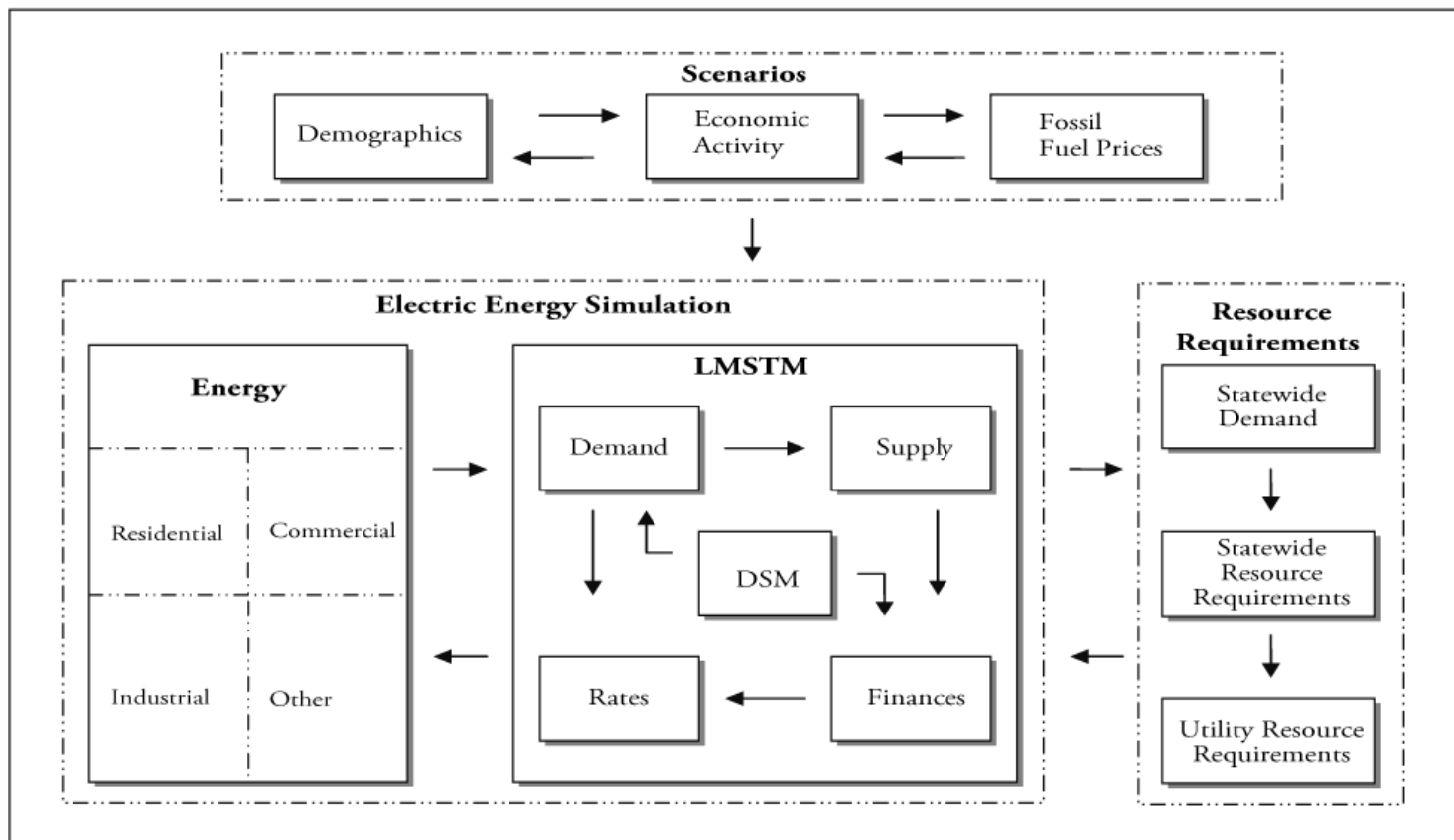# SUFG Forecasting Model

Presented by:
State Utility Forecasting Group
Energy Center
Discovery Park
Purdue University

