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Air-Energy Integration Assessment

Presented by

Shaw Environmental & Infrastructure, Inc.

September 29, 2009

Agenda

- Introduction to Shaw
- Project Background & Goals
- Study Approach
- Modeling Process
  - Data collection
  - Power-flow Model
  - Emissions Calculation
  - Tool Development
- General Findings
- Conclusion

Corporate Profile

The Shaw Group is a global, vertically integrated provider of comprehensive engineering, design, construction, environmental, and maintenance services to government and private-sector clients in a wide array of industries.

Name:	The Shaw Group, Inc.
Headquarters:	Baton Rouge, Louisiana
Public corporation:	NYSE Symbol: SHAW
Number of employees:	27,000
FY08 Revenue:	$7.1 Billion
Current backlog:	$15.9 Billion

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Shaw – A Market Leader

Rank	Category
1	Power
1	Fossil*
1	Nuclear Plants*
4	Petroleum*
4	Refineries & Petrochemical Plants*
5	Clean Air Compliance*
5	Chemical & Soil Remediation*
7	Site Assessment/ Compliance*
10	Industrial Process/Petro
10	Hazardous Waste
11	International Markets
13	Chemical Plants*

April 2009 Issue *June 2008 Sourcebook Issue

Rank	Category
3	Hazardous Waste
4	Power
7	Fossil Fuel*
2	Nuclear*
4	O&M*
6	Transmission & Distribution*
9	Industrial Process*
3	Chemical Plants*
10	Contractors by New Contracts
11	Domestic Heavy Contracts
16	Industrial Process/Petro.
19	Contractors Working Abroad

May 2008 Issue *Sept 2008 Sourcebook Issue

Rank	Category
2	Hazardous Waste
5	Construction/ Remediation
8	Type of Client: Federal
9	Consulting/Studies
9	Nuclear Waste
24	Contracts Awarded in 07

July 2008 Issue

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Worldwide Locations

138 U.S. Locations

33 International Locations

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Background on Air-Energy Integration Assessment

- In 2005 Shaw participated in a project to analyze the emissions impact of a renewable portfolio standard (RPS) and energy-efficiency portfolio standard (EEPS) proposed for the State of Illinois.

- Project conducted in collaboration with:
  - Illinois Department of Commerce and Economic Opportunity (DCEO)
  - Illinois Environmental Protection Agency (EPA)
  - U.S. EPA Region 5
  - U.S. Department Of Energy (DOE)

- Project result: “Emissions Impact Assessment of the Sustainable Energy Plan for Illinois” – 2007

Project Goals

- Identify the electric power generation and air emissions changes that would be anticipated due to adoption of EERE initiatives
- Build upon the “Emissions Impact Assessment of the Sustainable Energy Plan for Illinois” – 2007
- Further policymakers’ understanding of how state energy policies help improve air quality both in-state and regionally
- Produce a tool and methodology that can be used by other states

EERE Plans Included in the Study

1. **Illinois RPS and EEPS**
   - Illinois Power Agency Act
   - RPS: 25% Renewables by 2025
   - EEPS: 2% by 2015

2. **Illinois Climate Action Plan**
   - Mandated carve out for solar photovoltaic technologies

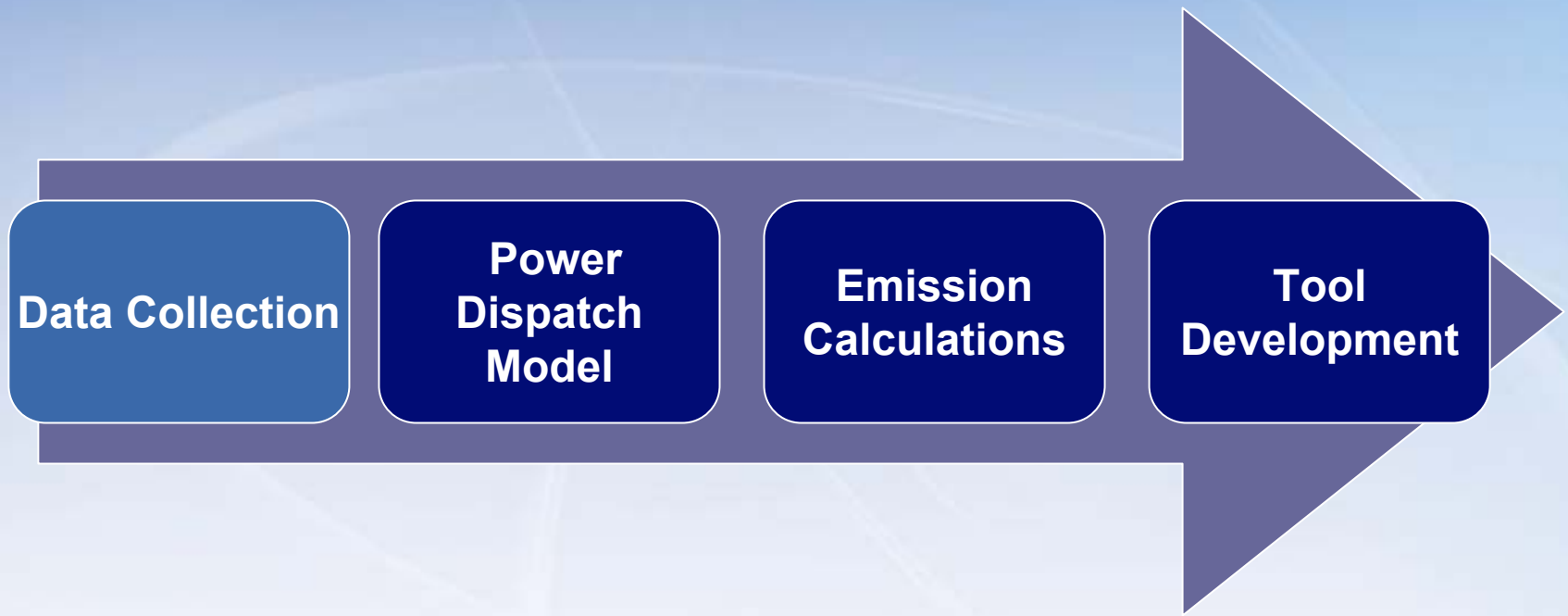
3. **Michigan's "21st Century Electric Energy Plan"**
   - RPS: 10% Renewables by 2015
   - EEPS: 0.75% by 2011

