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Iowa 2010 Greenhouse Gas Inventory Challenges and Lessons Learned

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Outline

- Objective

- Uniquely Iowa

- Inventory Overview and History

- Challenges

- Methods and Solutions

- Results

- Lessons Learned

- Moving Forward

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Objective

- Share my experience developing a statewide GHG inventory for the first time

  – Other states can learn from our challenges

  – Give EPA feedback and examples of how States use the SIT and how SIT could better fit our needs
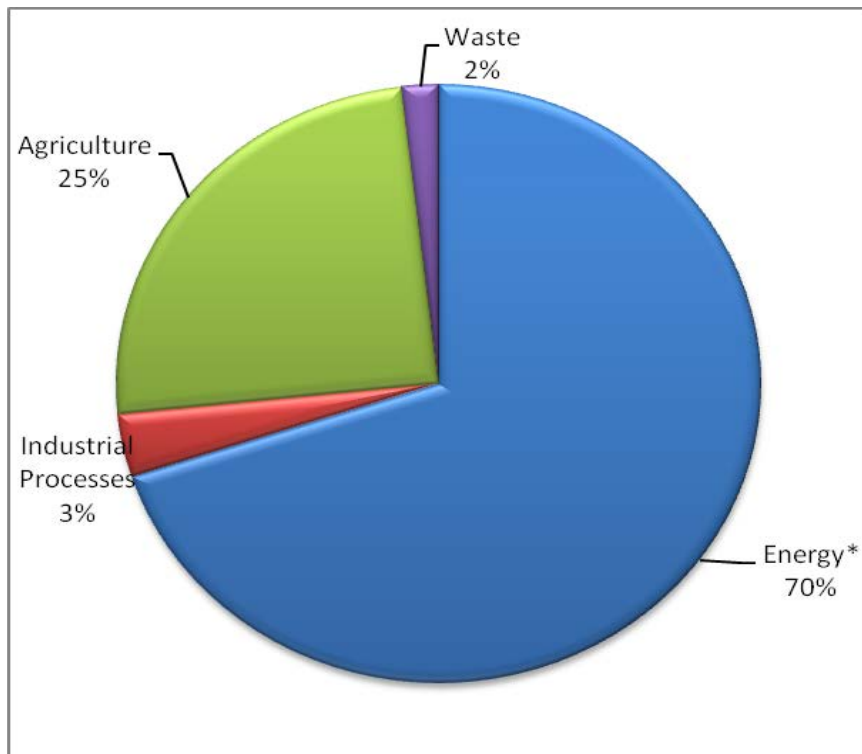
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Uniquely Iowa (2010)

- 30th most populous state with just over 3 million people

- 30.8 million acres of farmland (86% of total land area) producing:
  - 2.2 billion bushels of corn and 496 million bushels of soybeans
  - 3.9 million cattle and 19 million pigs

- 41 ethanol plants produced 3.7 billion gallons of ethanol

- Leader in energy generation from wind
  - 4322 MW currently online (2nd in US)
- 85% of energy from electric utilities is generated from coal

- Per capita GHG emissions (44.82 metric tons CO_2e) are nearly double US per capita emissions (22.10 metric tons CO_2e)
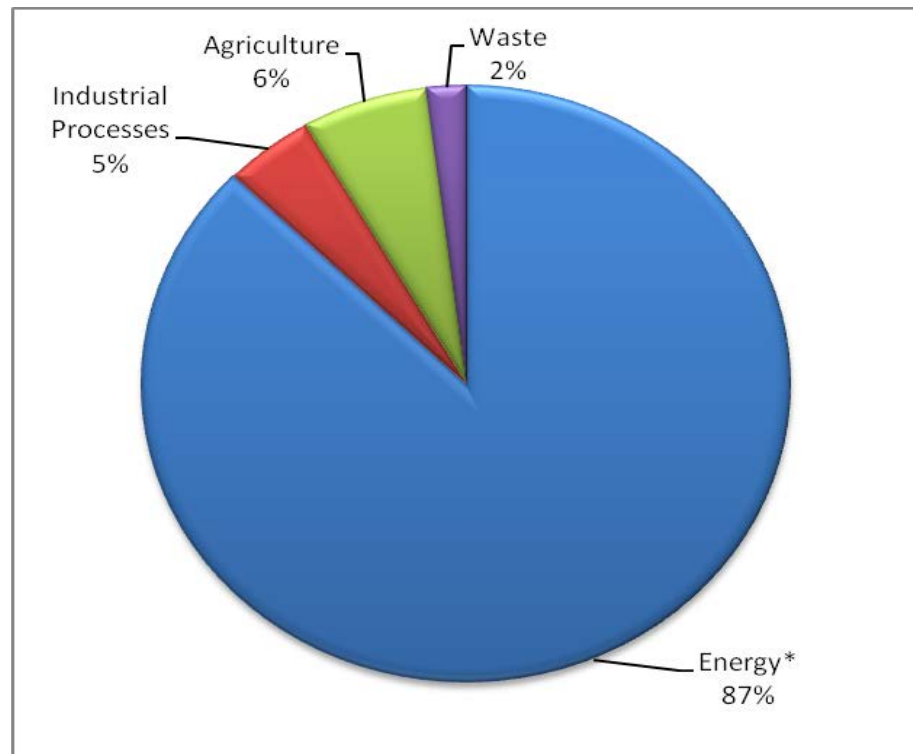
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Iowa vs. US GHG Emissions