Presented to:
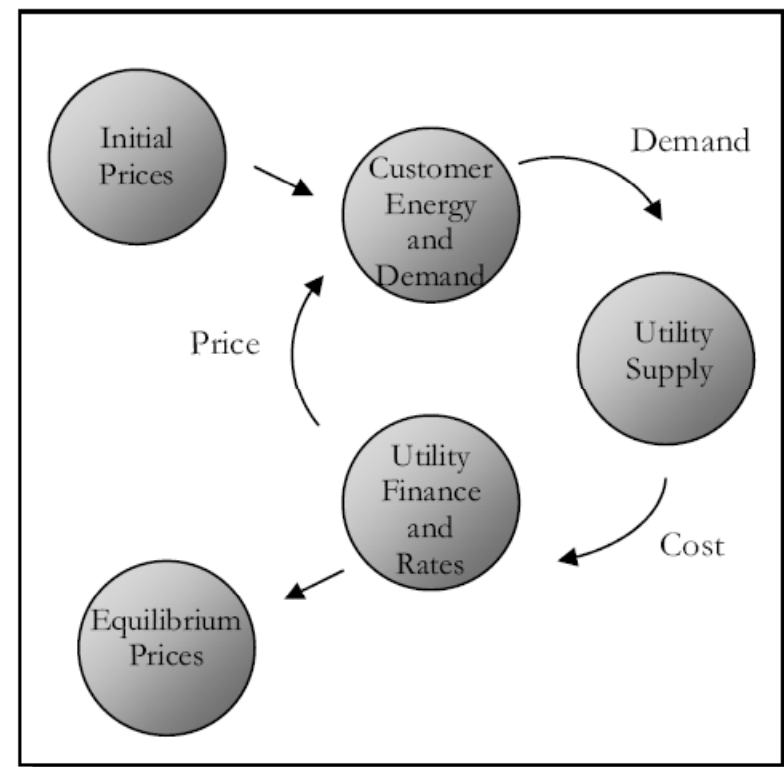Integrated Modeling Workshop
Indianapolis, IN

November 17, 2011

SUFG's Modeling System

Cost-Price-Demand Feedback Loop

- Prices effect customer demand

- Demand effects utility supply costs

- Costs effect prices

- System is solved iteratively by going through the loop until the results are stable (no change in price from one iteration to the next)
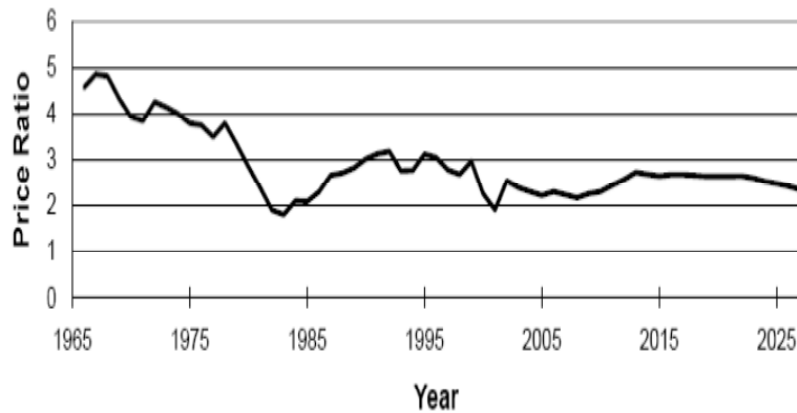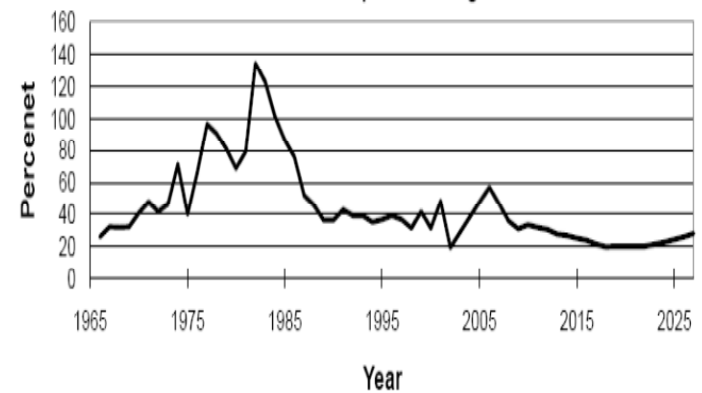