Study Approach

- Study conducted by Shaw
  - Supported by PowerWorld Corporation
- Period of Study: 2010 – 2025
- Eight Scenarios

	EEPS	RPS	Solar Baseline	Solar Aggressive
Condition 1: Illinois RPS and EPS				
Scenario 1	•			
Scenario 2	•	•		
Condition 2: Illinois Climate Action Plan				
Scenario 3	•		•	
Scenario 4	•	•	•	
Scenario 5	•			•
Scenario 6	•	•		•
Condition 3: Illinois Climate Action Plan & Michigan's 21st Century Plan				
Scenario 7	•			•
Scenario 8	•	•		•

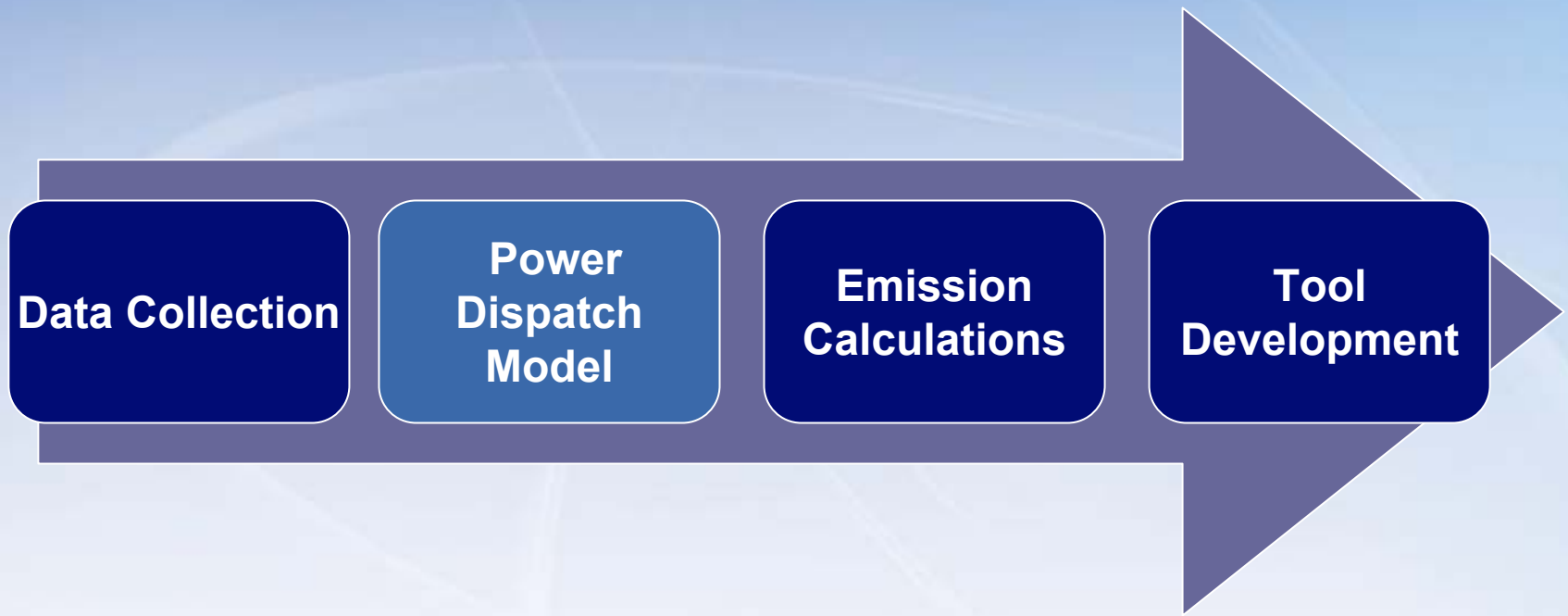
Modeling Process



Data Collection

- Historic generation data by fuel type
- Historic emissions by existing plants
- Fuel cost data
- Fuel heat content data
- Emission Factors
- Annual targets for IL EPS and RPS
- Wind profiles and solar intensity maps
- Technology capacity factors
- Grid constraints for power flow

