Renewable Portfolio Standard (RPS) / Renewable Fuels Standard (RFS)

Issues, Implications, and Strategies

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Renewable Portfolio Standard
Background

- A policy requiring a gradually increasing amount of an electric suppliers' retail load (1% to 20%) come from renewable energy resources within a set timeframe - 21 states now have some form of an RPS/RES

- Typical renewable resources:
  - hydro (limited applicability)
  - wind
  - biomass
  - solar
  - geothermal
- Flexible, market-based mechanism
- Encourages renewable energy sources to compete so that the requirement is achieved at the lowest cost
- 10% National RPS was considered in the 2005 Energy Bill
- What are the energy, environmental, and economic implications of an RPS?

Why Consider Renewable Portfolio Standards?

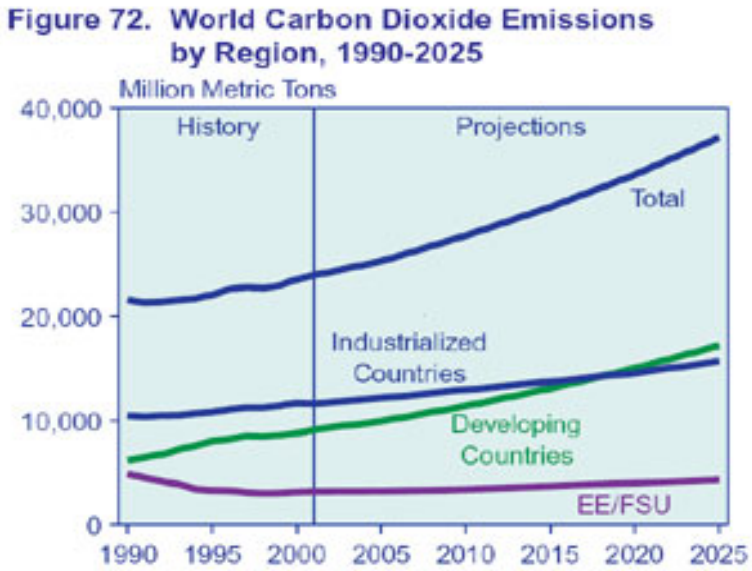
4 Key Reasons to Consider an RPS (state and/or national level)

1) Insulate consumers and economy from fossil fuel price spikes and potential supply shortages through fuel diversification and new competition

2) Improve national energy security

3) Reliable energy delivery and system reliability; distributed generation aspects

4) Environmental concerns
   - Air quality
   - Soil quality
   - Water quality



Renewable Portfolio Standard

Pros and Cons

- Pros:
  - ✓ Sustainability – Energy and Environment
  - ✓ Economic Development (Use and Credit Trading)
  - ✓ Clean Energy Resources – Abundance in Kansas
  - ✓ Energy Security
- Cons:
  - Potentially higher near-term electricity supply costs
  - Possible, and very probable, increased grid investment
  - Can be centrally planned/mandated, not market based

Future United States Projections –
Electricity and the Renewable Energy Contribution

Figure 5. Electricity generation by fuel, 1970-2025 (billion kilowatthours)

