

#### **E** Exploring Energy Efficiency & Alternatives







#### 4th Friday Series (June 27, 2014) NRCS Services for Ag-Sector Landowners



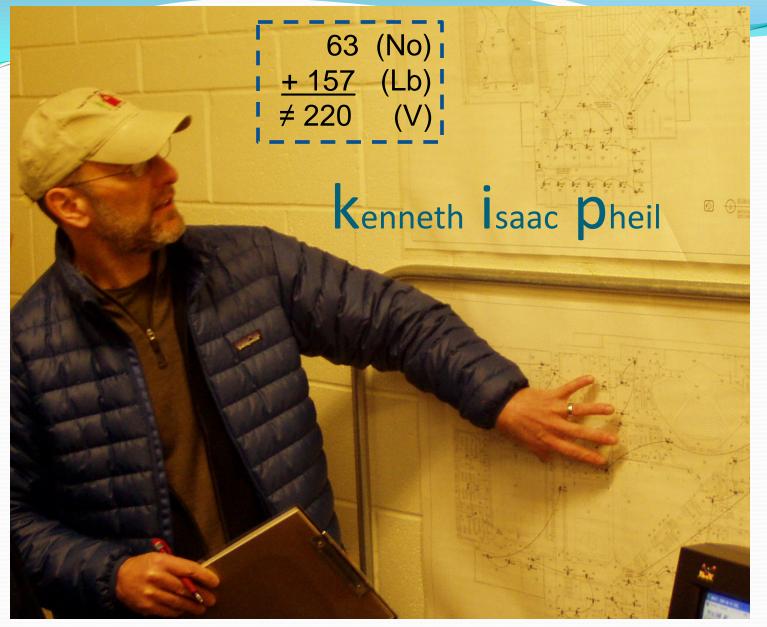




#### Agenda

- Terms energy & NRCS dialects
- Timelines NRCS + Agricultural Energy
- Targets NRCS Goals for Ag Energy
- Tactics NRCS Approach to Ag Energy
  - Clients / Staffing / Partners / etc.
- Tools (aka Technology)
  - Conservation Practice Standards for Energy
  - Energy Analysis Tools Calculators + Consultants
  - \$ (Cash not a defined Technology but clearly a tool)





AOI \*
OSU
(BSME)
ODOE
(SELP)
(RPS)
NRCS
(ETDT)

\* - acronym of interest (defined in notes)

[Feb 2011]



### Terms (acronyms, etc.)

Ag-Sector Landowner =

Farmer, Forester, Rancher, Vintner, etc. (mostly on privately held lands though NRCS works with Tribes, varied government-sector agencies, etc.).

EIA = Energy Information Administration (US)

viz = vis-á-vis (kip jargon)



#### A Brief History of Earth & Energy

- 1930 Dust Bowl
- 1933 Soil Erosion Service (SES)
- \* 1973 Oil Embargo (one)
- 1994 Natural Resources Conservation Service
- 2006 NRCS Nat'l Energy Technology Team
- \* 2010 NRCS Energy Resource Concerns
- 2011 Farmstead Energy Improvement (374) CPS ^
- \* 2013 Lighting (670) & Building (672) CPS
- 2013 State Technical Energy Leads for QA

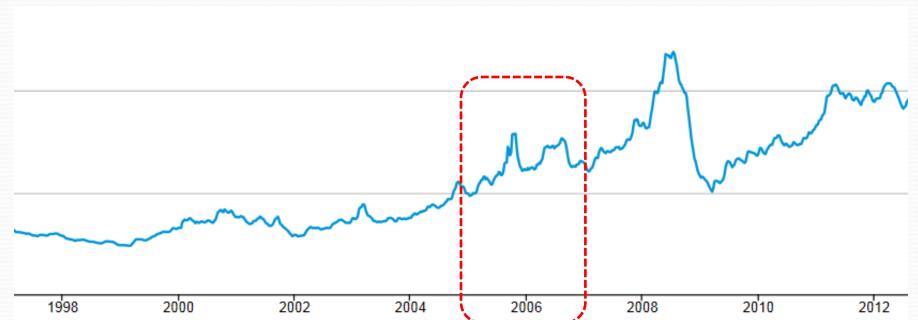


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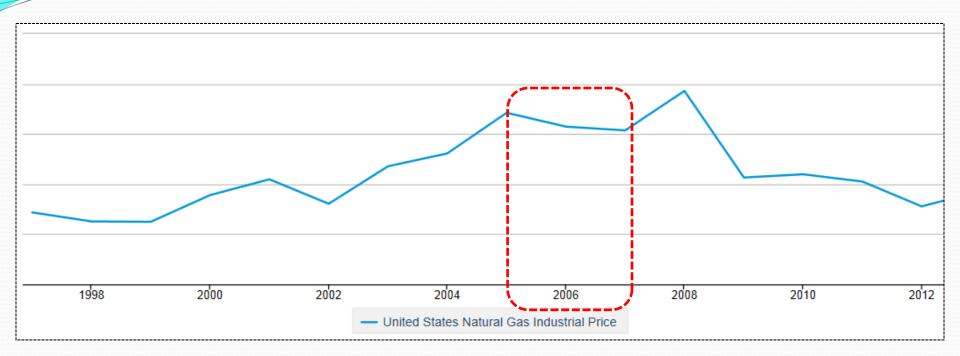
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- Energy Historically Incidental to SWAPA