2010 Iowa

- Waste 2%
- Agriculture 25%
- Industrial Processes 3%
- Energy* 70%

2010 US

- Agriculture 6%
- Industrial Processes 5%
- Waste 2%
- Energy* 87%

*The energy sector includes fossil fuel combustion, natural gas transmission and distribution, and transportation emissions.

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Inventory Overview

- Legislatively-required annual emissions inventory and forecast
  - conducted for **previous year's** emissions

- Inventory report is policy neutral

- 2010 inventory is a "top-down" inventory for 2005 – 2010
  - builds on 2005 inventory conducted by the Center for Climate Strategies for the Iowa Climate Change Advisory Council
  - Uses EPA State Inventory Tool (SIT)

- DNR previously conducted "bottom-up inventories for 2007 – 2009 using data collected in Iowa mandatory reporting program
  - Iowa no longer requires mandatory reporting – defer to federal program

Challenges

- Turnaround time
- Lack of current activity data

- Limitations of SIT software
- Forecasting
  - 2010 emissions calculated were higher than the 2010 emissions estimated using the SIT Projection Tool

- Agricultural soil carbon sequestration
  - High uncertainty

- In order to track emissions trends, some SIT sectors were combined to match sectors used by Center for Climate Strategies inventories (such as transportation).

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Sectors Included in the Inventory

Inventory Sector	SIT Module Name
Agriculture	
Enteric Fermentation	Ag
Manure Management	Ag
Ag Soil Management	Ag
Burning of Ag Crop Waste	Ag
Fossil Fuel Combustion	
Electric Power Fuel Use	Stationary Combustion and CO2FFC
RCI Fuel Use	Stationary Combustion and CO2FFC
Industrial Processes	IP
Land Use, Land Use Change, and Forestry	Land Use, Land Use Change, and Forestry
Natural Gas Transmission & Distribution	Natural Gas and Oil
Transportation	Mobile Combustion and CO2FFC
Waste	
Municipal Solid Waste	Solid Waste
Wastewater	Wastewater

To allow for trends analysis, some modules (see transportation) were combined to match sectors used in previous inventories.

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Methods and Solutions

- Emissions were calculated using EPA's State Inventory Tool
  - Used default SIT activity data for 2005 – 2008
  - Used Iowa-specific activity data for 2009 – 2010 when possible
    - If not available, 2008 used as a surrogate for 2009 and 2010
    - Used EIA Annual Energy Outlook to forecast fossil fuel emissions for 2009 and 2010
  - In some cases, refined calculations using national GHG inventory (agricultural residue burning and transportation)
  - Used data from mandatory reporting for some industrial sectors
  - Sought help from EPA

- Carbon sequestration in agricultural soils was not included

- Report was peer-reviewed then placed on public notice prior to publication

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Improvement to Agriculture Sector

- Agricultural Residue Burning
  - Emissions are being over-estimated
  - SIT assumes 3% of Iowa corn, soybean, and wheat fields are burned annually
  - This is not a common practice in Iowa
  - DNR calculated emissions using the method from J.L. McCarty in the national GHG inventory and two published McCarty studies

    - Crop area burned is approximated using the remote sensing data from Moderate Resolution Imaging Spectroradiometer
    - McCarty study also used improved combustion efficiencies, emission factors, and fuel loads
    - EPA provided the Iowa-specific data used in the national inventory to DNR

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- For Iowa, the average percentage burned was 0.1%, not 3%

- McCarty found that EPA overestimated cropland burned area by a factor of two and methane emissions were overestimated by 78%

