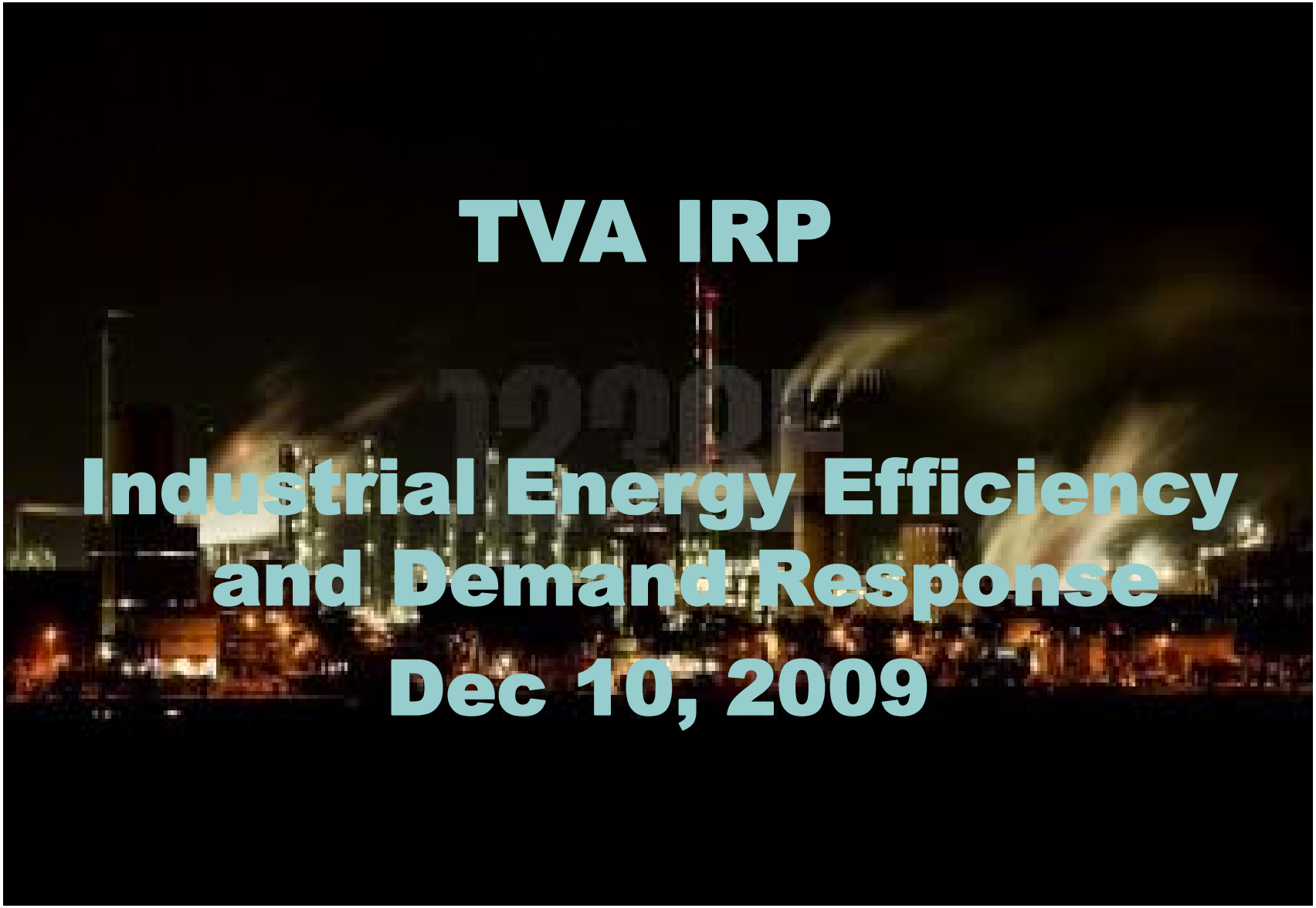