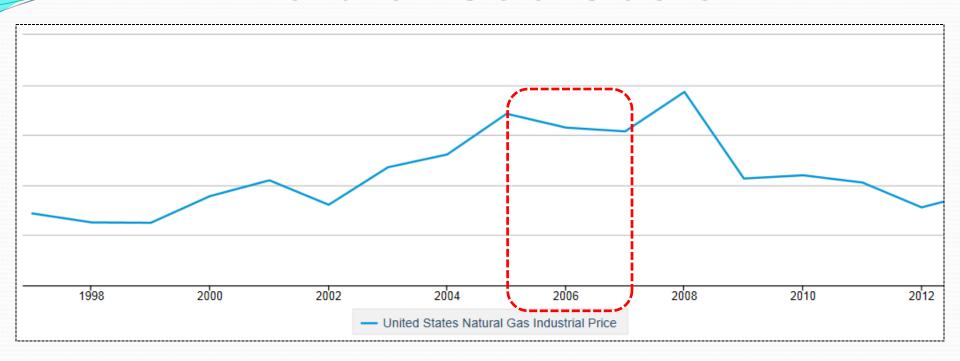
## Diesel Costs (EIA)



#### Natural Gas Costs



#### Natural Gas Costs

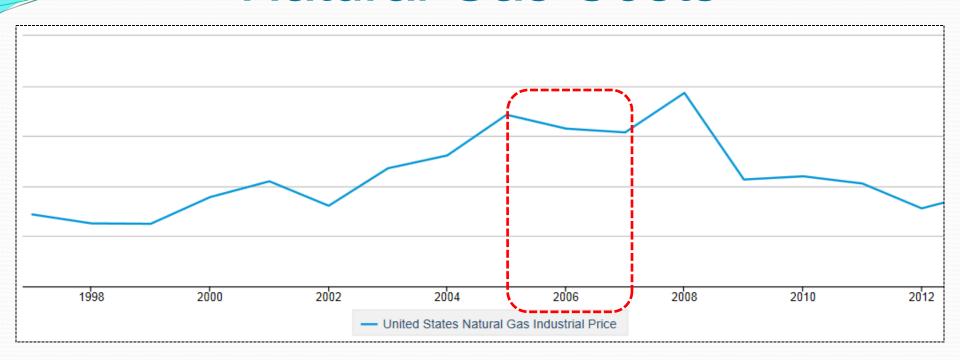


Few ag-enterprises use natural gas - does it matter?

Does an Industrial rate apply to farmers?



#### Natural Gas Costs



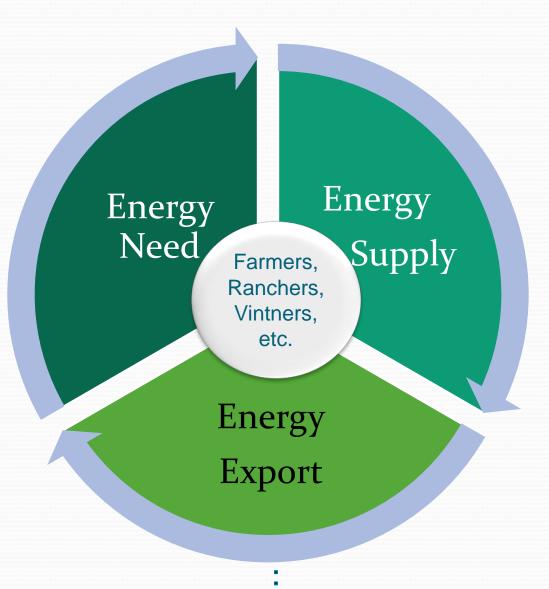
Natural gas is a key driver for the cost of synthetic nitrogen fertilizers:

- primary feedstock;
- direct process heat;
- indirect process power (lags coal-fired electricity on a % basis).

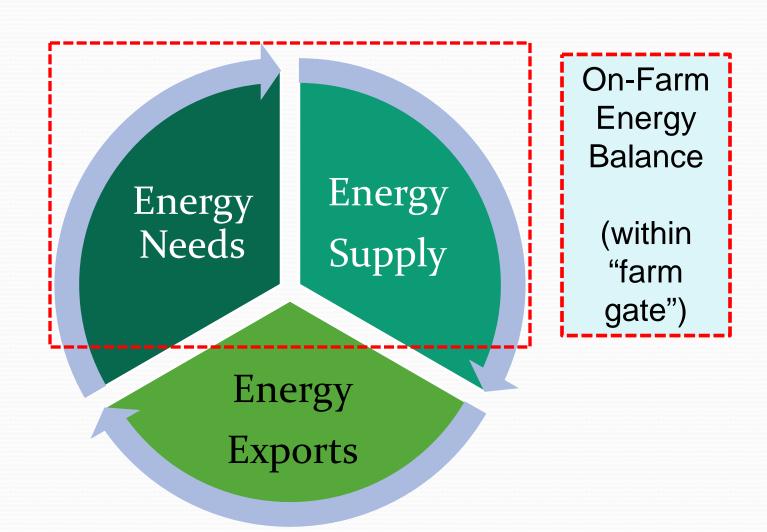
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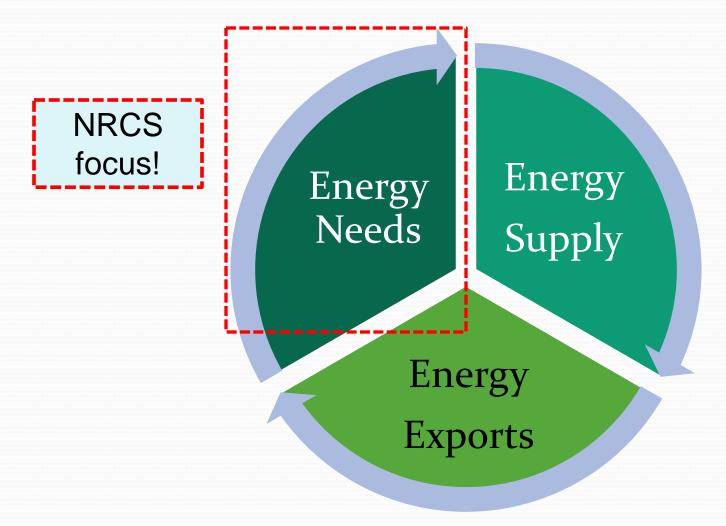