	(MMtCO2e)	
Year	McCarty	SIT
2003	0.003	0.147
2004	0.005	0.191
2005	0.008	0.192
2006	0.011	0.184
2007	0.011	0.189

- DNR assumed that the percent area burned for 2008 – 2010 was equal to the average percent burned from 2003 – 2007

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Industrial Emissions Improvement

- DNR was able to use actual facility-level data for cement production, lime manufacture, iron and steel production, ammonia and urea production, and nitric acid production:

    - 2005 – 2009 DNR used either SIT or World Resources Institute (WRI) Protocol
        - DNR required use of WRI protocol in its mandatory program 2008 – 2009
        - If more detailed throughput data was available on the facility's Title V (major source) air emissions inventory, DNR used WRI

    - 2010 DNR used emissions calculated by facilities and reported to EPA under the federal GHG Reporting Program
        - EPA hadn't published the data yet, so DNR called each affected facility and asked them to provide their emissions
- Other sectors were calculated using 2009 consumption proportioned for 2010 population

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Other Improvements

- Transportation

    - State-specific 2010 energy consumption data was not available, so 2010 CO_2 emissions were projected using EIA's Annual Energy Outlook 2011

    - 2010 VMT was distributed among vehicle/fuel classes using 2009 national distribution in national GHG inventory

    - 2010 VMT for alternative vehicles was derived from the 2009 national VMT data in the national GHG inventory

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Other Improvements

- Waste

  - 2006 and 2011 Iowa Waste Characterization Studies were used for proportions of plastics, synthetic rubber, and synthetic fibers discarded.
  - Also used for percentage of yard trimmings and food scraps landfilled in LULUCF sector.

  - Facility-level quantities of municipal solid waste combusted, landfill gas collected and landfill gas flared were used.
  - These values are reported by the facilities to DNR on their annual Title V (major source)emissions inventories.
  - This data is more accurate than the data available from EPA's Landfill Methane Outreach Program.

Carbon Soil Sequestration

- Agricultural soil carbon sequestration

  - May have large impact on net Iowa emissions
    - Previously estimated at 11.4 MMtCO$_2$e sequestered
  - Not included in SIT
  - Disagreement among recent studies regarding no-till
  - High uncertainty

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Forecasting

- SIT modules designed to calculate emissions from 1990 – 2008
- SIT Projection Tool designed to project emissions from 2009 – 2030 using 1990 -2008 consumption or historical emissions