3

Residential Sector Models

- Econometric Model

  – demographics

  – households

  – household income

  – energy prices

- End-Use Model

  – 3 dwelling types

  – 3 fuel choices

  – 10 end uses

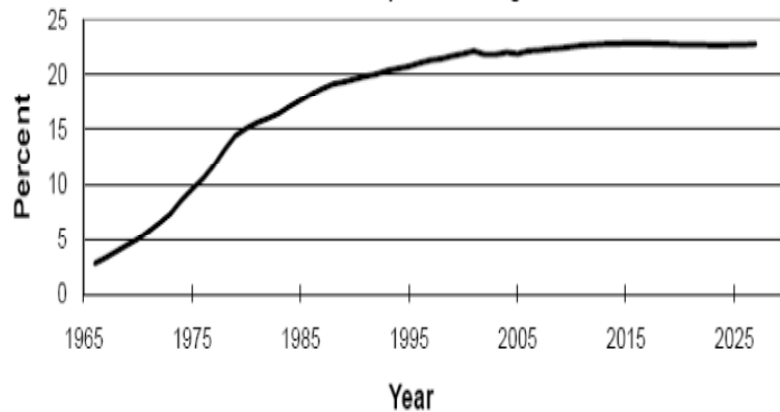# Residential Econometric Model

Panel A. Electric/Gas Price Ratio

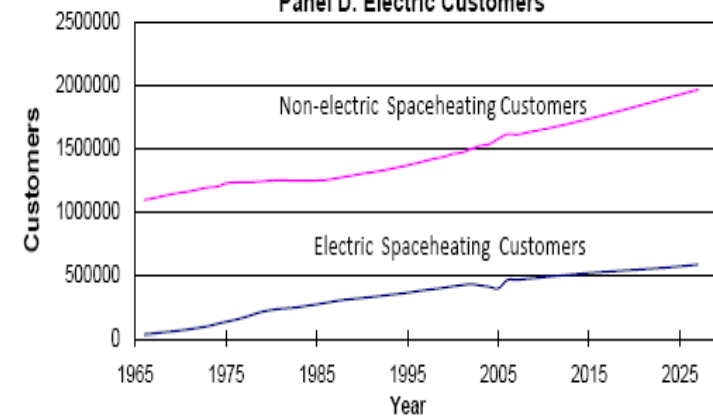Panel B. Electric Space Heating Penetration

Panel C. Electric Space Heating Saturation

Panel D. Electric Customers

Residential Econometric Model

- **Residential sector split according to space heating source**
  - electric
  - non-electric