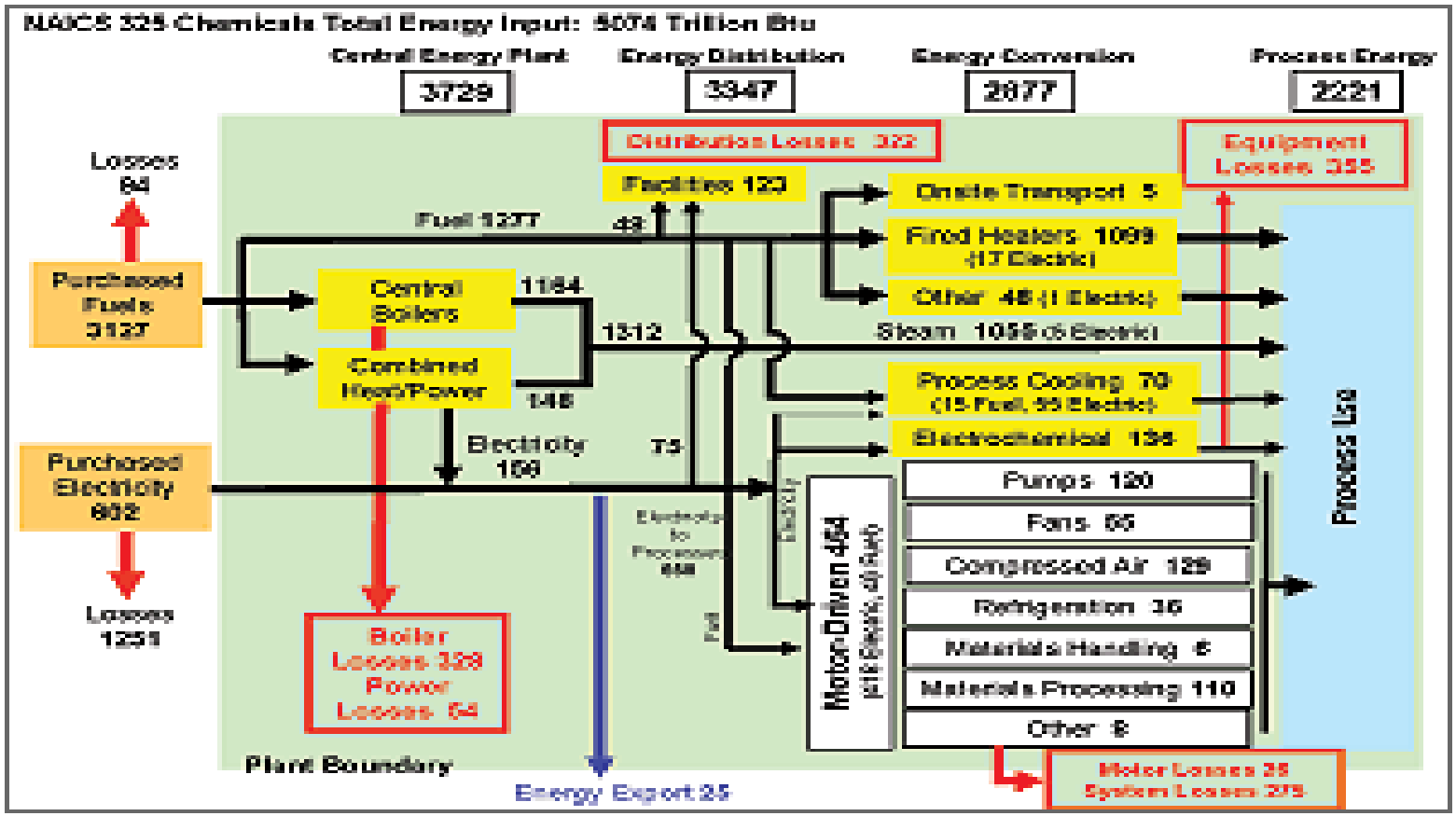


