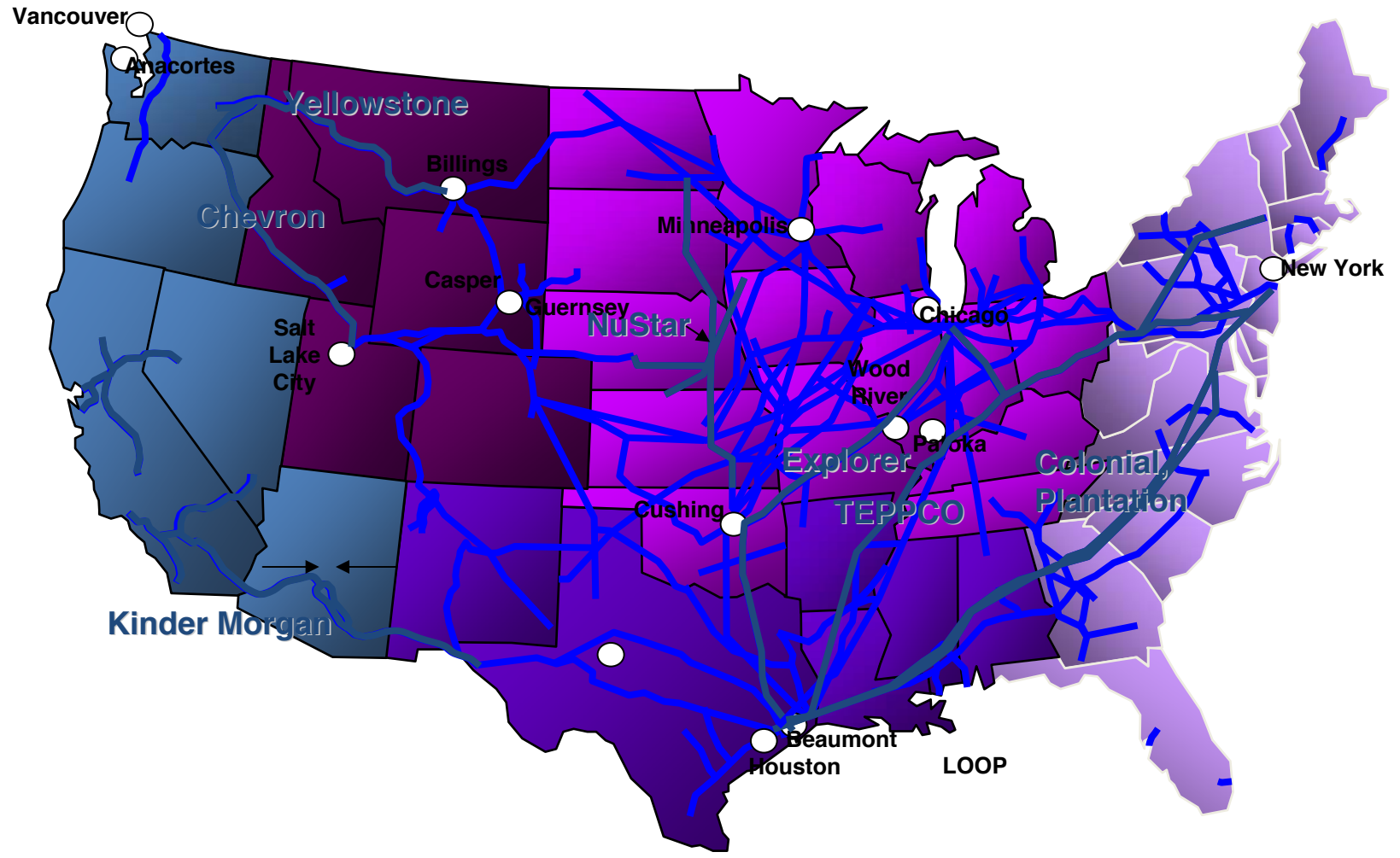


Estimated Average Daily Truck Traffic 1998 vs. 2020



Source: U.S. Department of Transportation

Selected Major Refined Product Pipelines



E10 Blend Wall

- EISA requires refiners and importers - *obligated parties* - to use ethanol or acquire credits (Renewable Identification Numbers -RINs) based on market share, small refiners exempt through 2010
- Based on EIA's projected gasoline production, obligated parties will be required to use (or purchase RINs that represent) the following *volume percentages* of ethanol in their gasoline:

<u>Year</u>	<u>Percent Ethanol</u>
2008	7.2%
2009	8.6%
2010	9.7%
2011	8.9%
2012	9.6%
2013	10.4%
2014	11.5%

Note: Based on EIA 2007 projection, recent gasoline demand decreases may accelerate blend wall

Source: API

E85 Issues

- **E85 is fuel containing 70-85% ethanol for use in flexible fuel vehicles (FFV's)**
 - **Lower level blends > E10 can also be used in FFV's**
- **There will be significant costs to install pumps and tanks at retail outlets**
 - **There are 1,693 E85 public retail outlets out of 167,500***
 - **DOE estimates that 60,000 retail public outlets will be needed**
- **Currently 6 million FFVs on the road out of 250 million**
- **Manufacturers committed to increasing number of FFVs in future model years**
- **Significant misfueling concerns - different sized vehicle fuel inlets may be necessary with corresponding pump nozzles**

* Per the National Ethanol Vehicle Coalition (10/13/2008) <http://www.e85fuel.com>

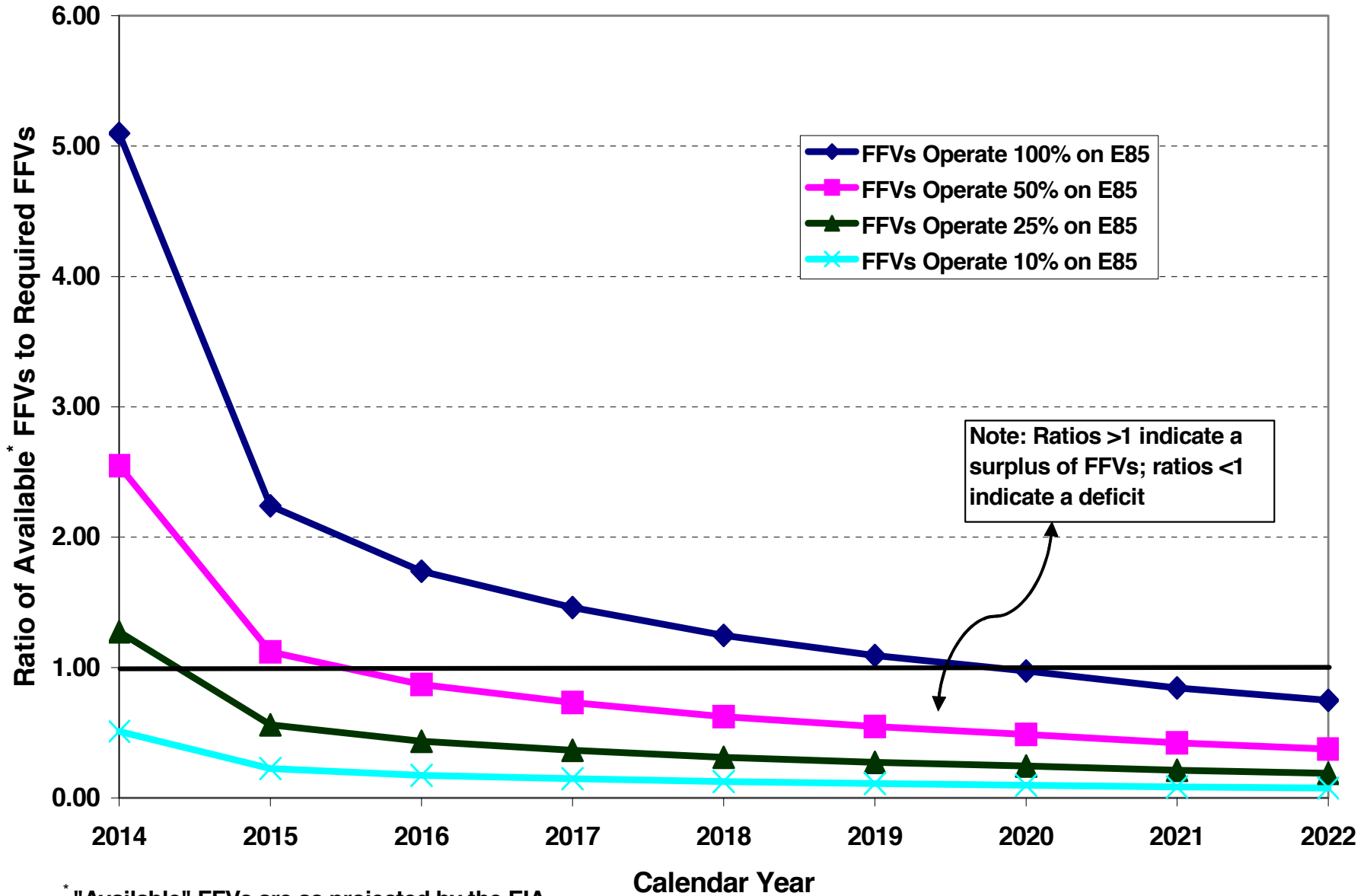
E85 Fueling Facilities

- Minnesota 357
- Illinois 188
- Missouri with 112
- Texas 37 (4 not public) Kroger and H-E-B
- Seven states do not offer E85: Maine, New Hampshire, Vermont, Rhode Island, New Jersey, Alaska and Hawaii

E10+ Scenario Summary

- To implement the RFS, there will be several “blend walls” that will be encountered
- E10 blend wall in 2013
- E85 blend wall in 2020
 - 2020 assumes that all FFVs are fuels 100% on E85
- In concept, a combination of E10+ and E85 can work through 2022 (if FFV production is increased)
- But there is no guarantee that E10+ will ever be viable

Will there be Enough FFVs?



Note: Ratios >1 indicate a surplus of FFVs; ratios <1 indicate a deficit

* "Available" FFVs are as projected by the EIA 2008 Annual Energy Outlook (revised)

Impediments to Pipeline Transportation

Fuel Quality: Ethanol has an affinity for water which can be picked up as the product flows through the pipeline network.

Pipeline industry's limited experience has revealed that transportation of ethanol in multi-product pipelines produces a scouring effect on the internal surface that may lead to additional fuel quality issues.

Stress Corrosion Cracking (SCC): The presence of ethanol in pipelines and terminals has caused stress corrosion cracking (SCC).

Causes (presence of oxygen) and potential remedies are the subject of extensive, ongoing technical studies by DNV/CC Technologies under the auspices of the Petroleum Research Council International (PRCI). Additives in the form of "oxygen scavengers" are being developed.