Panel E. Annual Use per Electric Space Heating Customer

Panel F. Annual Use per Non-electric Space Heating Customer
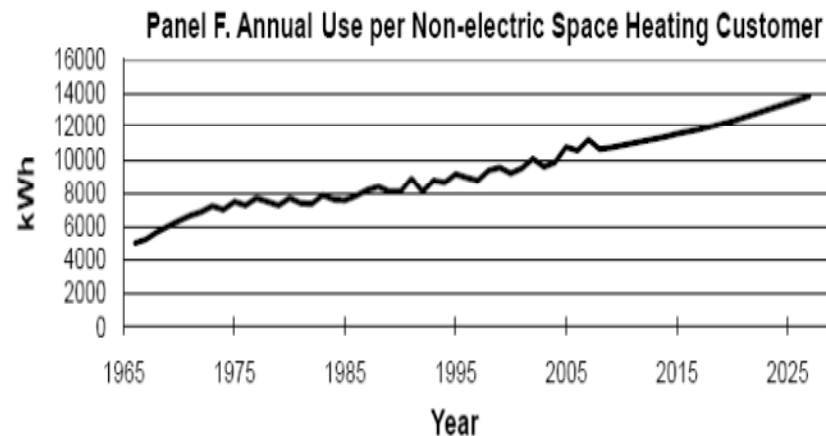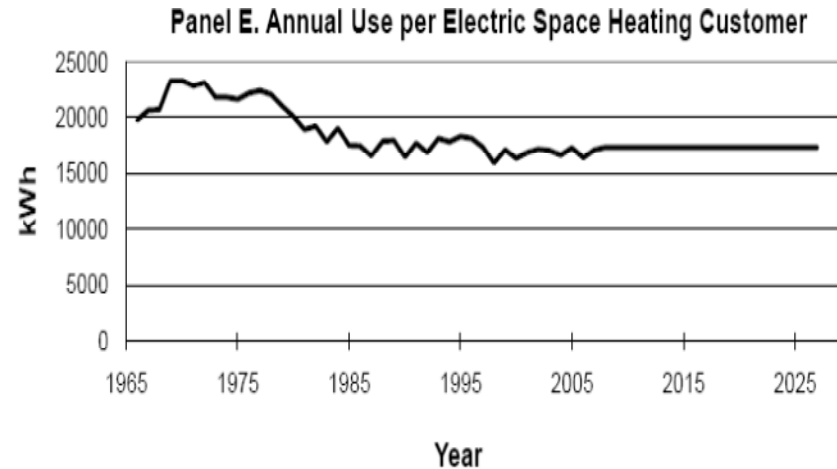
Housing Formation Model
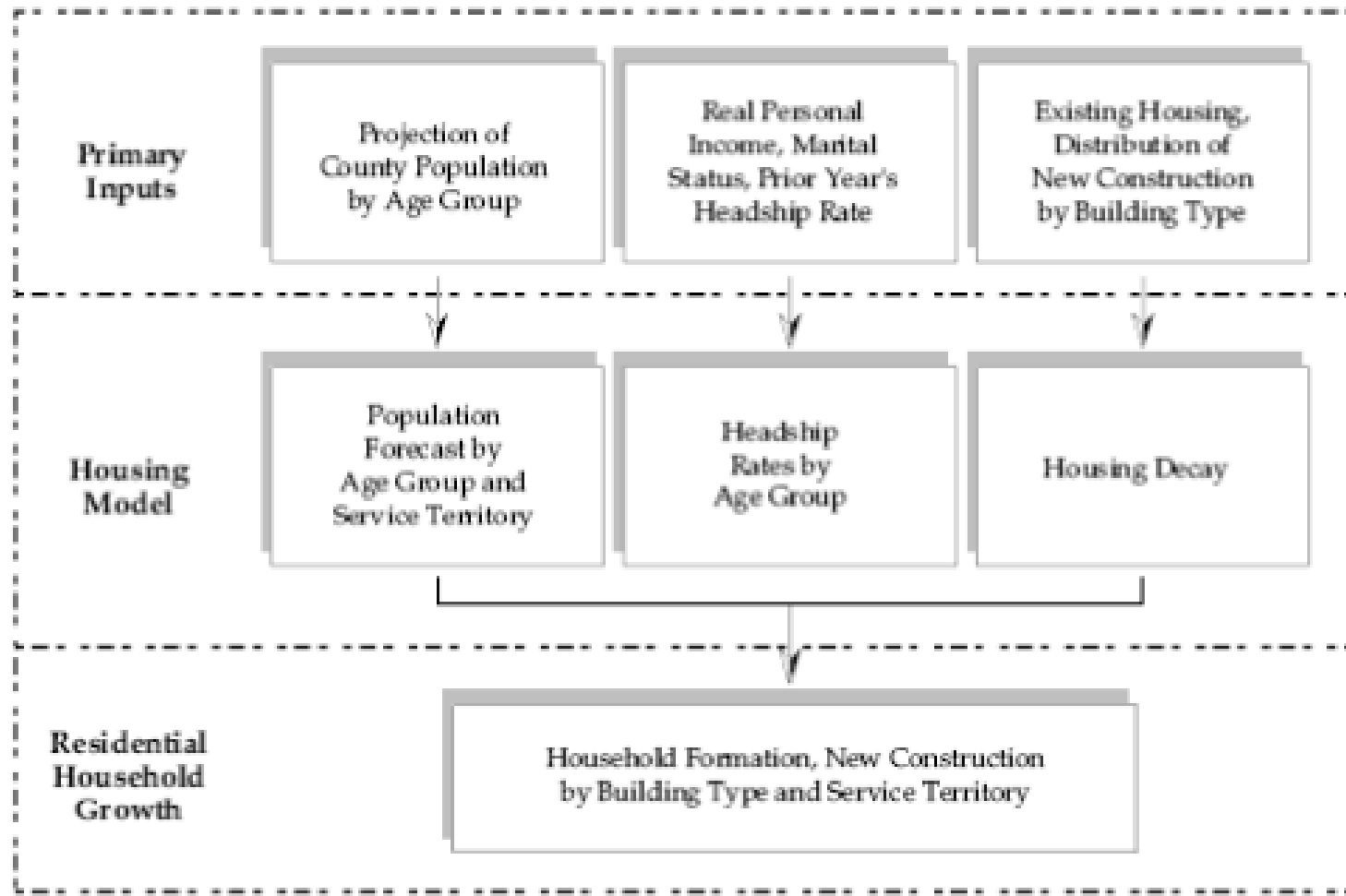
Residential End-Use Model

- Residential Energy Demand Model System (REDMS)
- Proprietary model from Jerry Jackson & Associates

End-Use Models

- For each end use/building type combination there is an initial stock of equipment