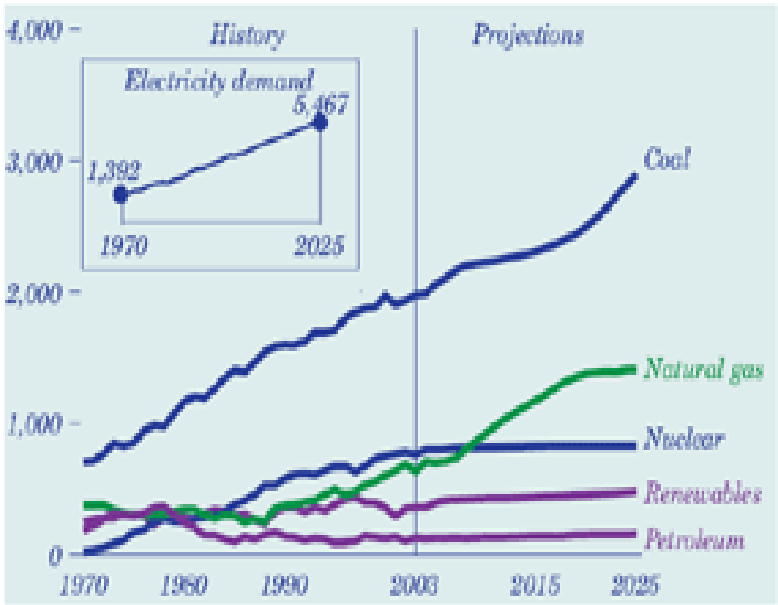
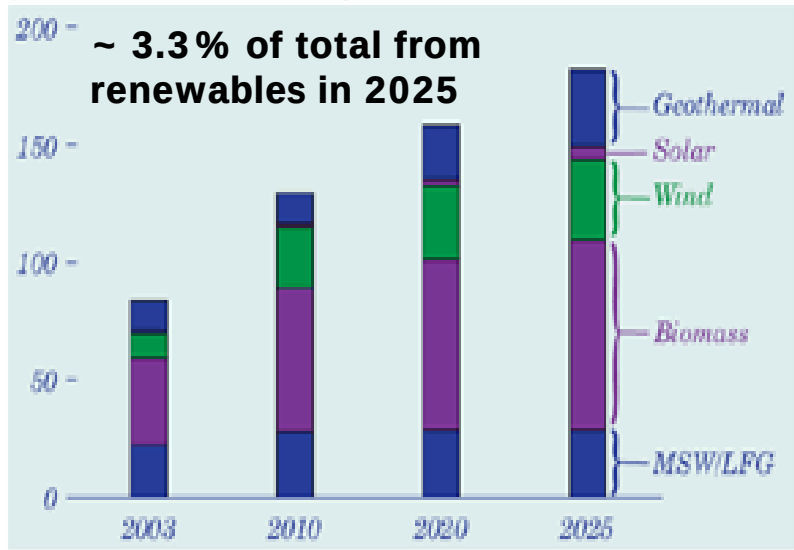