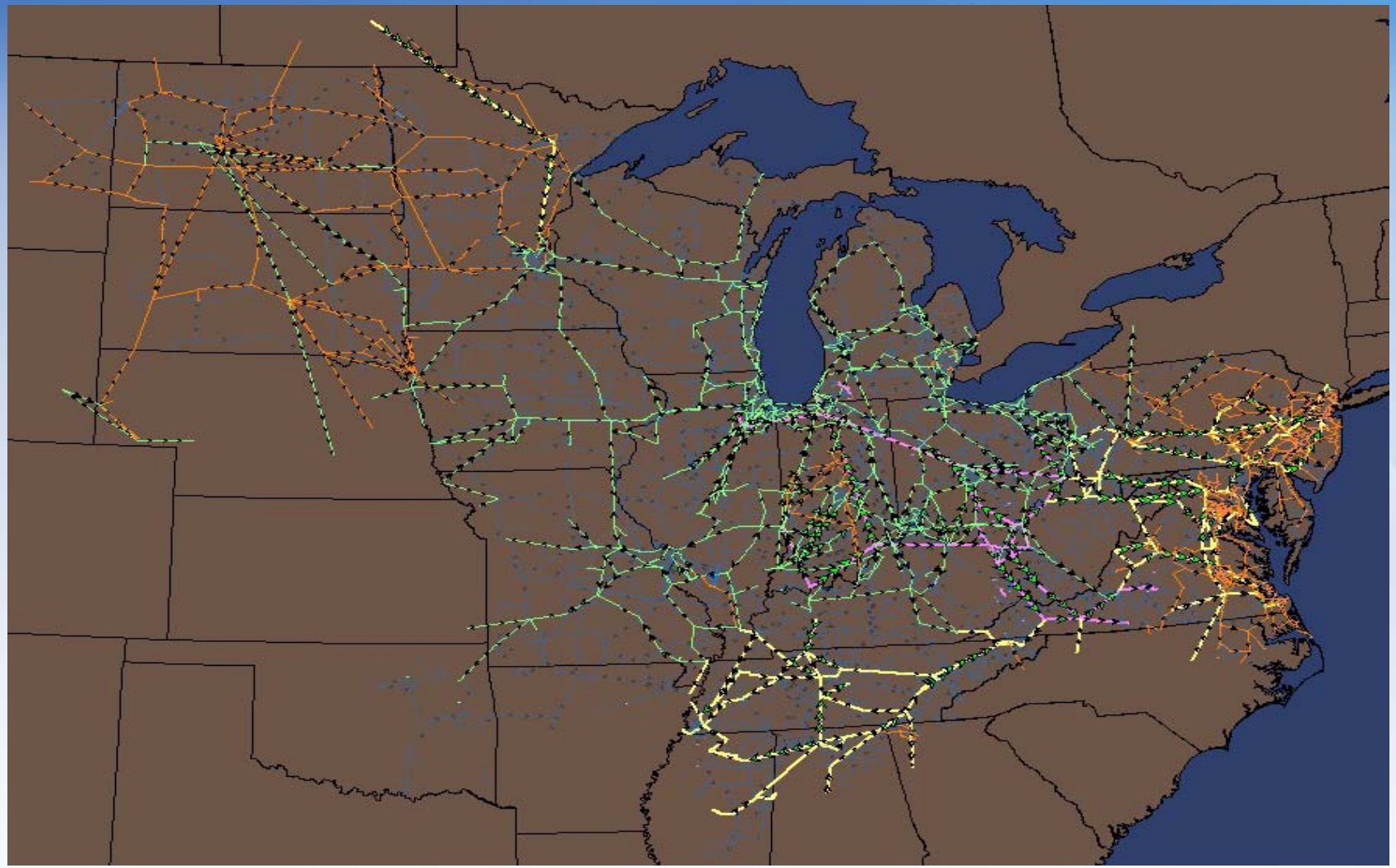
Modeling Process



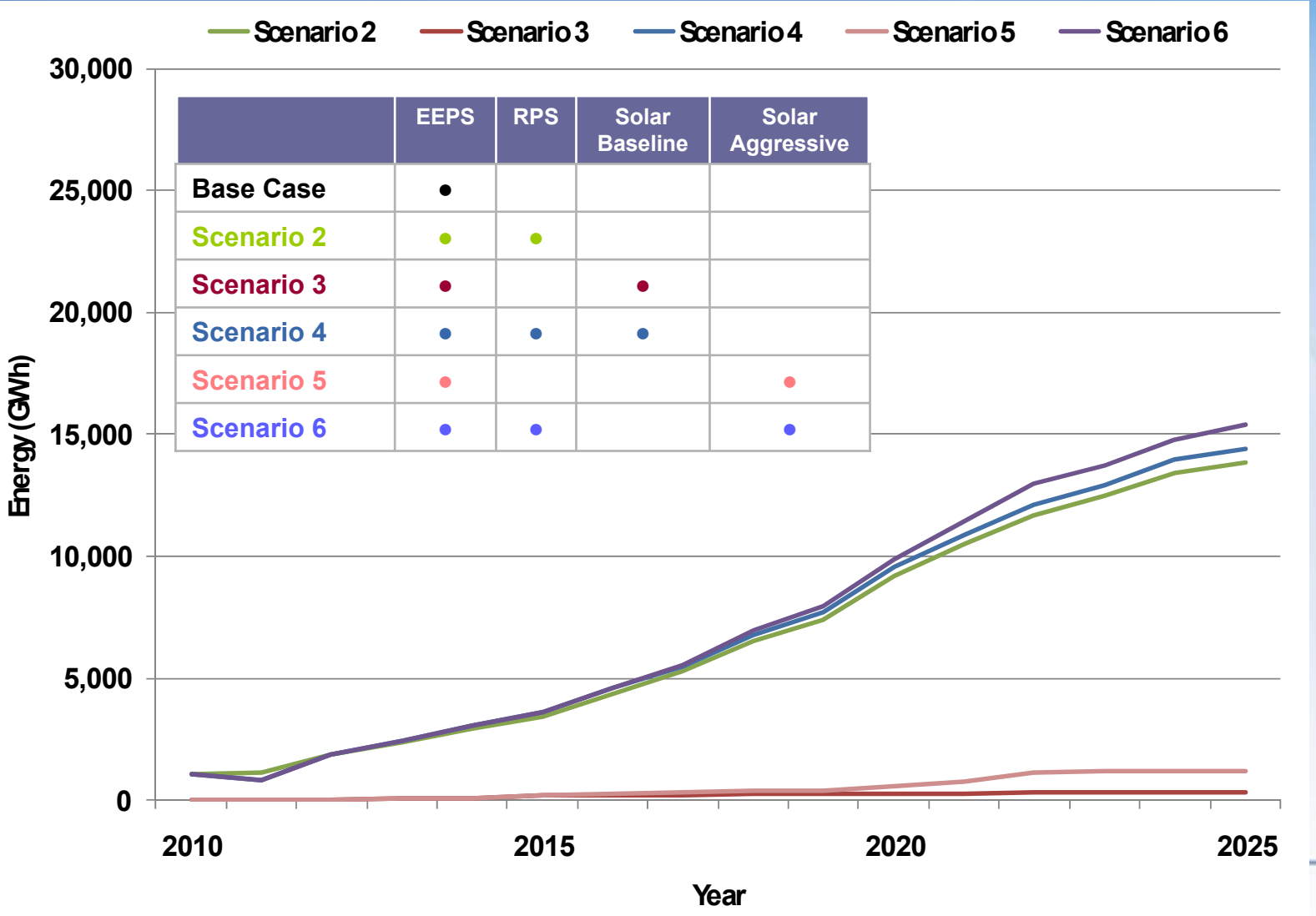
Power Dispatch Model

- Economic dispatch model of the physical and economic operation
- PJM, most of MISO, and TVA systems, and other planning areas that neighbor Illinois
- The power system model used a historical database to configure the interconnected electrical grid.
- Load was added into the model in the ensuing years to see how the load flows changed with the addition of the forecast loads.

Power Flow Modeling Study Area

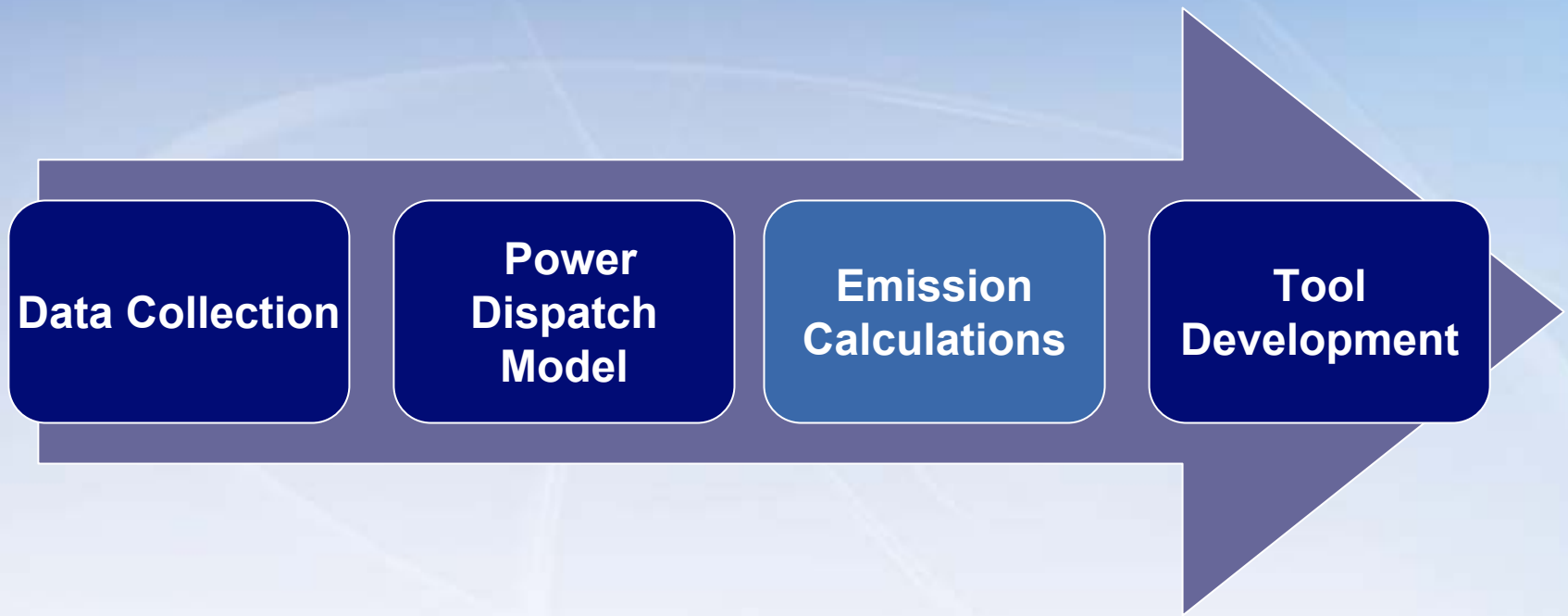


Decrease in Generation in Illinois Relative to Base Case



	EEPS	RPS	Solar Baseline	Solar Aggressive
Base Case	●			
Scenario 2	●	●		
Scenario 3	●		●	
Scenario 4	●	●	●	
Scenario 5	●			●
Scenario 6	●	●		●