  - Iowa calculated 2010 emissions were higher than what was projected by SIT for 2020 based on 1990 - 2008
  - EPA helped us redo the energy projections using Annual Energy Outlook 2011, but unsure how to handle other sectors
  - Projections were briefly mentioned in finally report
    - Mentioned EIA energy emissions projections
    - Used US Climate Action Report 2010 projections
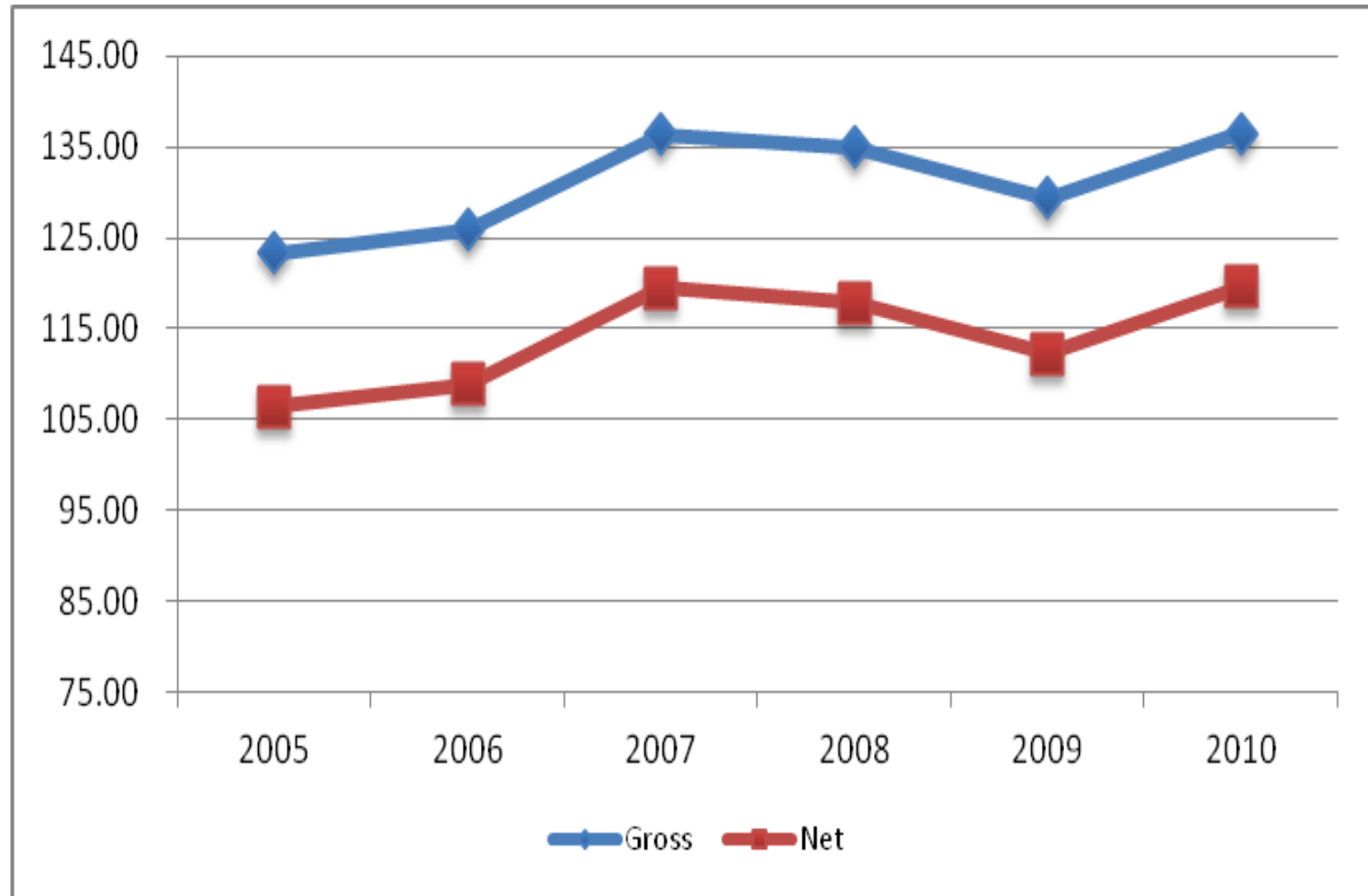   - Did not use our own projections
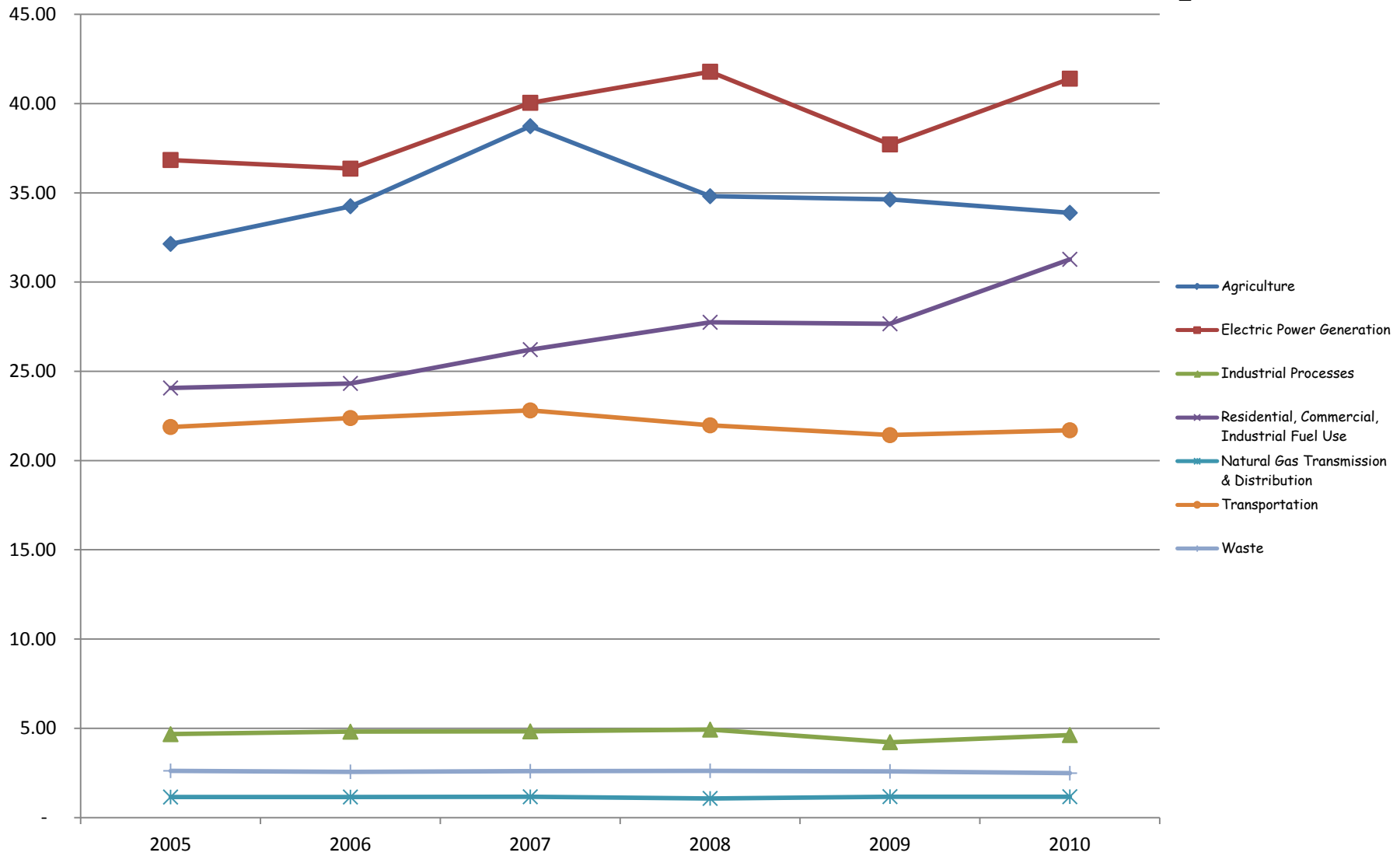
Iowa GHG Emissions 2005 – 2010, By Sector