- Initial stock is separated by age (vintage) and efficiency

- Additional stock for next year is determined by economic drivers

- Some existing stock will be replaced due to failure or early replacement

- Older vintages are more likely to be replaced

Major End-Use Model Drivers

- Population
- Real Personal Income
- Energy Prices

Structure of Residential End-Use Energy Modeling System
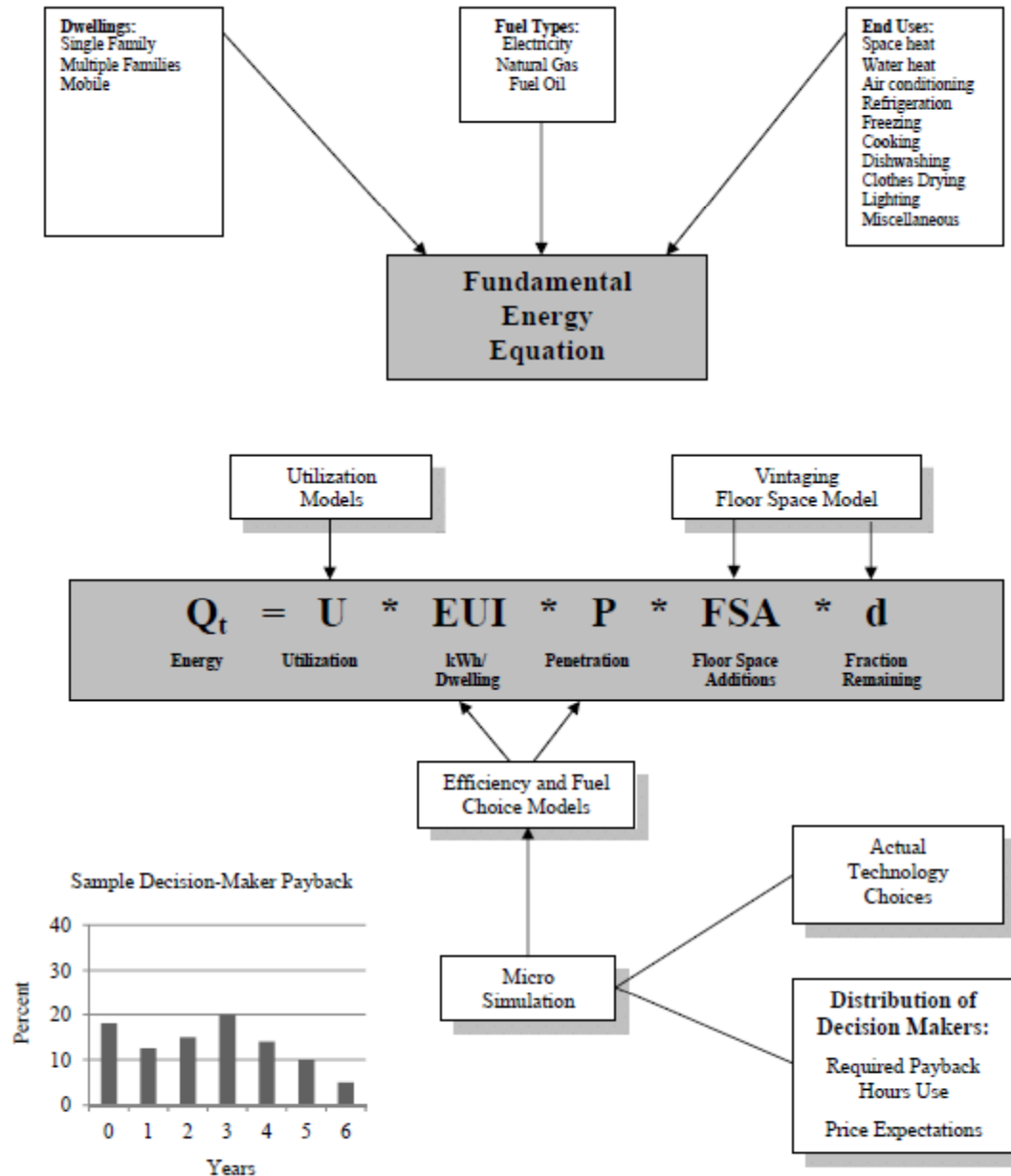
SUFG Commercial Sector Model

- End use oriented model

- 21 building types modeled

- 4 fuels

- 19 end uses per building type

Major Commercial Drivers

- Floor space inventory
- End use intensity
- Employment growth
- Population (schools and colleges)
- Energy prices