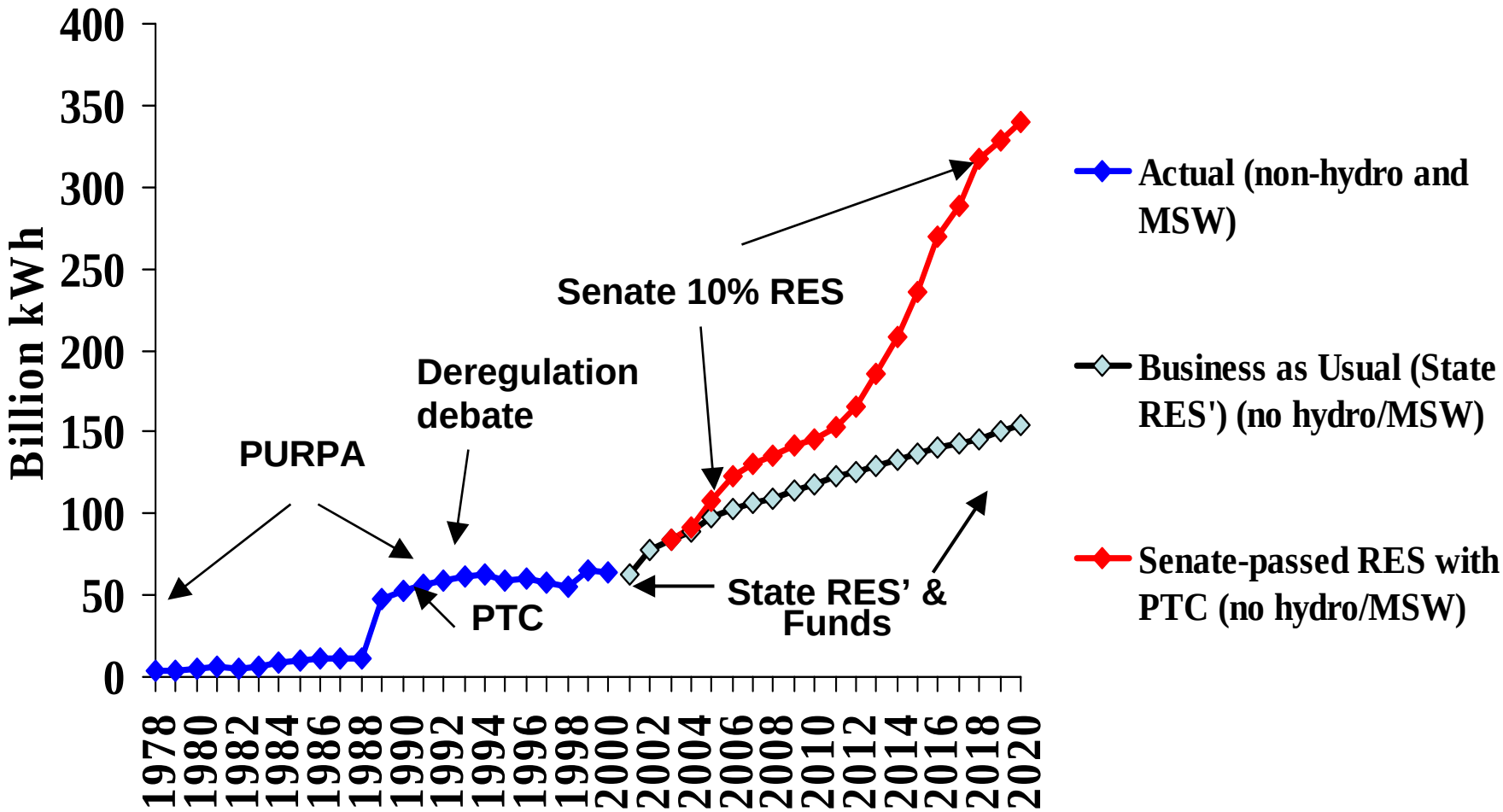
Figure 75. Nonhydroelectric renewable electricity generation by energy source, 2003-2025 (billion kilowatthours)



What will/can Kansas' contribution be toward the nearly 182 billion kilowatt-hours of projected renewables in 2025?