Emissions (MMtCO2e)	2005	2006	2007	2008	2009	2010
Agriculture	32.14	34.25	38.73	34.81	34.63	33.88
Fossil Fuel Combustion (Electric Power & RCI)	60.90	60.68	66.26	69.53	65.38	72.67
Industrial Processes	4.67	4.81	4.83	4.93	4.22	4.62
LULUCF	(16.97)	(16.93)	(16.96)	(17.09)	(17.15)	(16.96)
Natural Gas Transmission & Distribution	1.15	1.15	1.16	1.07	1.17	1.17
Transportation	21.88	22.38	22.81	21.97	21.42	21.70
Waste	2.62	2.56	2.60	2.62	2.59	2.49
Gross Emissions	123.37	125.83	136.39	134.94	129.41	136.52
Sinks	(16.97)	(16.93)	(16.96)	(17.09)	(17.15)	(16.96)
Net Emissions	106.40	108.90	119.43	117.84	112.26	119.56
% Change in Gross from Previous Year		2.00%	8.40%	(1.07) %	(4.10) %	**5.50%**
% Change in Gross from 2005		2.00%	10.56%	9.38%	4.90%	**10.67%**

Note: Transportation and natural gas transmission & distribution emissions are reported separately from fossil fuel combustion (electric power & RCI).

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Total Iowa GHG Emissions 2005 – 2010 (MMtCO$_2$e)

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Iowa Gross GHG Emissions by Sector 2005 - 2010 (MMtCO$_2$e)

Legend:
- Agriculture
- Electric Power Generation
- Industrial Processes
- Residential, Commercial, Industrial Fuel Use
- Natural Gas Transmission & Distribution
- Transportation
- Waste

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2010 Iowa Gross GHG Emissions by Sector (MMtCO$_2$e)