Structure of Commercial End-Use Energy Modeling System

14
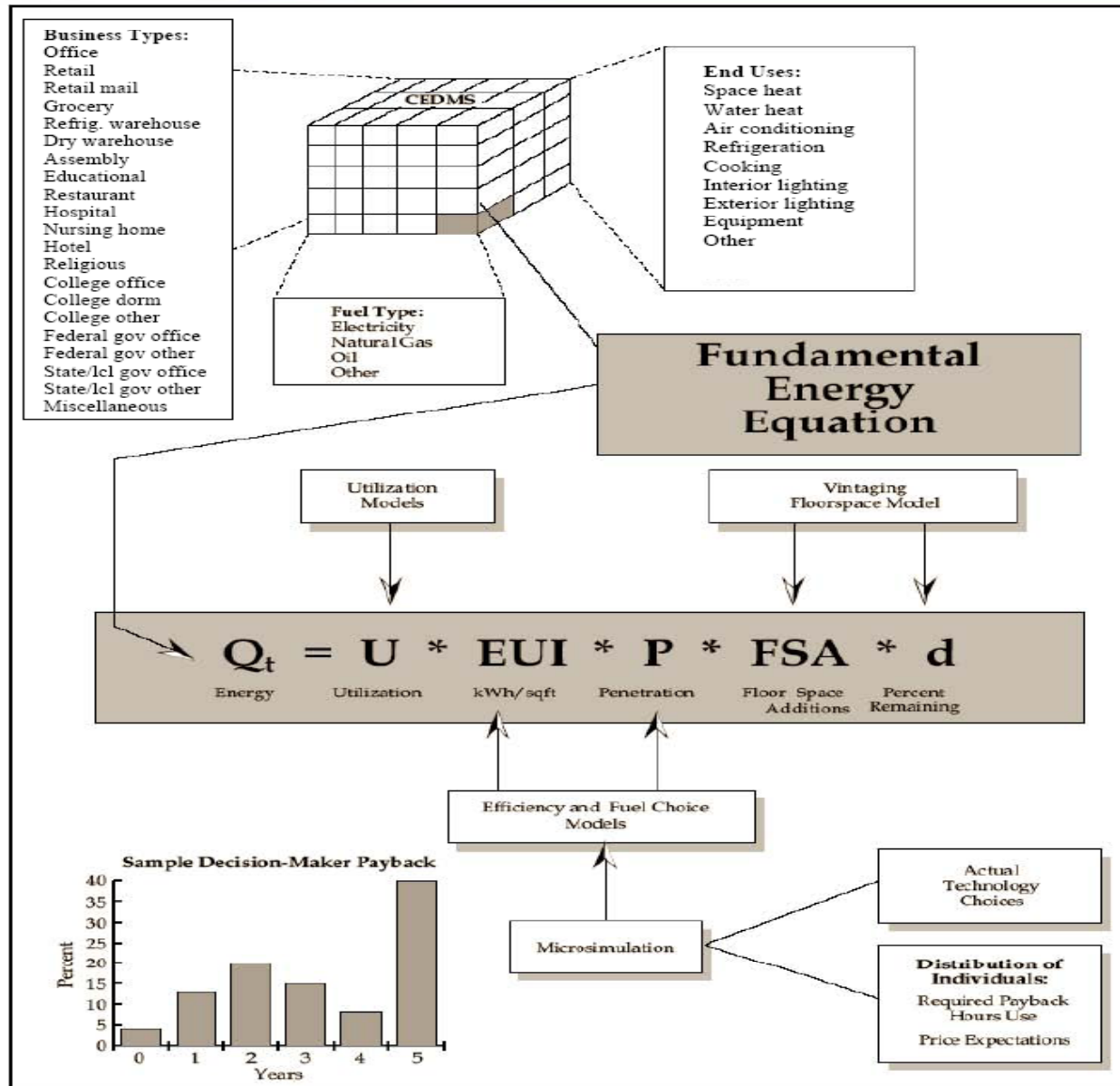
SUFG Industrial Sector Model

- Major forecast drivers
  - – industrial activity
  - – energy prices
- 15 industries modeled
  - – classified by Standard Industrial Classification (SIC) system
  - – some industries are very energy intensive while others are not