Modeling Process



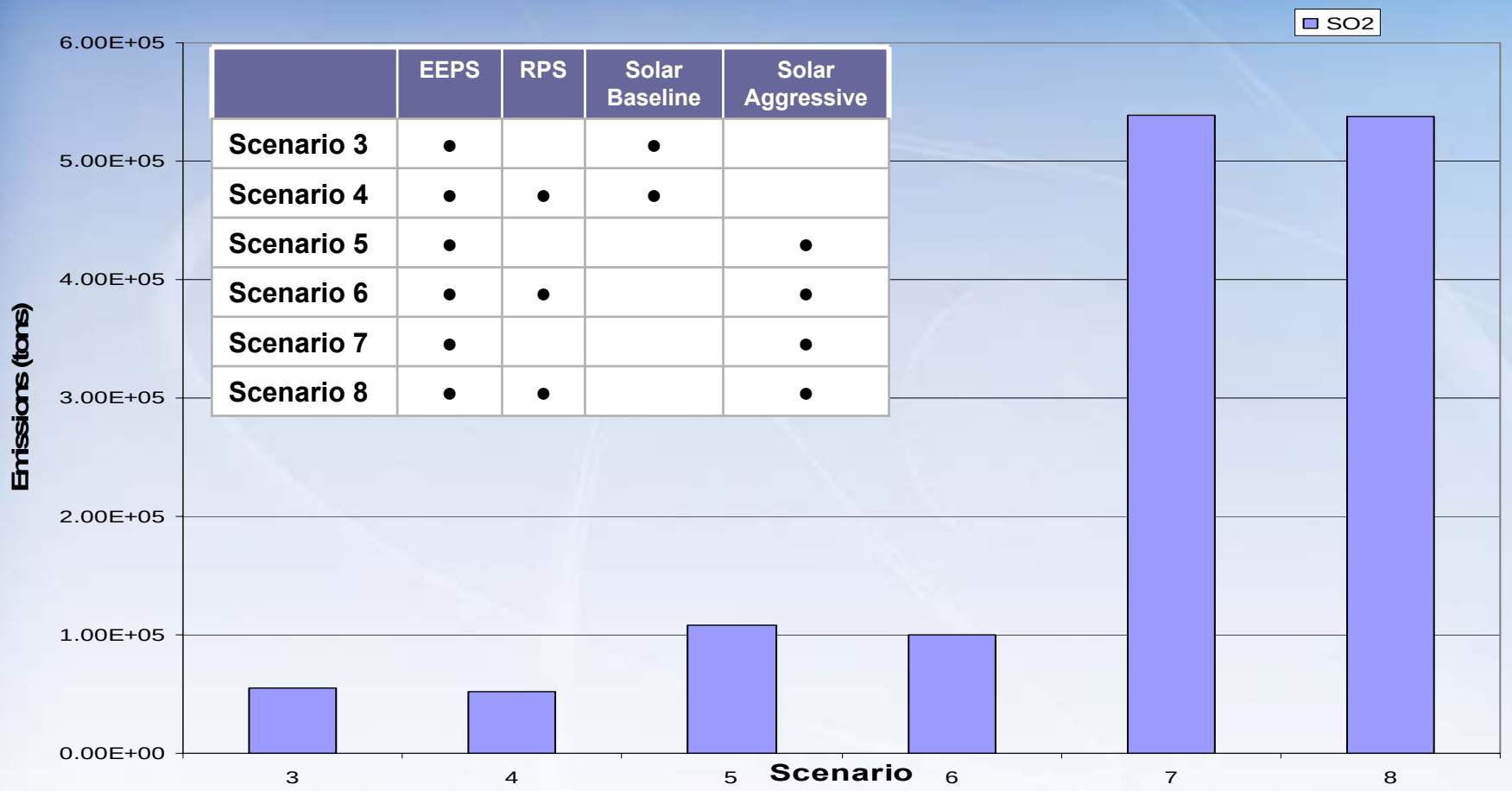
Emission Factors for Calculations

- Emissions of the pollutants were estimated using fuel heat rates and emission factors

Pollutant	Source
SO2, NOx	Emission unit specific emission factors from Acid Rain Database (ARD) from 2008
CO2	Emission unit specific emission factors from Acid Rain Database (ARD) from 2008
Hg	State specific factors Illinois Hg control plan Others states plans – New Jersey New York Delaware Wisconsin Michigan