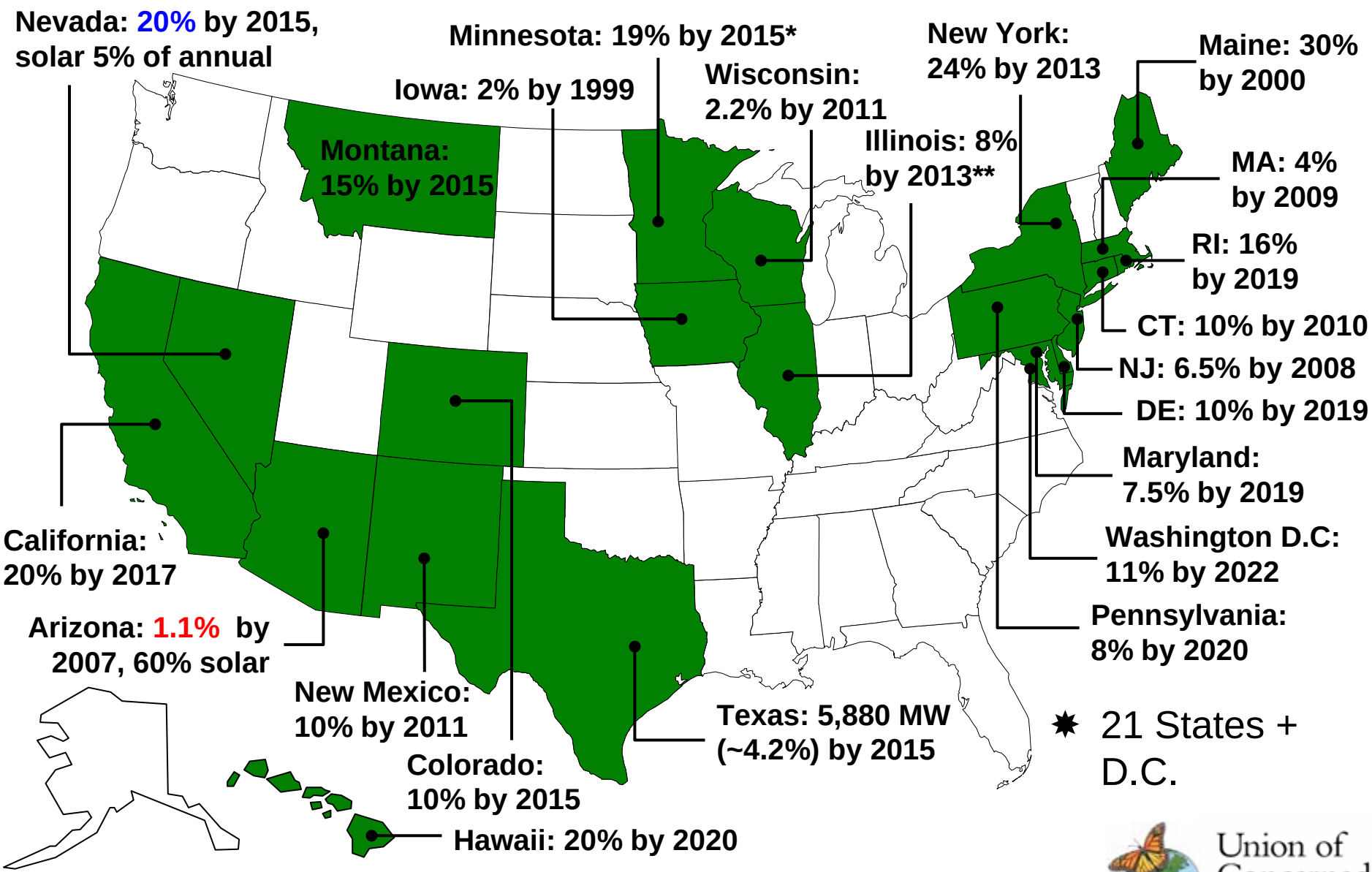
Reference: ***US Department of Energy – Energy Information Administration***

Potential Renewable Energy Generation in the United States due to a 10% RPS



Sources: EIA (actual, business as usual (includes state RESs and funds),UCS (Bingaman RES)).

Renewable Electricity Standards



*Includes requirements adopted in 1994 and 2003 for one utility, Xcel Energy.

**No specific enforcement measures, but utility regulatory intent and authority appears sufficient.

Union of Concerned Scientists

RPS Design Components

The devil is in the details…

Structure

- Who's obligated: IOUs, ESPs, Munis, Coops?
- Percentage vs. capacity
- Target levels/ramp-up rate
- Start date/end date
- Single requirement or multiple tiers
- Resource diversity (set-asides or multipliers)
- Application: product vs. company-based
- Funding mechanisms

Eligibility

- Resource types (define)
- In-state vs. out of state
- Generation deliverability vs. RECs only
- New vs. existing (define)
- Customer-sited resources

Other Issues

- Interaction with other policies (i.e. state funds)
- Interaction with green power programs
- Compatibility with RPS programs in other states

Administration

- Oversight (PUC, Energy office, both?)
- Compliance verification (REC trading or other)
- Resource eligibility certification
- Enforcement mechanisms
- Filing requirements
- Cost caps
- Cost recovery
- Contract standards
- Flexibility mechanisms
- Program review