Structure of Industrial Econometric Energy Modeling System

16

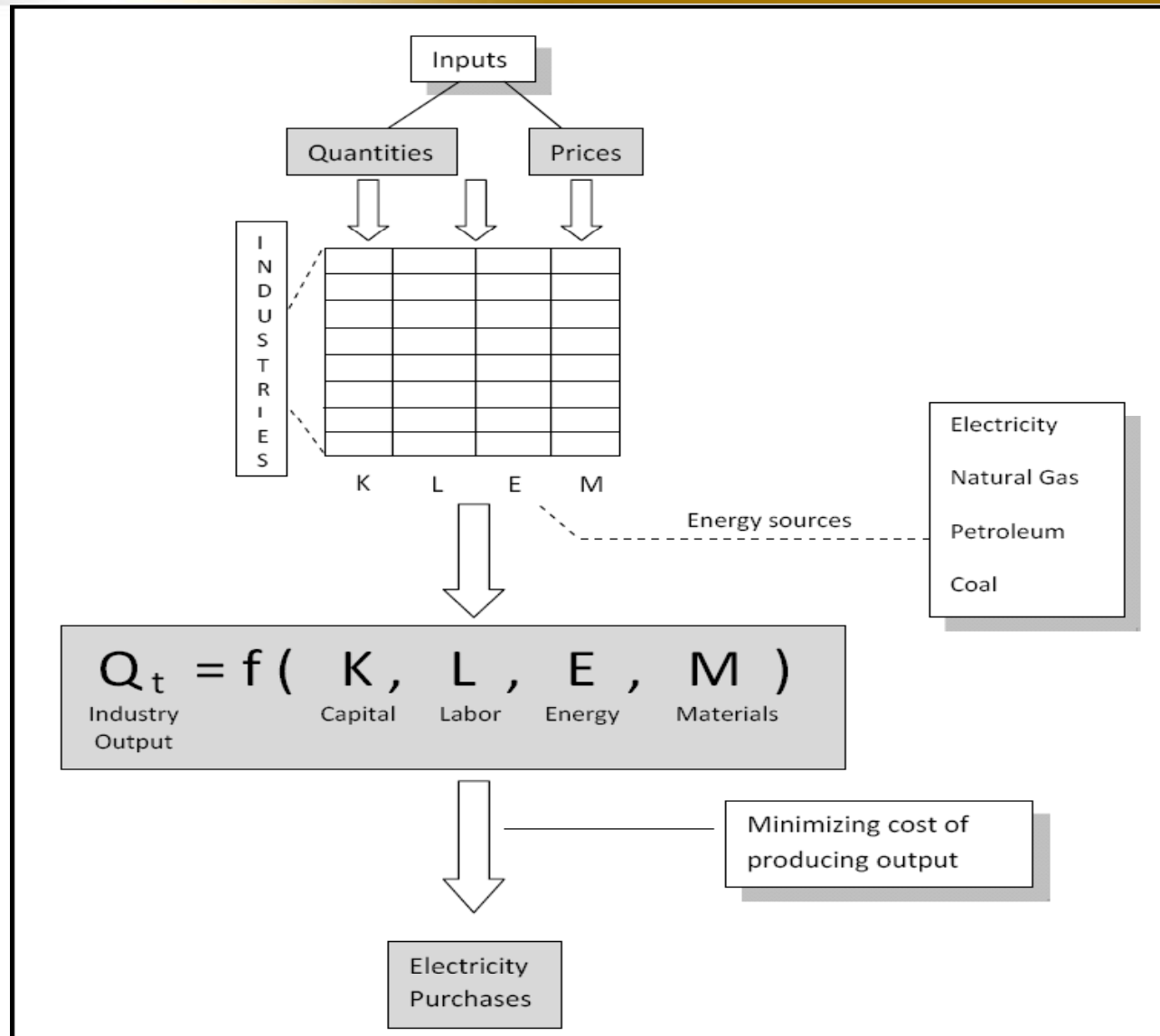# Industrial Sector (Prior to DSM) (%)

SIC	Name	Current Share of GSP	Current Share of Electricity Sales	Current Intensity	Forecast Growth in GSP Originating by Sector	Forecast Growth in Electricity by Intensity by Sector	Forecast Growth in Electricity Sales by Sector
20	Food & Kindred Products	4.47	6.82	0.58	2.84	-1.78	1.06
24	Lumber & Wood Products	2.48	0.69	0.10	2.84	-1.52	1.31
25	Furniture & Fixtures	4.52	0.36	0.03	2.81	-1.17	1.64
26	Paper & Allied Products	1.72	2.76	0.61	2.84	-1.80	1.04
27	Printing & Publishing	3.25	1.34	0.16	2.84	-1.76	1.07
28	Chemicals & Allied Products	15.50	18.95	0.46	2.84	-1.19	1.65
30	Rubber & Misc. Plastic Products	2.88	6.24	0.82	3.42	-1.40	2.03
32	Stone, Clay, & Glass Products	4.58	5.50	0.45	2.81	-1.52	1.29
33	Primary Metal Products	5.23	30.10	2.18	2.35	0.31	2.66
34	Fabricated Metal Products	4.81	5.03	0.40	4.28	-1.49	2.78
35	Industrial Machinery & Equipment	7.81	4.28	0.21	4.53	-1.69	2.83
36	Electronic & Electric Equipment	6.64	5.24	0.30	2.49	-1.75	0.74
37	Transportation Equipment	21.42	8.20	0.14	6.12	-2.15	3.97
38	Instruments And Related Products	6.15	1.08	0.07	2.81	-1.19	1.62
39	Miscellaneous Manufacturing	3.32	0.59	0.07	2.81	-3.87	-1.06
Total	Manufacturing	100.00	100.00	0.38	3.95	-1.79	2.16