TVA IRP

Industrial Energy Efficiency and Demand Response

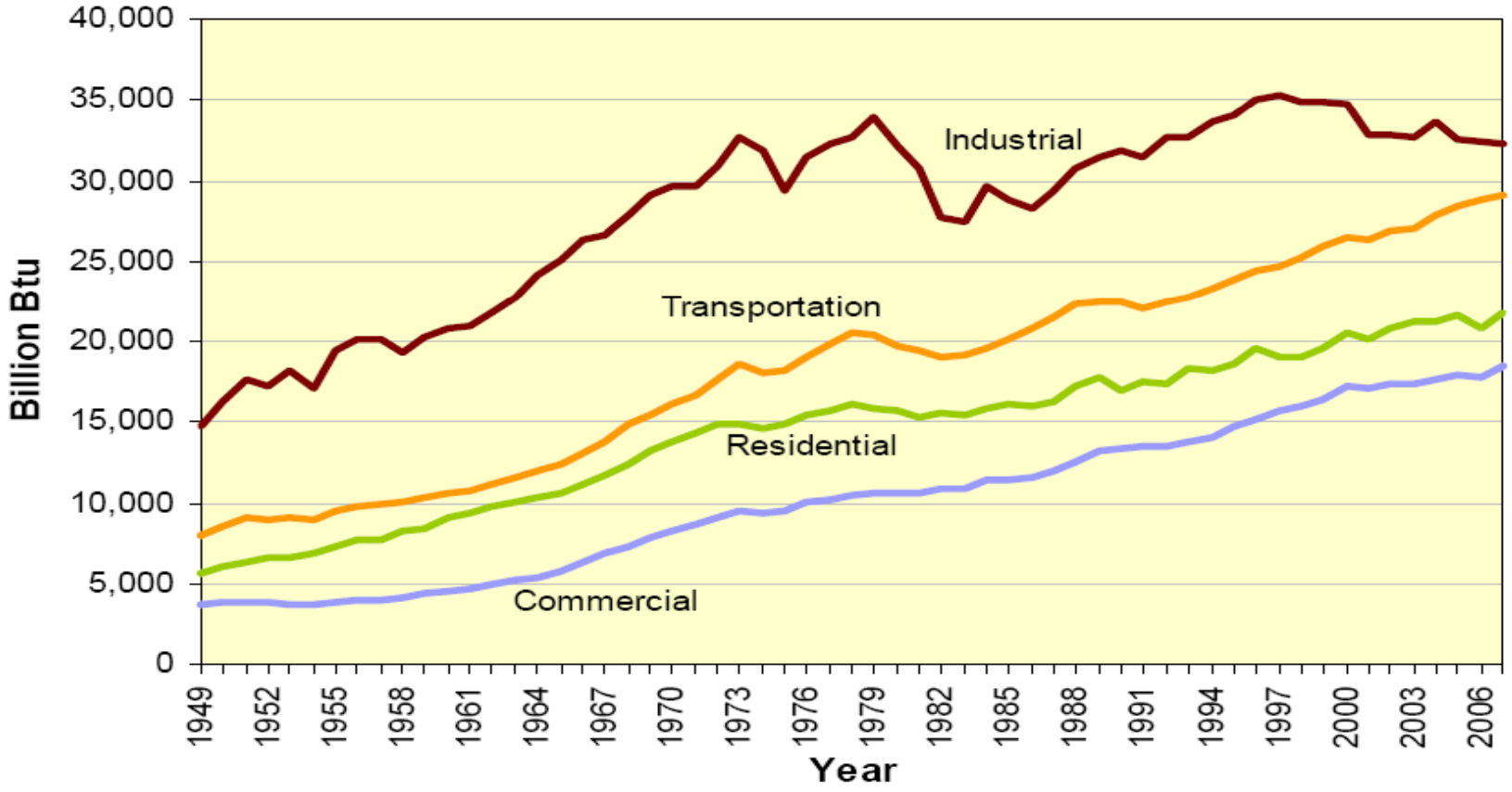
Dec 10, 2009

Industrial Energy Use is Complex



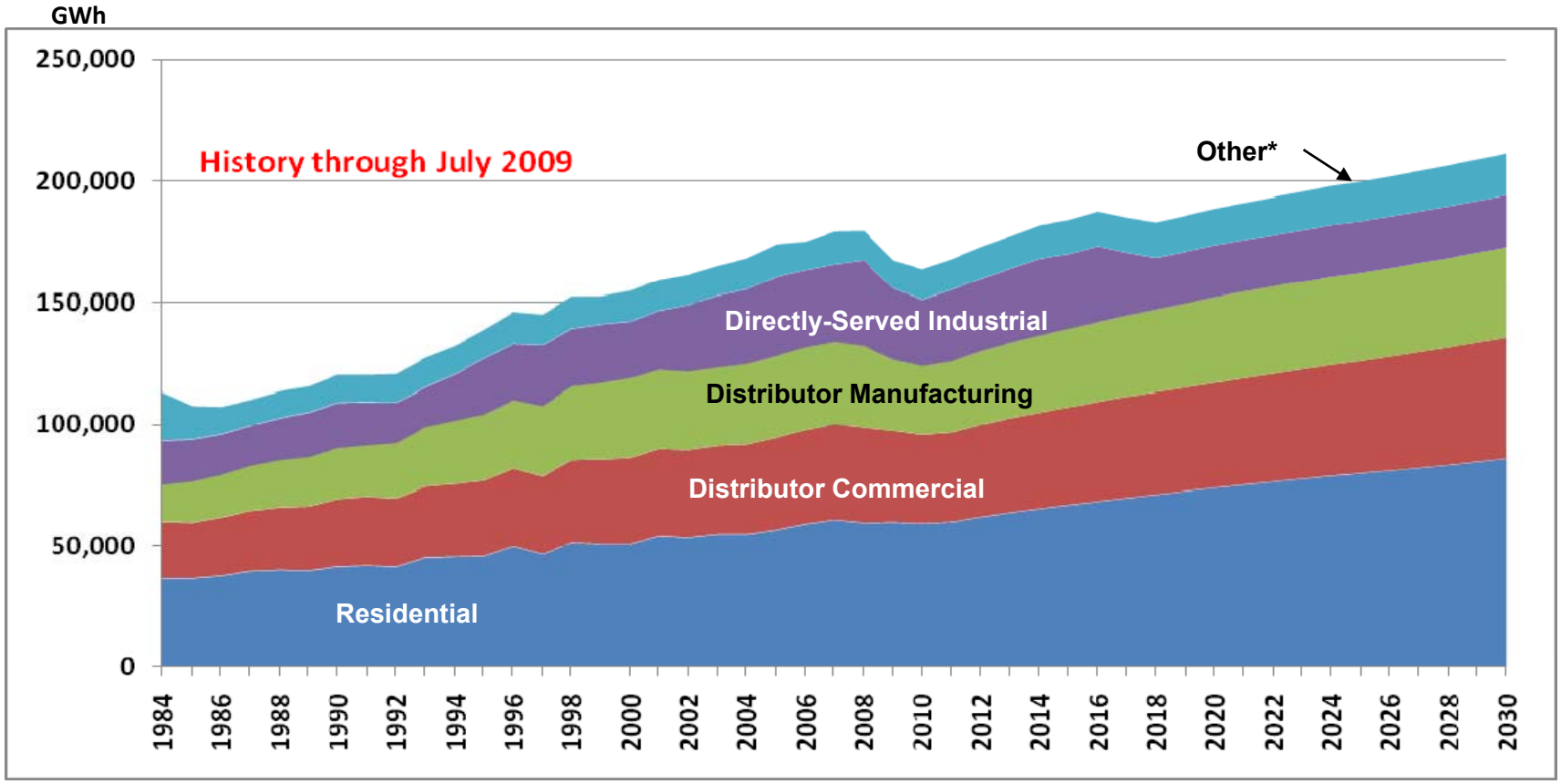
Source – DOE EERE Website

US Energy Consumption by Sector