Source: R. Wiser, et al., *Evaluating Experience with Renewables Portfolio Standards in the United States*, U.S. DOE LBL, March 2004. Available online at: http://eetd.lbl.gov/ea/ems/reports/54439.pdf

National Renewable Fuels Standard (RFS)

Provision in the Energy Policy Act of 2005

General Objective

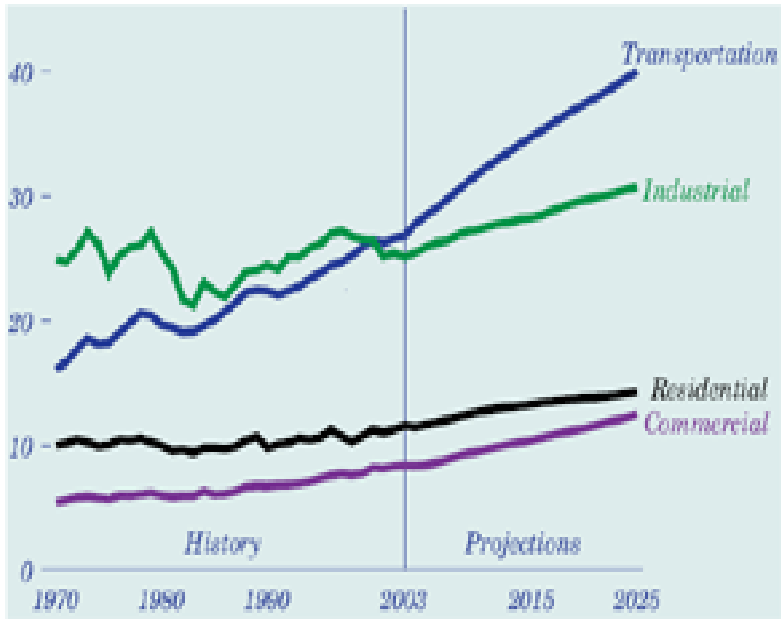
- Idea is to double the amount of renewable fuels (ethanol and biodiesel) by 2012 to 7.5 billion gallons from current levels of about 3.25 billion gallons

- No set “split” between ethanol and biodiesel

Renewable Fuels Standard Projections

2006	4.6 billion gallons
2010	6.8 billion gallons
2012	7.5 billion gallons

Figure 2. Delivered energy consumption by sector, 1970-2025 (quadrillion Btu)



Projected Increase in Petroleum Consumption for Transportation to 2025

Other RFS Provisions of Interest

- Beginning in 2013, a minimum of 250 million gallons a year of cellulosic derived ethanol be included in the RFS.

- Credit trading program for refiners that allows for the most efficient and cost-effective use of renewables.

  - The credit trading program will result in lower costs to refiners and thus, consumers. RFS credits have a lifespan of 12 months.

  - ***Every gallon of cellulose-derived ethanol is equal to 2.5 gallons of renewable fuel.***

Maximum Production from Grain Stocks of Corn and Grain Sorghum

- Each bushel of corn/grain sorghum produces between 2.6 and 2.8 gallons of ethanol
- Average 2003-2005 production was 11.4 B bushels
- Therefore, approximately 31.9 B gal of ethanol could be produced if we used 100% of the corn and grain sorghum produced
- This falls far ***way short*** of the 140 B gal of gasoline currently used by the transportation sector, but would be enough at the E15 level; still this assumes **ALL** grain is used plus the remainder of the gasoline market must be addresses.
- To replace all 140 B gal with E85 would require 119 B gal of ethanol, 50 B bushels of corn, and 340 M acres of land (~9% of the United States)

Possible Cellulosic Feedstock Sources

- Agricultural residues
  - Stover, straws, bagasse, alfalfa
- Forestry waste
  - Mill residue, bark, wood chips, thinnings
- Dedicated energy crops
  - Switchgrass, willows, poplars, sorghum, eucalyptus
- Municipal solid waste
  - Yard wastes, paper, packaging, organic wastes