(none of these lines are as hard as they appear)







Diesel/Gasoline ~35%
Synthetic Fertilizer ~30%
Electricity ~20%
Propane / Nat'l Gas ~10%
Pesticides ~5%

U.S. Ag Energy Sources^

Energy Supply



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Synthetic Fertilizer ~30%
Electricity ~20%
Propane / Nat'l Gas ~10%
Pesticides ~5%

U.S. Ag Energy Sources

Energy Supply

Renewable Resource Share of total:

~ 3%

Mostly delivered as electricity.

(see notes for add'l sources, derivation)



#### Net-Zero Ag

#### Net-Zero Agricultural Operations:

- A. Serve energy needs for continued operations with renewable resources.
- B. Based on annual average conditions & yield.

#### In / Out / Uncertain:

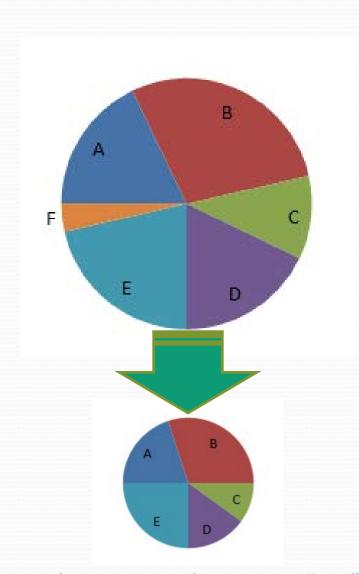
- Embedded energy.
- De minimis uses.

Steps to Reach
Net-Zero Agricultural
Operations:

- 1) Reduce Energy Needs.
- 2) Meet those Needs with Renewable Resources.



#### Step 1 to Net-Zero Ag



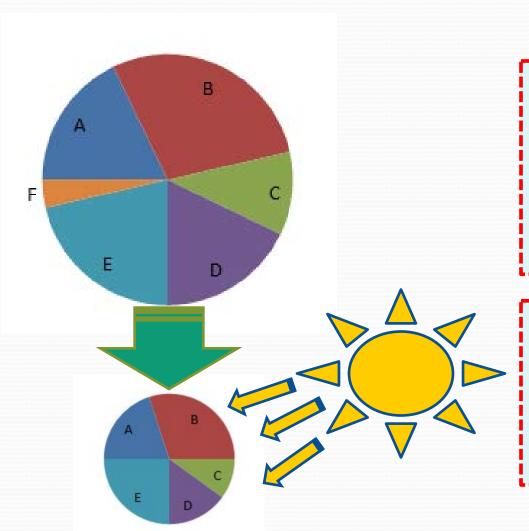
**NRCS Focus** 2010 - present

1) Reduce Energy Needs.

(i.e., shrink the demand pie)



#### Step 2 to Net-Zero Ag



NRCS Focus 20yy - TBD

- 1) Reduce Energy Needs.
- 2) ?

(i.e., shrink the demand pie)

2) Renewable Resources?

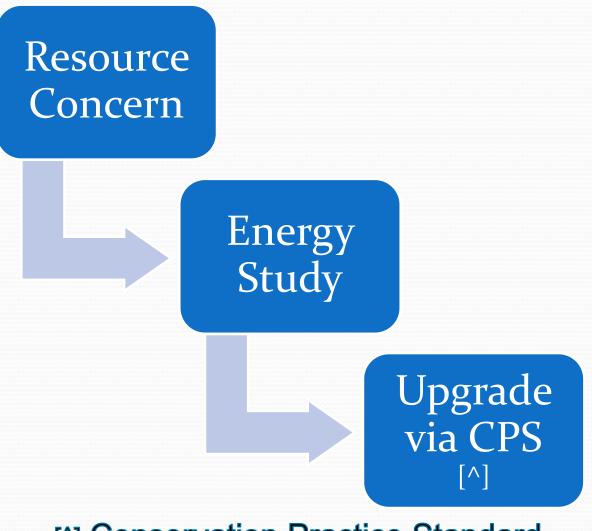
USDA Rural Development Utilities Extension Energy Others