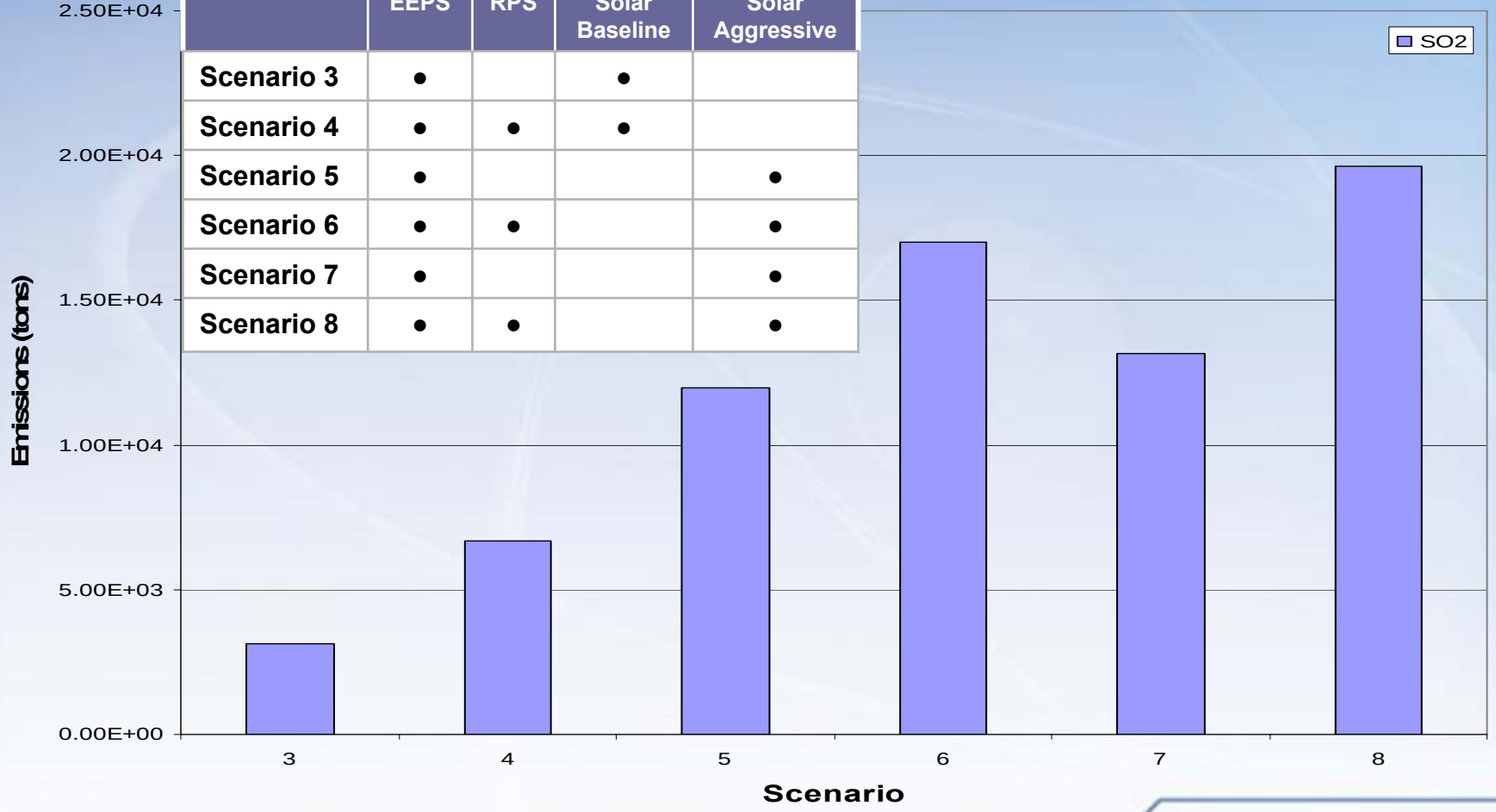
Total SO2 Emission Reduction in Study Area

	EEPS	RPS	Solar Baseline	Solar Aggressive
Scenario 3	•		•	
Scenario 4	•	•	•	
Scenario 5	•			•
Scenario 6	•	•		•
Scenario 7	•			•
Scenario 8	•	•		•