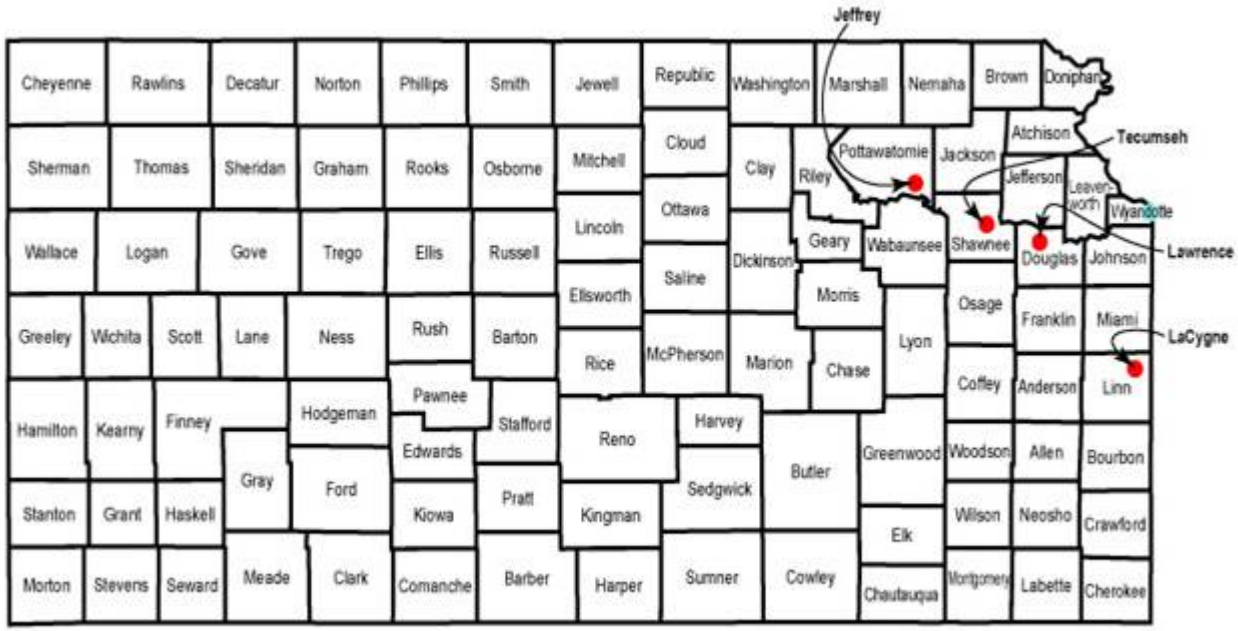
Difference between Quantity and Supply !

Issues

Agricultural Crops require a Land Base

- Availability
  - Is there enough land to grow sufficient quantities of biomass and foodstuffs?
  - How much biomass is potentially available (supply curves) and at what economic/financial cost?
- Sustainability
  - Is the harvesting of large quantities of biomass sustainable and from where will it come from?
  - How does using ethanol produced from biomass impact the environment from a total life cycle perspective?

Qualified Electric Generating Facilities for Biomass (Herbaceous Energy Crop) Co-firing for Meeting RPS Requirements



Nameplate Capacities

Jeffrey - 2,160 MW

LaCygne - 1,578 MW

Lawrence - 566 MW

Tecumseh - 232 MW

Plant Capacity Factor ~67%

Four Herbaceous Energy Crop Co-firing Scenarios (% of total megawatt-hours at each facility)

	scenario #1	scenario #2	scenario #3	scenario #4
2007	0.25%	1.00%	0.125%	0.50%
2008	0.50%	1.50%	0.25%	0.55%
2009	1.00%	2.00%	0.50%	0.60%
2010	1.50%	2.50%	0.75%	0.65%
2015	5.00%	5.00%	2.50%	0.90%
2020	10.00%	7.50%	5.00%	2.00%
2025	10.00%	10.00%	5.00%	2.00%

Soil Erosion Reduction Magnitude via Herbaceous Energy Crop Utilization

Recent research shows considerable decreases in soil erosion and nutrient transfer to water supply vectors when producing herbaceous energy crops versus traditional commodity crops.