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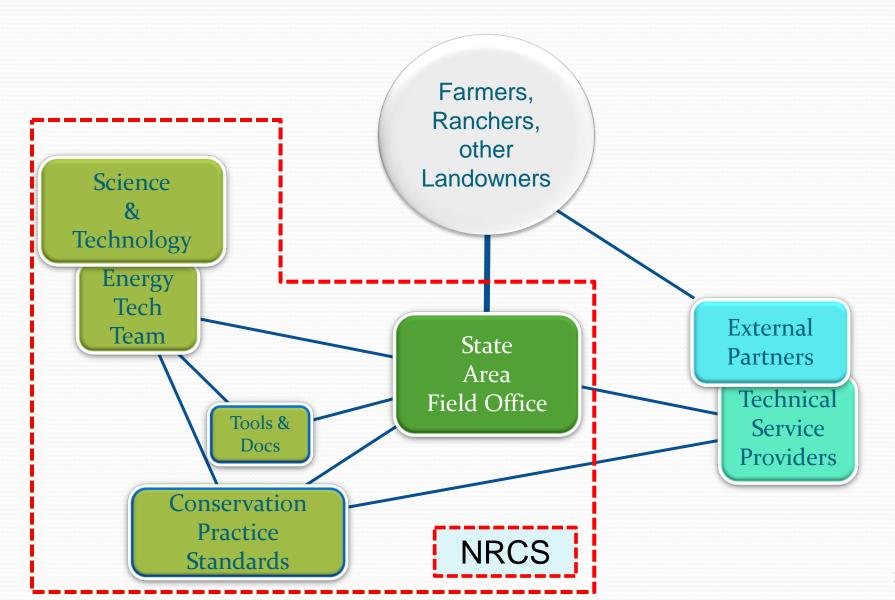
#### NRCS Energy Upgrade Path