Pipelines Venturing Forward

Pipeline Options

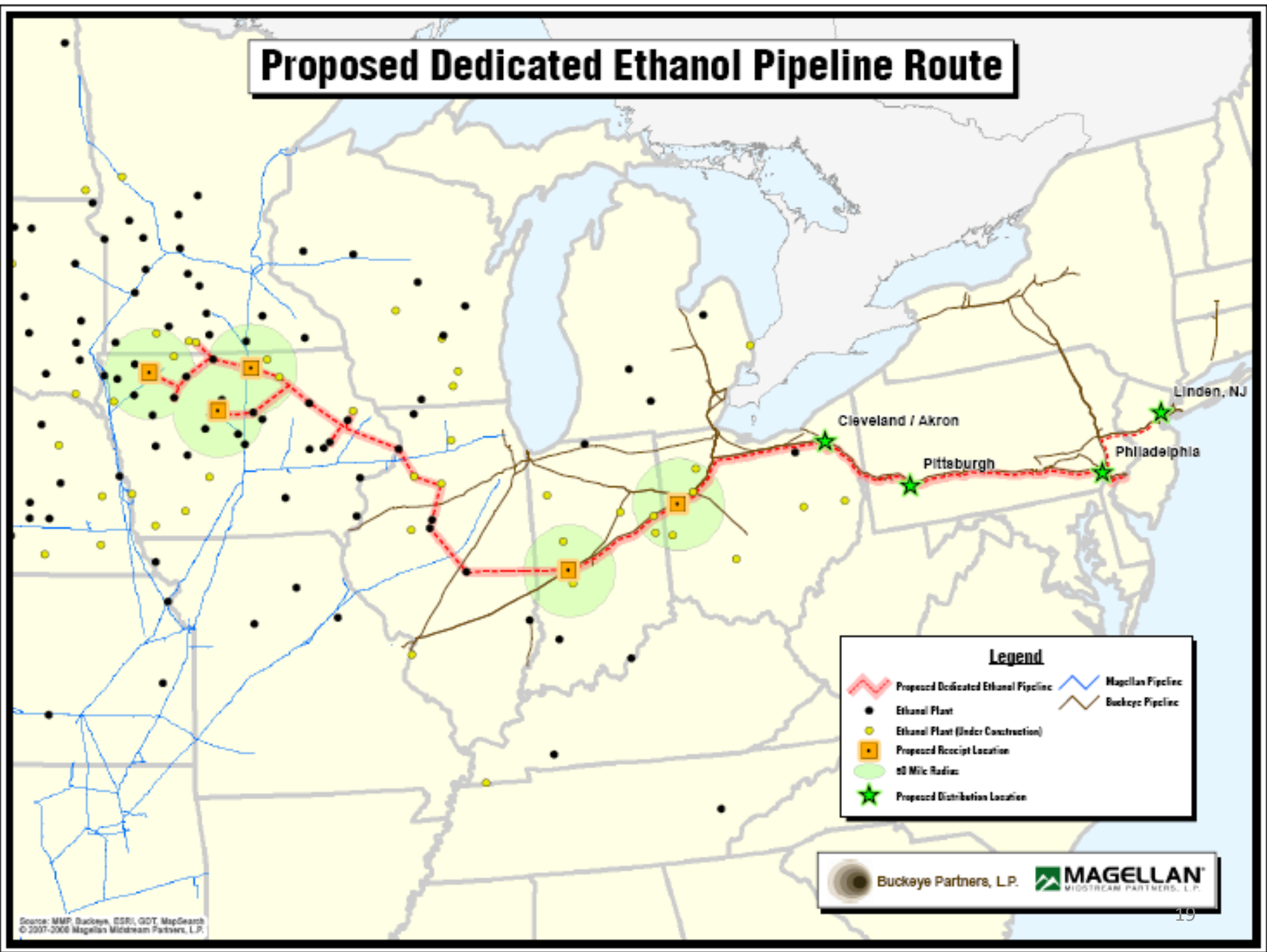
- Batch shipments in multi-product pipelines,
- Ship blends in existing pipelines,
- Build dedicated ethanol pipelines

Several pipelines have run trials of neat (denatured) ethanol batches. One project expects to be in commercial service in 2008

Dedicated ethanol pipeline - Magellan-Buckeye joint venture for a proposed a feasibility study

Note: the Emergency Bailout legislation included an amendment to count shipments of ethanol as qualifying income for MLPs

Proposed Dedicated Ethanol Pipeline Route



Legend

- Proposed Dedicated Ethanol Pipeline
- Ethanol Plant
- Ethanol Plant (Under Construction)
- Proposed Receipt Location
- 50 Mile Radius
- Proposed Distribution Location
- Magellan Pipeline
- Buckeye Pipeline

Buckeye Partners, L.P. **MAGELLAN**
MIDSTREAM PARTNERS, L.P.

Source: MMP, Buckeye, ESRI, GDT, MapSearch
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