- Sediment Yield 99.4%
- Surface Runoff 55.2%
- N in Surface Runoff 34.7%
- Edge-of-Field Erosion 98.7%

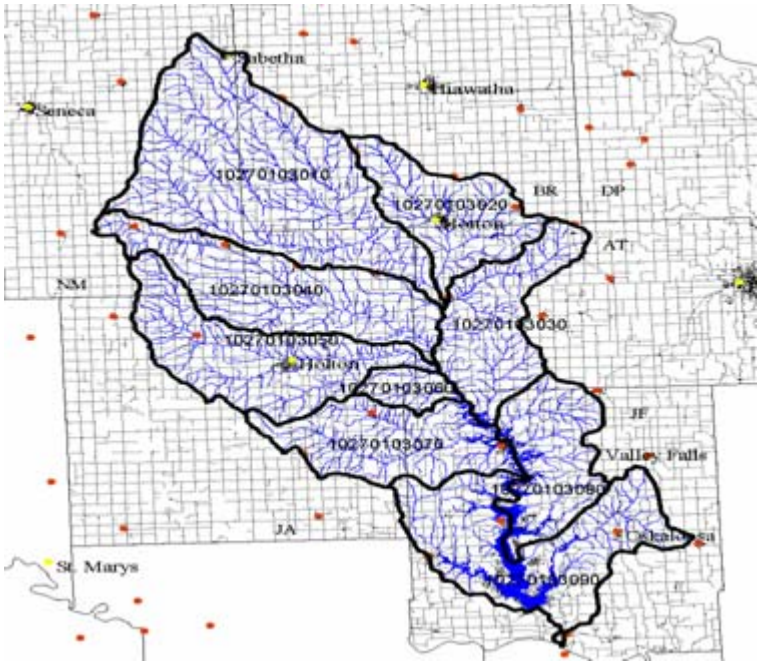
Magnitude of reduction in soil erosion, and hence, the water quality benefit, potentially achievable from herbaceous energy-crop production as co-firing fuels is a function of:

- structure of the RPS (percentage of renewables required),
- herbaceous energy crop yield,
- quantity of herbaceous energy crop required by each particular RPS scenario and geographic location of production (climate characteristics),
- soil types and physical characteristics of the soils (soil erodibility),
- operating characteristics of the electric generating facility (required heat-rate input), and
- cost of competing agricultural commodity crop crop/land use and energy source.

RPS, RFS & Associated Environmental Benefits

Herbaceous Energy Crop Production for Alternative Energy Production and Use

Food, Fuel, Water Quality & Supply Issues



Example modeled cumulative, 24-year soil erosion (total tons) comparison between switchgrass and four conventional commodity crops on two major soil types in Pottawatomie county, Kansas.

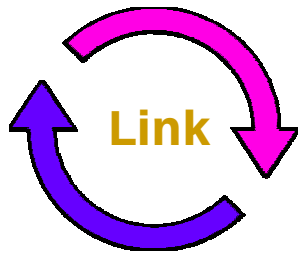
Soil Type	Switchgrass	Corn	Soybeans	Wheat	Grain Sorghum
Pawnee	0.34	30.28	33.42	11.21	33.54
Clime	0.77	68.87	76.98	27.86	76.93

Average Annual Soil Erosion Savings

Jeffrey (2,160 MW nameplate capacity)

co-firing scenario	average annual savings (2007-2025)
#1	208,751
#2	198,765
#3	104,376
#4	43,747

Energy (herbaceous energy crops)



Environment (water quality and supply)