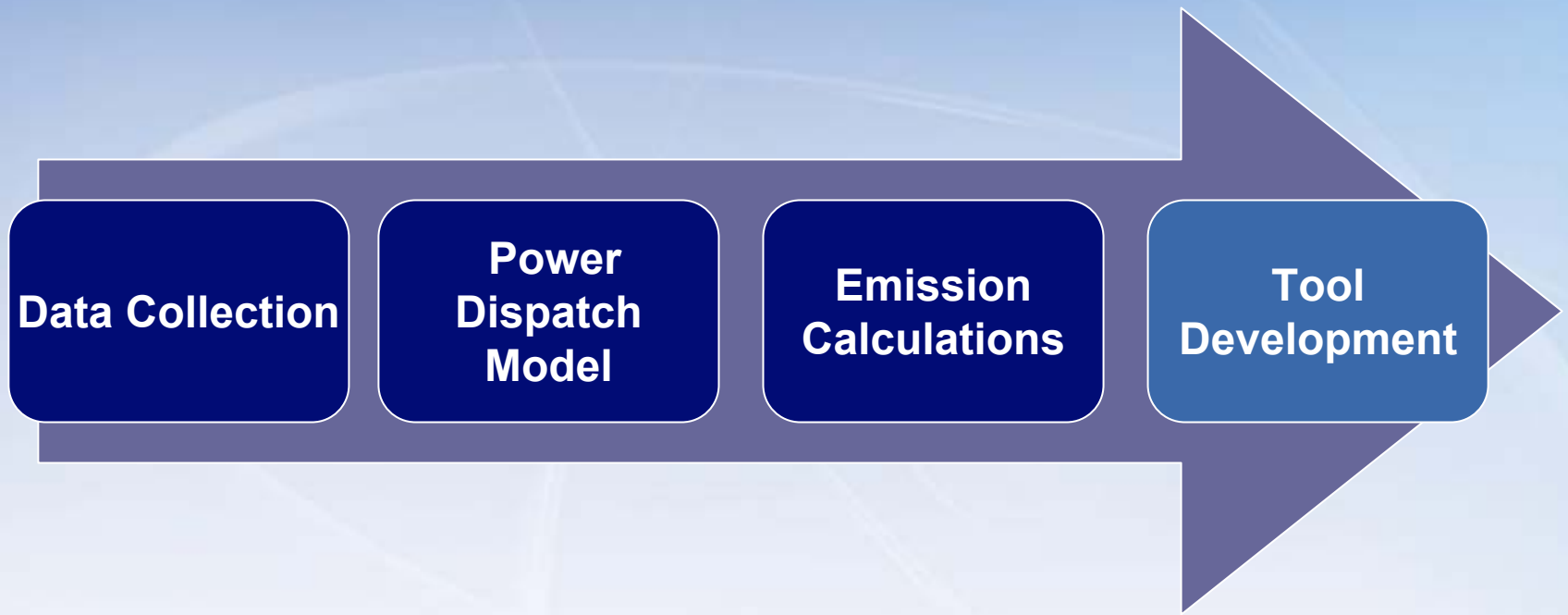


Total SO2 Emission Reduction in Illinois

	EEPS	RPS	Solar Baseline	Solar Aggressive
Scenario 3	•		•	
Scenario 4	•	•	•	
Scenario 5	•			•
Scenario 6	•	•		•
Scenario 7	•			•
Scenario 8	•	•		•



Modeling Process



Air Energy Integration Assessment Tool

- Designed to predict changes in emissions for SO2, NOx, CO2, and Hg due to displacement of emission units for EERE measures
- SQL server based system necessary due to large quantity of data involved; Microsoft Access based interface for
  - 30 million data for each scenario; 240 million for all scenarios
- Financial module allows estimation of cost for EERE measures and for renewable energy systems
- Several summary reports built in the tool

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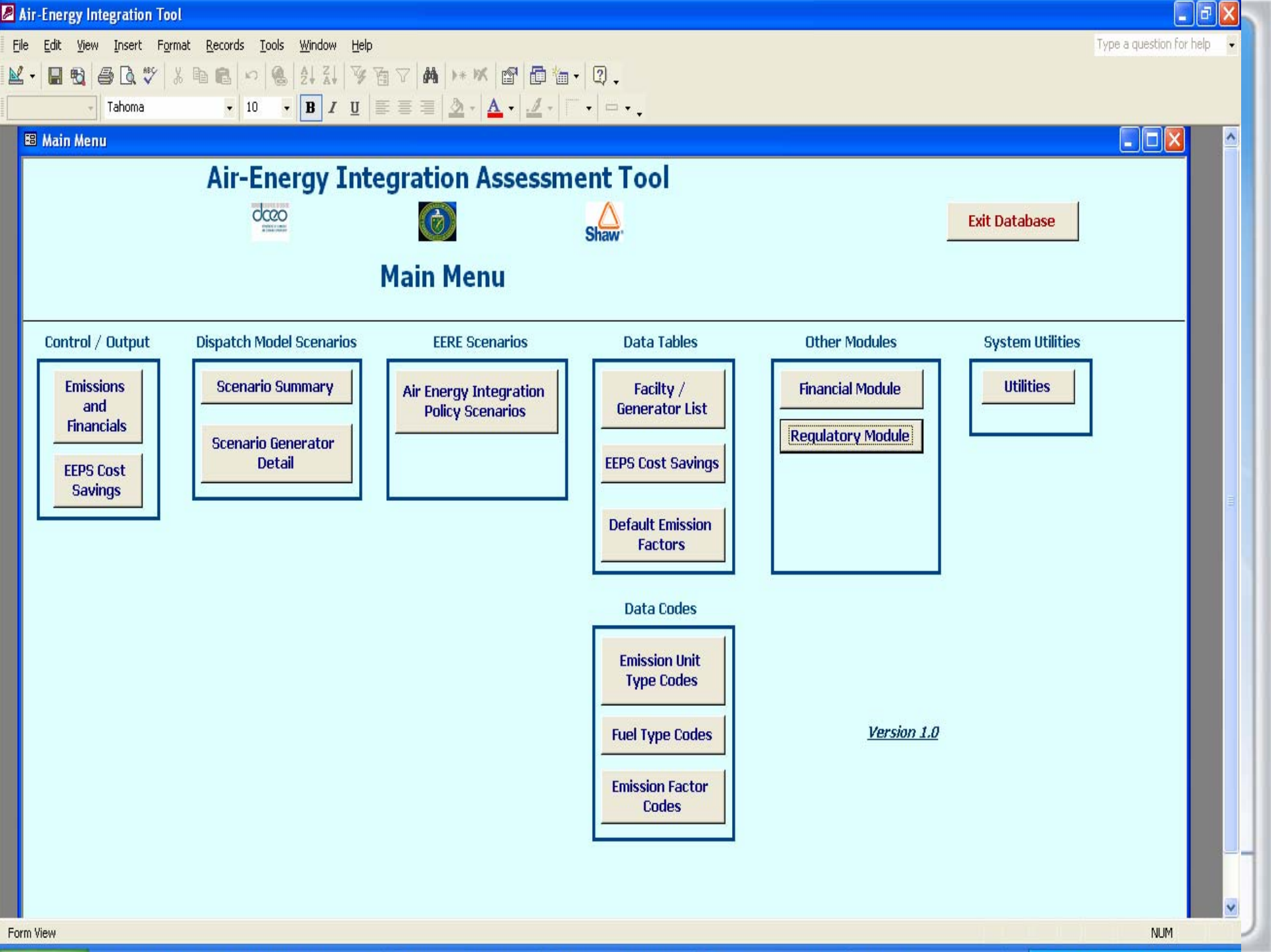