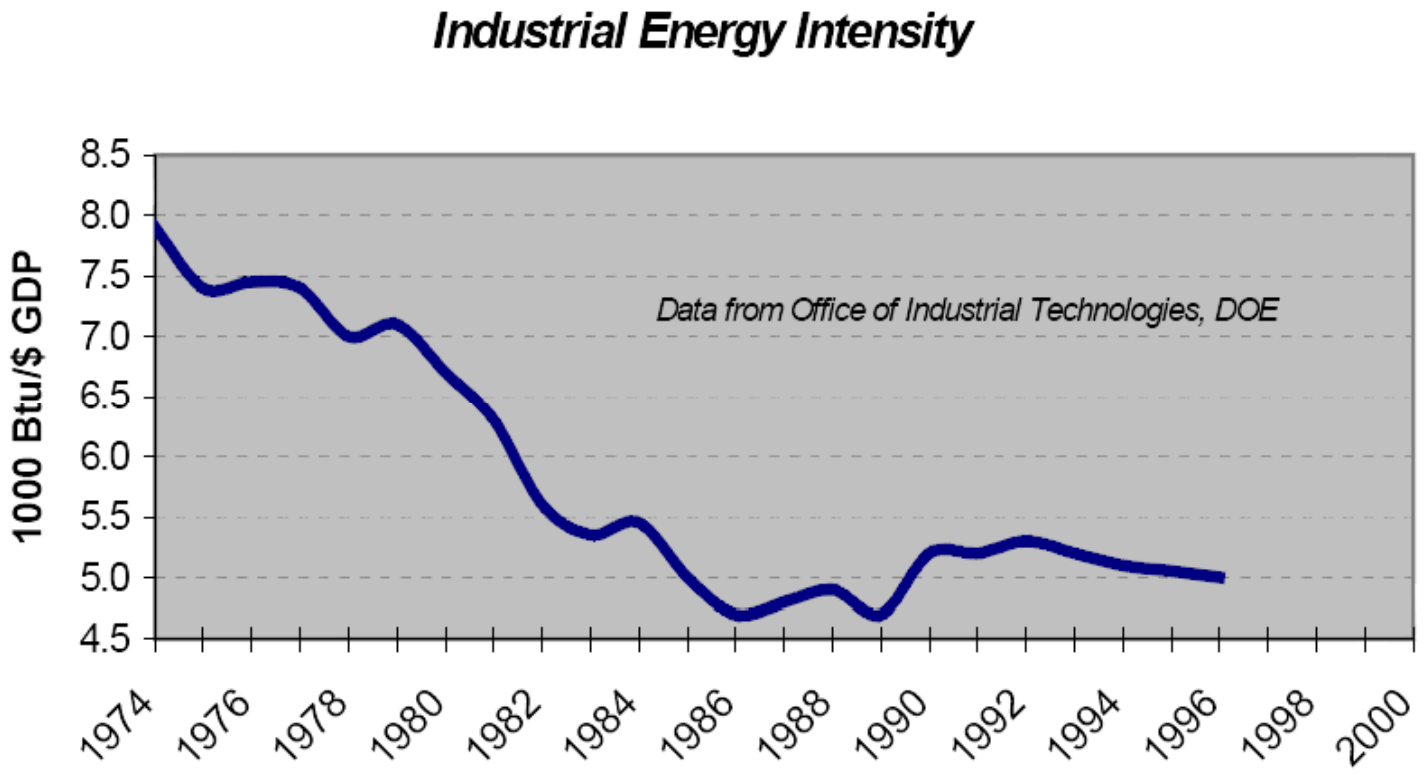
Source: EIA (2009a)

TVA Load Forecast
Results – System Energy Forecast by Sector



*Other includes outdoor lighting, interdivisional and distribution & transmission losses

US Industrial Energy Intensity



Characteristics of Industrial Sector Energy Consumption

- Heterogeneous
  - Intensity
  - Flexibility
  - Self Generation
- Many have specialists who focus on energy
- Baseload energy suppliers
- Engaged in policy development
- Competition for investment

What Aspects of Energy are Important to Industrial?