[^] Conservation Practice Standard

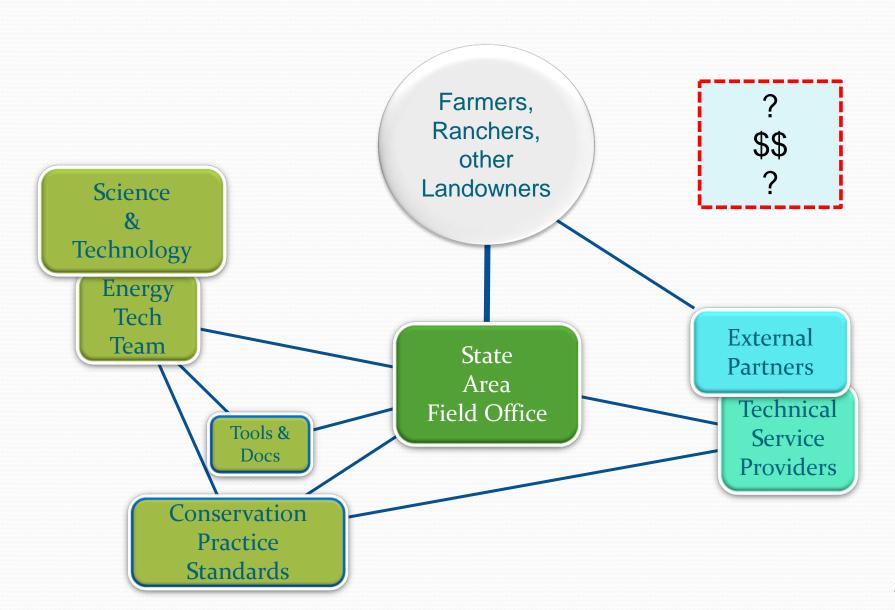


## Technical Structure (Simple)



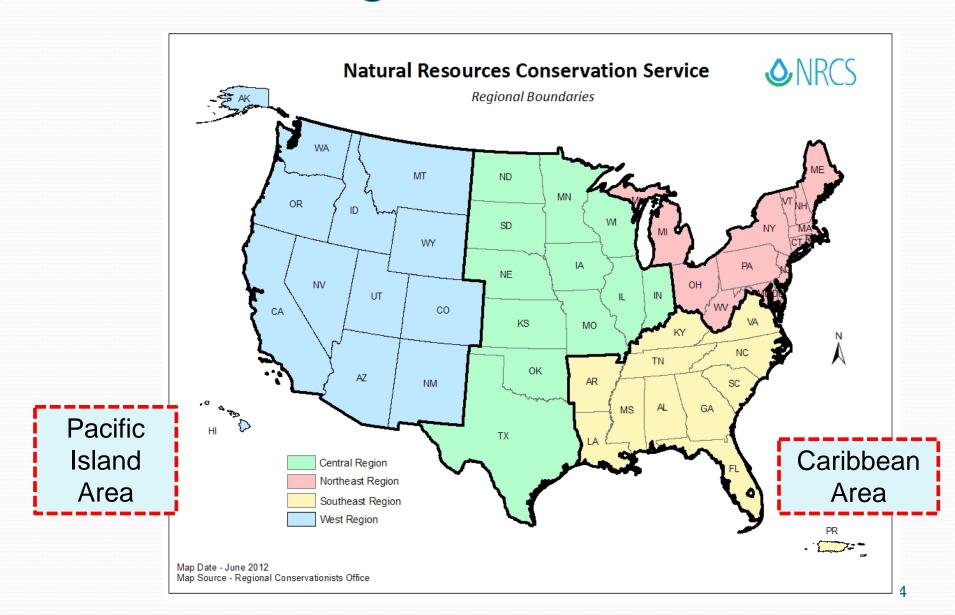


## Structure (Simple)



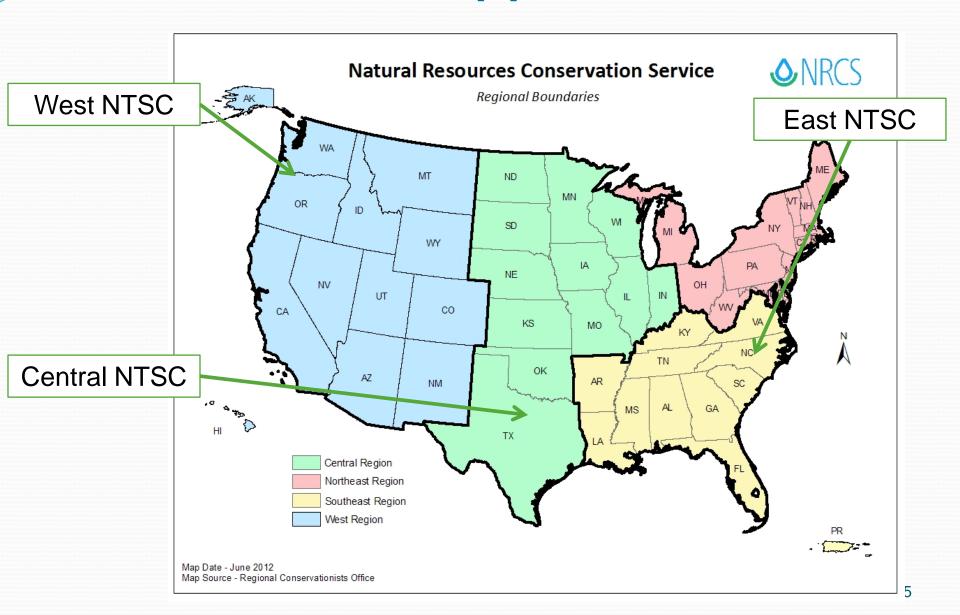


## NRCS Regions – 51 "States"



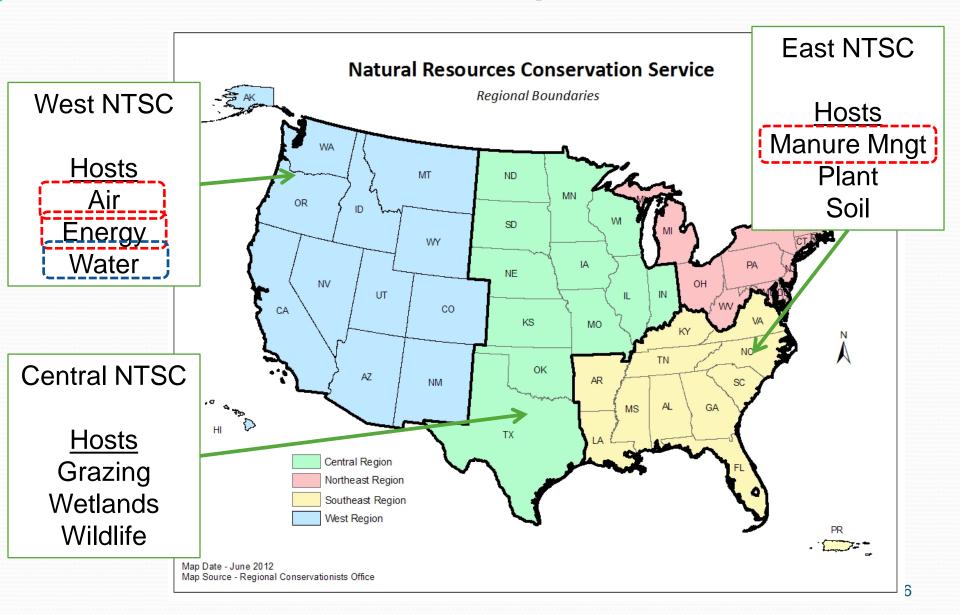


#### Nat'l Tech Support Centers



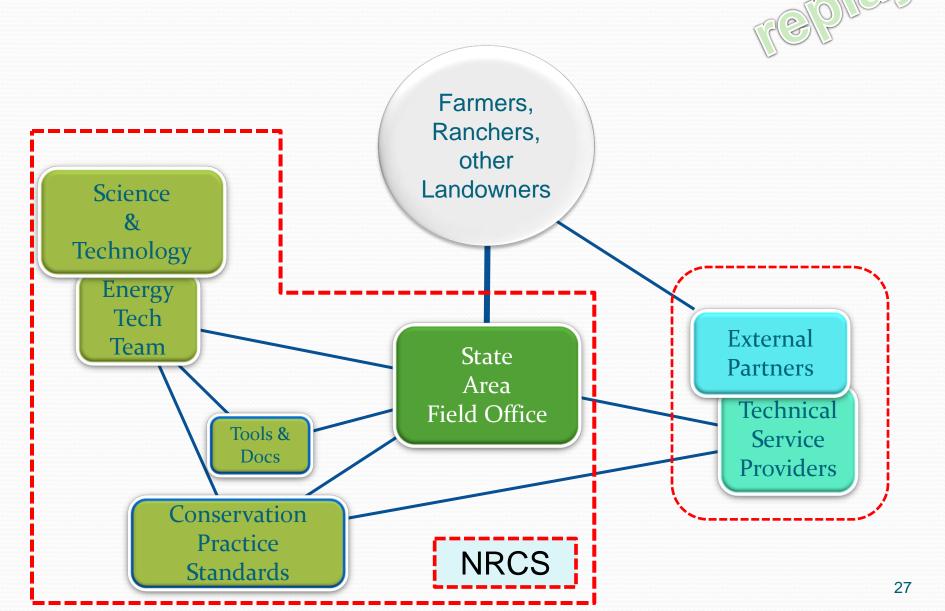


#### Nat'l Tech Development Teams





# Technical Structure (Simple)





#### External Partners (some ..)

- USDA Agencies, e.g.,:
  - Agricultural Research Service (ARS)
     (Energy Supply & Exports spokes viz biomass)
  - Economic Research Service (ERS)
  - National Institute of Food and Agriculture (NIFA)
     (support of Extension, etc.)
  - Rural Development (RD)(\$ to address Need, Supply, Export spokes)
  - Rural Utilities Service (RUS)(\$ mainly on Supply spoke)