Air-Energy Integration Tool
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Type a question for help
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Main Menu
Air-Energy Integration Assessment Tool
Exit Database
Main Menu
Control / Output
Emissions and Financials
EEPS Cost Savings
Dispatch Model Scenarios
Scenario Summary
Scenario Generator Detail
EERE Scenarios
Air Energy Integration Policy Scenarios
Data Tables
Facilty / Generator List
EEPS Cost Savings
Default Emission Factors
Other Modules
Financial Module
Regulatory Module
System Utilities
Utilities
Data Codes
Emission Unit Type Codes
Fuel Type Codes
Emission Factor Codes
Version 1.0
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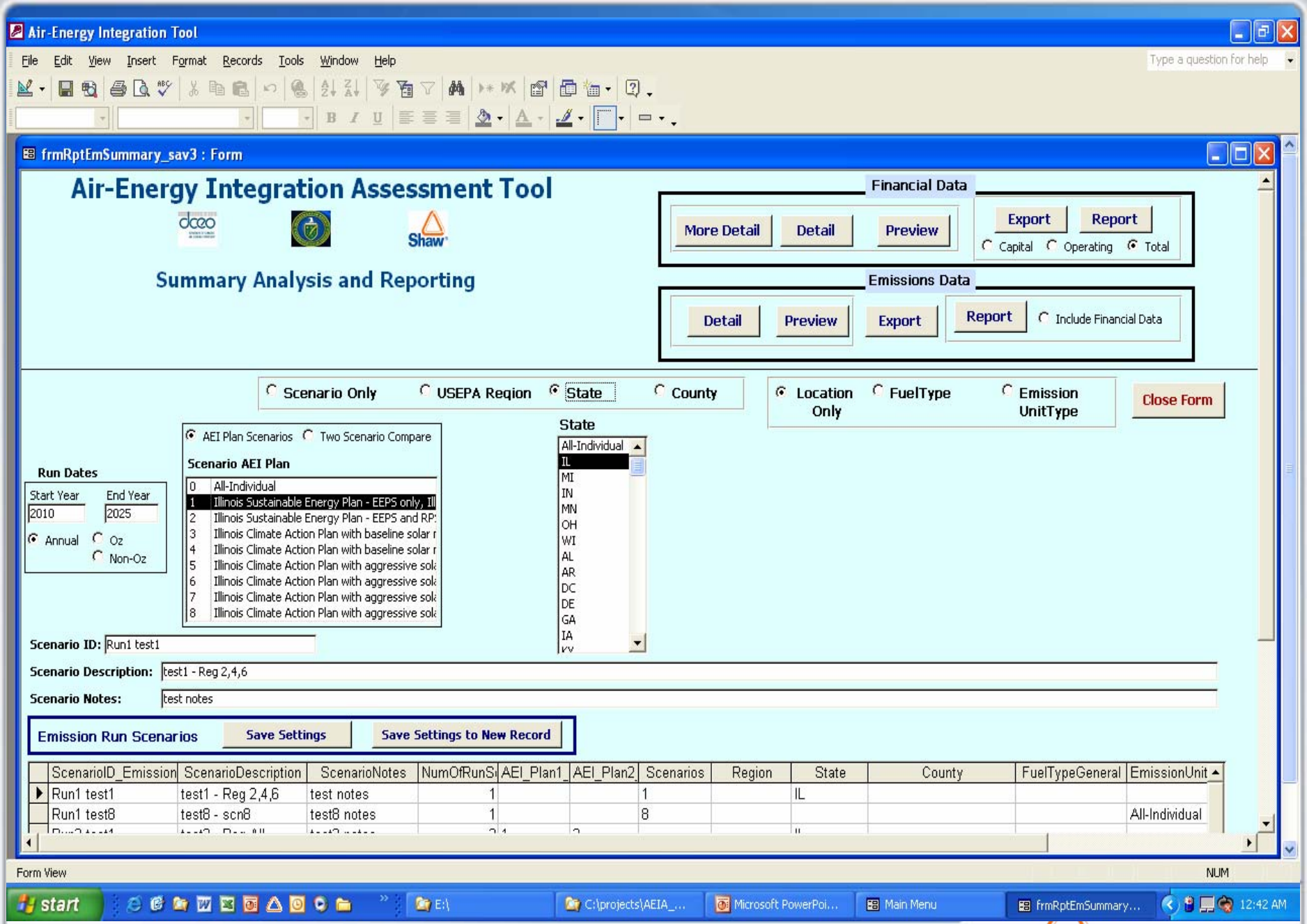