Source: SUFG 2011 Forecast

Utility Simulation Model

- Load Management Strategy Testing Model (LMSTM)

- 4 main sub-models
  - demand
  - supply
  - finance
  - rates

Resource Requirements Flowchart
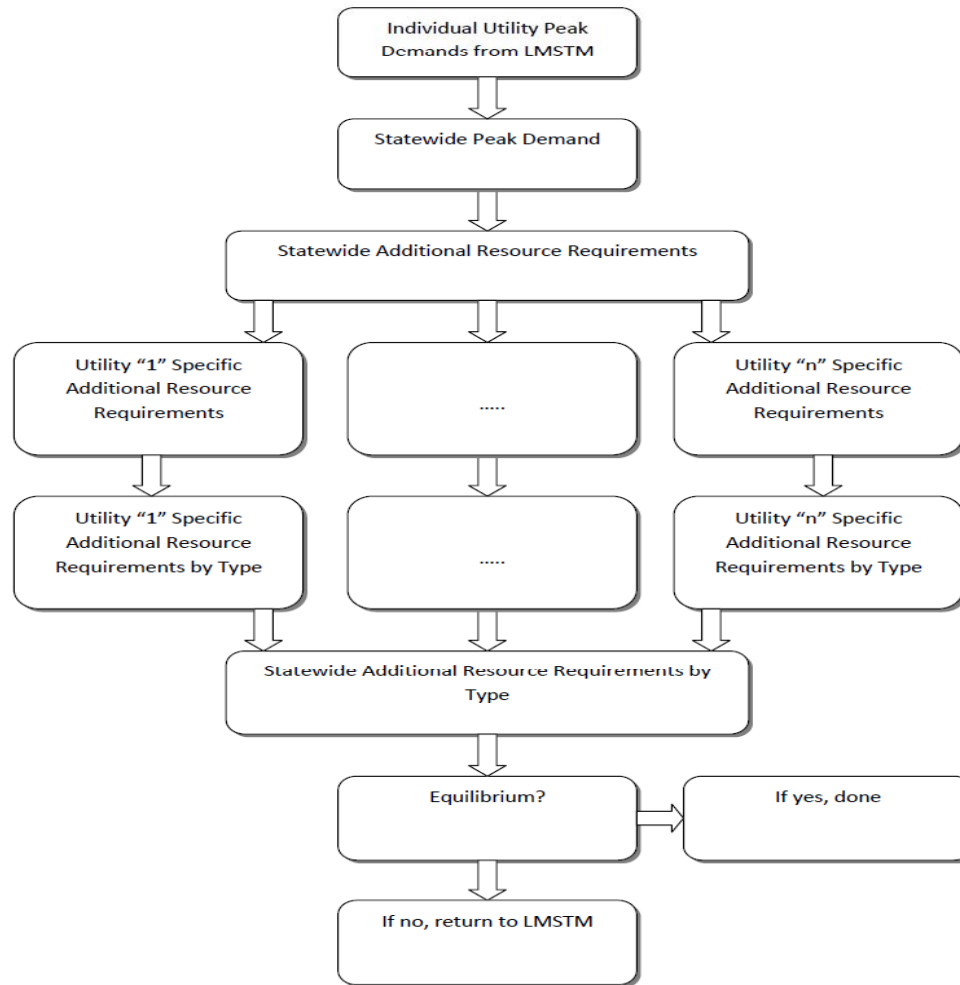
Data

- Calibration and estimation
  - Energy, demand, prices, load shapes, contracts, etc.

- Exogenous
  - Macroeconomics, demographics, fuel prices

Other Modeling

- Regional competitive electricity markets (1990s)

- Industrial motor end-use model (1990s)

- Regional natural gas delivery and storage (early 2000s)

- Mean-variance generation portfolio

- Intermittent resource generation expansion