#### External Partners (...)

- Dept. of Defense (DOD)
- Dept. of Energy (USDOE)
- Dept. of Interior (DOI)
- Environmental Protection Agency (EPA)

   (Anaerobic Digesters viz AgSTAR)
   (crossover to wider SWAPA areas)
- Universities
  - Ag / Biological Engr Dept. (typical)
  - Extension Energy (+)

#### External Entities (...)

- State Energy & Ag Agencies
  - Nat'l Assn of State Energy Offices (NASEO)
- Non-Governmental Org's, e.g.,:
  - American Council for an Energy-Efficient Economy (ACEEE)
  - American Society for Agricultural & Biological Engineers (ASABE)
  - Consortium for Energy Efficiency (CEE)
  - Innovation Center for U.S. Dairy
  - National Center for Appropriate Technology (NCAT)
  - The Nature Conservancy (TNC)



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#### Primary Energy Partners - TSP

- Environmental Quality Incentives Program (EQIP)
- Conservation Activity Plan (CAP)
- Technical Service Provider (TSP)
- Technical Service Provider Registry (TechReg)
- Field Office Technical Guide (FOTG)

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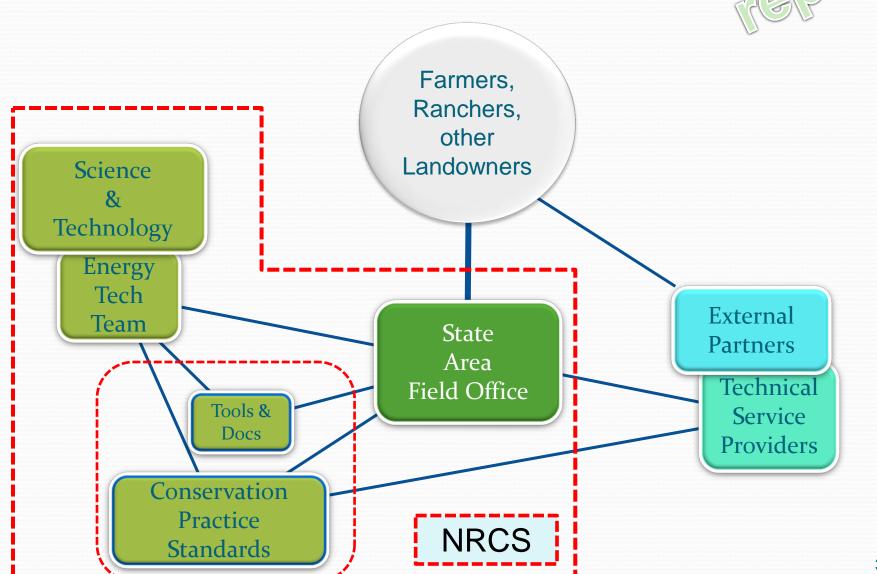
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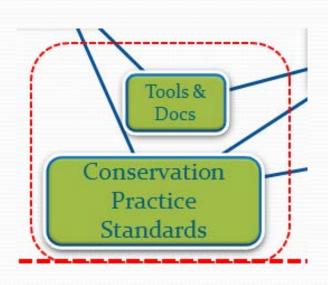
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# Technical Structure (Simple)



## Technology ^



### Technology

"acquire and develop nationally relevant technology"

Energy Conservation Specialist,

NRCS job posting [2010]



Technology ≈ spreadsheets other models standards

<u>Technology</u> ≠ fans, motors, pumps, ballasts



### CPS<sup>^</sup> for Energy – 2010 Review

### Legacy CPS

- Irrigation (many)
- Tillage (many)
- Forestry (some)
- Crops (some)
- Air Quality (few)

Newly Revamped CPS (2011)

Farmstead Energy Improvement (374)

Reduce Energy Needs:
Enhance the technical base.



### CPS for Energy – 2010 Review

### Legacy CPS

- Irrigation
- Tillage
- Forestry
- Crops
- Air Quality

Drove Revamped CPS (2011 update)

Farmstead Energy Improvement (374)

Purpose Statements (typical):

- 1) Reduce Energy Use (22).
- 2) Renewable Energy Source or System (18).

Some CPS serve both purposes.

Note: That Was Then, ...



## Energy by CPS

Function or System Group ('Major Activity')

Lighting

Ventilation

Refrigeration

Milk harvesting

Controllers

Other motors/ pumps

Water heating

Air Heating / Bldg

environment

Drying

Waste handling

Air Cooling

Cultural Practices

Crop/feed Storage

Water management

Material handling

Irrigation

Major Activity from ASABE S612

2013 – new CPS split from (374)

- Lighting System Improvement (670)
- Building Envelope Improvement (672)

**Cultural Practices** 

Plant

Till

Harvest

Engine-driven eqpt

### Energy Terms – an aside

### Energy Analysts (typically)

- Energy Conservation Measure (ECM)
- Energy Conservation Opportunity (ECO)
- Energy Efficiency Measure (EEM)