General Findings - Generation

- Both wind and solar generations displace 90%+ coal fired generation in study area and approx. 60% coal generation in Illinois

- Savings in coal-fired generation for each MWh of renewable generation

	Wind	Solar
Illinois	0.59 MWh	0.99 MWh
Study area	0.20 MWh	0.89 MWh

- Michigan's 21st Century Plan has little impact on Illinois generation pattern but has significant impact in study area

General Findings - Emissions

- Study shows significant emission reductions from baseline due to proposed EEPS
- SO2 shows largest emission reductions followed by NOx
  - Over 500,000 tons in study area between 2010-2025
  - Over 25,000 tons in Illinois between 2010-2025
- Over 12 million tons of CO2 reductions predicted in Illinois alone
- Significant (~80 lbs) reductions of Hg predicted as a co-benefit in Illinois alone

Summary

- Air Energy Integration Assessment tool provides rapid assessment of-co benefits of emission reductions due to RPS, EPS and Climate Change Plans
- The tool allows comparison of cost for emission reduction with conventional pollution control
- Greater flexibility in automatic data input from available sources (EIA, State databases, EPA) proposed in next phase
- Functionally portable for other states and regions

Acknowledgments

- Illinois DCEO
- Michigan Energy Office
- U.S. DOE
- PowerWorld Corporation

Questions?

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