Waste
2.49 MMtCO$_2$e
2%

Transportation
21.70 MMtCO$_2$e
16%

Agriculture
33.88 MMtCO$_2$e
25%

Natural Gas
Transmission &
Distribution
1.17 MMtCO$_2$e
1%

Residential,
Commercial,
Industrial Fuel Use
31.27 MMtCO$_2$e
23%

Industrial
Processes
4.62 MMtCO$_2$e
3%

Electric Power
Generation
41.40 MMtCO$_2$e
30%

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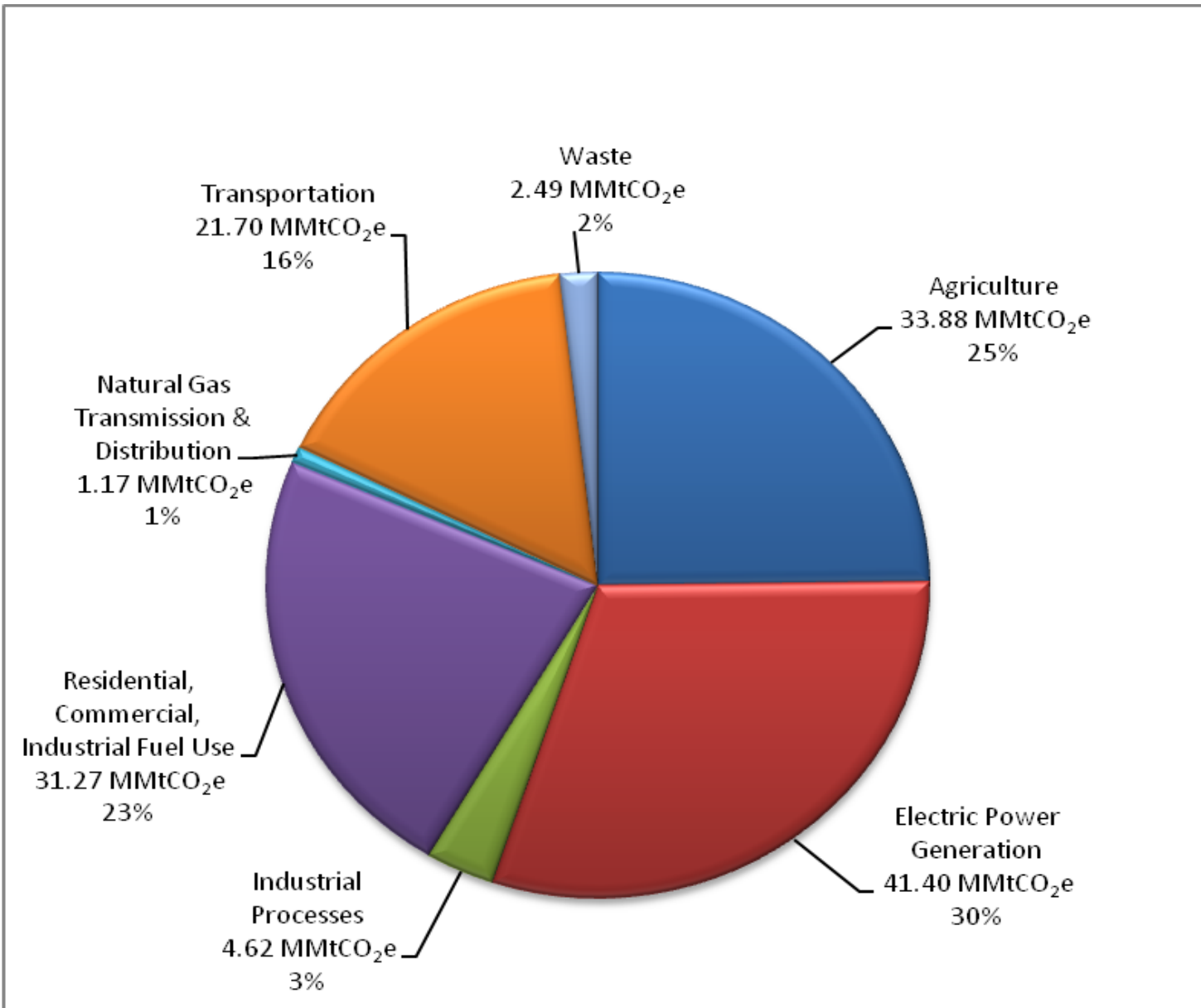
Lessons Learned

- Timing can be difficult.

- Use local information in conjunction with SIT and make adjustments to meet your needs.

- Update SIT with as much current, state-specific activity data as possible
  - Verify SIT calculation formulas
  - Work with EPA staff to trouble-shoot SIT for your needs
    - SIT is password protected
  - If you are using alternate calculation methods you may need to do your final calculations outside of the SIT Synthesis Tool
  - Use the national GHG inventory a guide to find sources of activity data
  - Use data from previous years as proxies/surrogates
  - Forecast emissions using other published reports

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Lessons Learned

- Be a detective.

- Peer review and public comment are beneficial.

- Document, document, document.

- Estimate what you can, explain what you can't.

- Know your audience.
    - Final report with references is 80 pages.

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Moving Forward

- Goal: use as much current activity data as possible with few surrogates

- How can we further incorporate data from federal GHG reporting program?

- Further research soil carbon sequestration

- Improve forecasting

- Different reports for different audiences?

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View the full 2010 GHG and previous
inventories at:
www.iowacleanair.com
Click on "Greenhouse Gas Emissions"

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