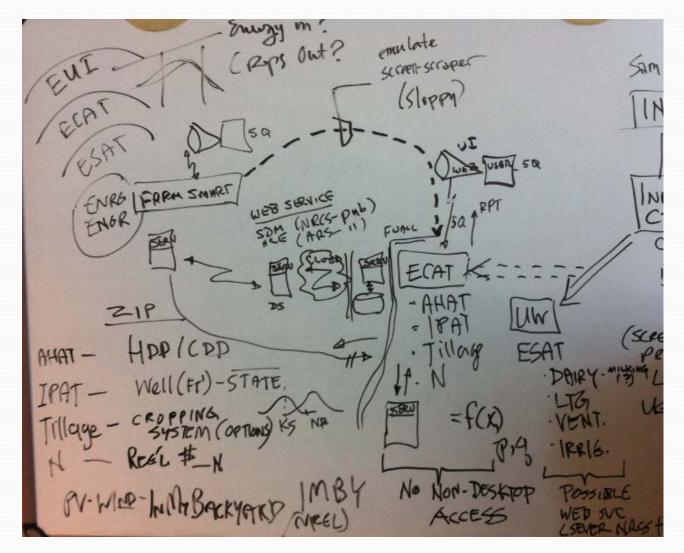
### NRCS (typically)

Payment Schedule Scenario
 (embedded w/in a Conservation Practice)

.



# **Energy Analysis Tools**





# **Energy Analysis Tools**



EUI = Energy Use Index

ECAT = Energy Consumption Awareness Tools

ESAT = Energy Self-Assessment Tools

Enrg Engr = Energy Engineer (or equal)



## NRCS-developed Tools (ECAT)



About Energy Tools Help Contact

You are here: Home

The Natural Resources Conservation Service (NRCS) has developed four energy tools designed to increase energy awareness in agriculture and to help farmers and ranchers identify where they can reduce their energy costs. The results generated by these tools are estimates based on NRCS models and are illustrative of the magnitude of savings. Please contact your local NRCS office for additional assistance.

### Spotlights



**Energy Estimator: Animal Housing** 

The Energy Estimator for Animal Housing tool is designed to enable you to estimate potential energy savings associated with swine, poultry or dairy cows housing operations on your farm or

ranch. This tool evaluates major energy costs in lighting, ventilation and heating costs for swine and poultry. It evaluates major energy costs with lighting air circulation, milk cooling, water heating and milk harvesting costs for typical dairy. This tool does not provide site specific recommendations.

**Energy Estimator: Irrigation** 

The Energy Estimator for Irrigation tool enables you to estimate potential energy savings associated with pumping water for irrigation. NRCS technical specialists developed this model

to integrate general technical information farm-specific crops, energy prices, and pumping requirement. This tool does not provide field-specific recommendations.



**Energy Estimator: Nitrogen** 

The Energy Estimator for Nitrogen tool enables you to calculate the potential cost-savings related to nitrogen use on your farm or ranch. NRCS agronomists developed this model to

integrate general technical information on nitrogen use with farm-specific information on fertilizer types, costs, timing, and placement. This tool does not provide field-specific

### **Energy Tools**

All NRCS Energy Tools

**Energy Estimators** 

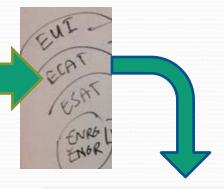
- o Animal Housing
- Irrigation
- Nitrogen
- Tillage

Other Energy Tools

- Grain Drying
- Energy Self Assessment Tools

(see details below)





### Energy Estimators

- Animal Housing
- Irrigation
- Nitrogen
- Tillage



# **ECAT Zip Code Function**

Tool	Uses
Animal Housing	Weather Data (est. ventilation & heating system run-time)
Irrigation	Water Required, State Average values Common Crops
Nitrogen	Typical synthetic fertilizer costs Common Crops
Tillage	Crop Management Zone Common Crops
All	Links to local resources (e.g., Extension, NRCS, and others).

(A Law of Averages: averages can be misleading)

### **ECAT - Care Instructions**

The results generated by these tools are estimates based on NRCS models ...

Illustrate ... magnitude of savings possible.

Not intended to provide precise estimates for your ... farm:

actual results ... depend on ... local conditions and operations ... soil types, rainfall, slope of land, machinery used, etc.

**About Energy Estimators** 

## NRCS-sponsored Tools (ESAT)



You are here: Home

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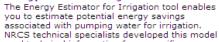


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All NRCS Energy Tools

**Energy Estimators** 

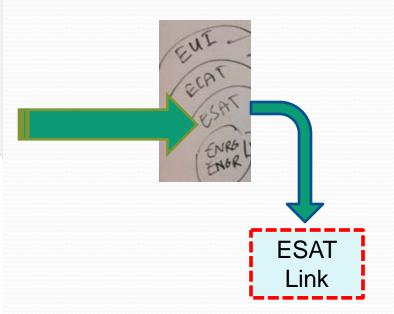
- Animal Housing
- Irrigation
- Nitrogen
- Tillage

Other Energy Tools

- o Grain Drying
- Energy Self Assessment Tools

(see details below)





# NRCS-sponsored Tools (ESAT)



### **Conservation Tools**

- Dairy
- Grain Drying
- Greenhouse
- Irrigation
- Lighting
- Livestock
- Maple Syrup
- Potato Storage
- Ventilation
- Water Fountain

### Renewable Tools

- Biogas
- Biomass
- Solar Electric (PV)
- Solar Water Heating
- Water Pumping
- Wind

## NRCS-sponsored Tools (Grain)



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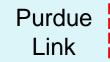
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# NRCS-sponsored Tools (Grain)





**Energy Estimator: Grain Drying** 

Welcome to Energy Estimator: Grain Drying

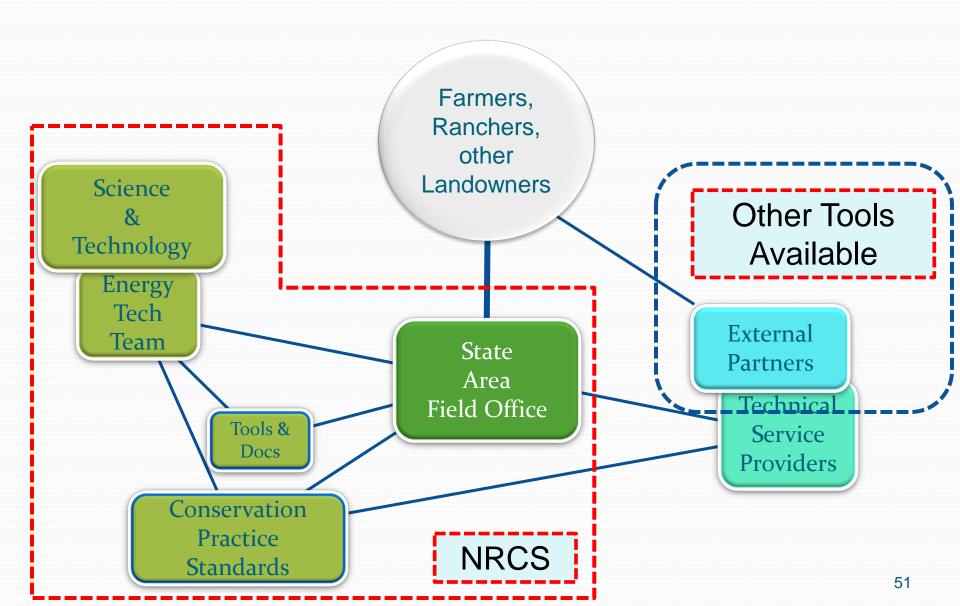
This tool does not provide operation-specific recommendations ...

it provides an idea of ... energy cost savings ... from selecting specific in-bin or high-temperature drying systems.

Results should not be construed as actual savings, but only as estimates.



# Technical Structure (Simple)



## ATTRA Tools (Grain)



Home > Master Publication List > Farm Energy Calculators: Tools for saving money on the farm

Farm Energy Calculators: Tools for saving money on the farm

More than 20 links to varied calculators (including NRCS).

### Energy Analysis – On-Site Study

On-line Calculators & other Tools provide:

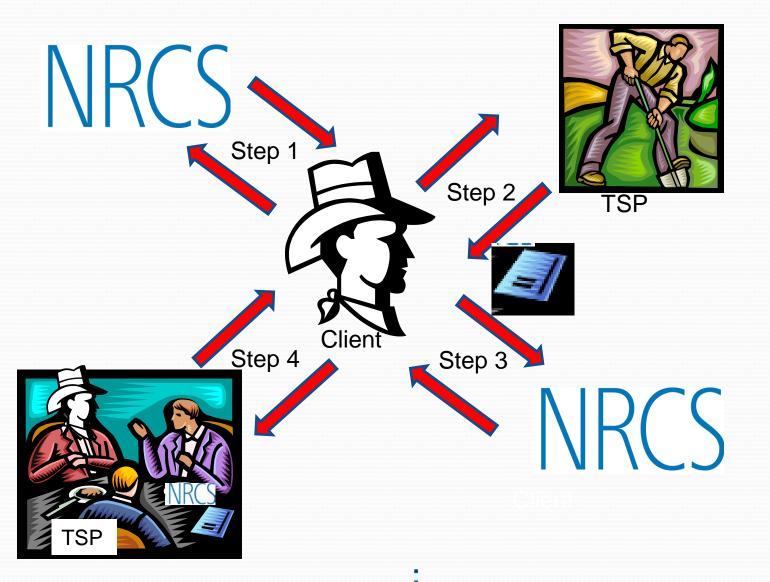
- Landowner 'what if?' options.
- Order of Magnitude Estimates.
- Ideas for Energy Upgrades.
- "Stop / Go" results.

Next Step May be An Energy Intervention:

- Contact NRCS.
- Energy Study based on Site-Specific Data
- Funds are available to assist.



# Circle of (Analytical) Life





## **Energy Analysis Options**

- **...**
- Energy Study based on Site-Specific Data
- **...**

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

FARMSTEAD ENERGY IMPROVEMENT

### General Criteria Applicable to All Purposes

Implement recommendations for components of a current energy audit performed in accordance with the American Society of Agricultural and Biological Engineers (ASABE) Standard S612, Performing On-farm Energy Audits.

NRCS, NHCP May 2011



### Links ...

2014	2014 Energy Webinars	
Mar 2	Mar 20 Key NRCS Practices: Farmstead Energy, Lighting, and Building Envelope	
May 2	May 22 Lighting Systems: Analysis, Performance, and Energy Conservation Opportunities	
Jul 24	ГBD	Energy Analysis: Who, What, When, Where, Why, and How?
Sep 18 Energy Upgrades: Steps to Implement Energy Conservation Opportunities		Energy Upgrades: Steps to Implement Energy Conservation Opportunities
Nov 20 Poultry Operations: Broiler and Layer Energy Conservation Opportuniti		Poultry Operations: Broiler and Layer Energy Conservation Opportunities

Replay or Live. (Search: "nrcs energy conservation opportunity webinar")

### Kip Pheil

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- kenneth.pheil@por.usda.gov
- (503) 310-3037 (m)



site-based analysis; Hells Canyon (2010)

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