1. Reliability
   - Startup/Shutdown
   - Ongoing Operation
2. Cost – Capital and Operating
   - Establish competitive position
     - For many means global position
   - Energy intensity
3. Compliance
   - Meet or exceed regulatory requirements

Energy Efficiency

DEFINITION

Most industrials use the measure definition of efficiency - consider energy intensity (million BTUs per unit of production) as the definition and metric of efficiency. Problem arises when there are structural changes to the industrial entity that may not be reflected in metric.

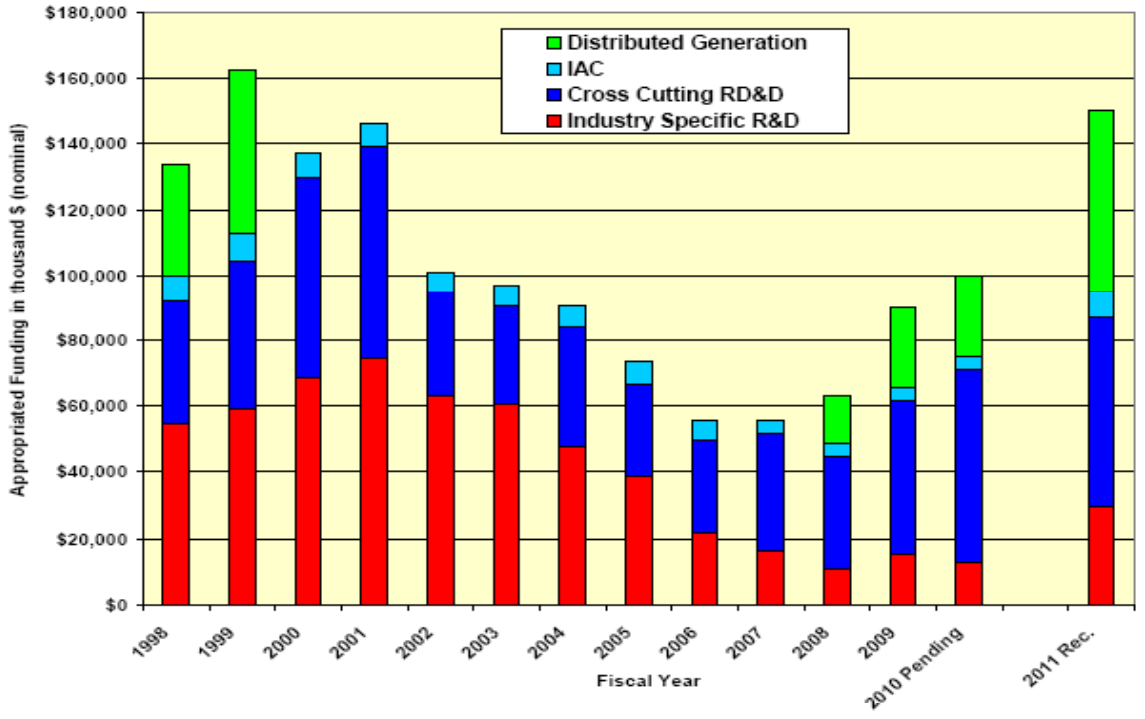
Industrial Energy Efficiency

- Can be industry specific
  - Energy efficiency in steel mill different than energy efficiency in refinery
    - e.g. steel mill doesn't generate fuel, refinery does
- Emphasis commensurate with level of energy intensity
  - Chemical custom synthesis plant vs aluminum smelter
- Improved efficiency may be detrimental to utility
  - Loss of off-peak baseload
- Typical that opportunities are identified but capital not available
  - Competition for capital – infrastructure vs units of production
    - Utility support often in form of investment grants
    - Cyclicality plays into investment decision

Examples of Industrial Energy Efficiency Programs

1. Duke Energy, South Carolina
   - Smart $aver Incentives
     - Capital for projects that reduce energy consumption and cut operating expenses
     - Funded by wholesale sales $$$
2. New York State Energy Research and Development Authority
   - State public benefits fund
   - Established Energy Efficiency Portfolio Standard
     - Reduce energy consumption by 15% in 2015
   - Incentives of 12 – 16 cents/KWh
     - CHP included
   - Some research and development
3. TVA – Major Industrial Program (New)
   - For customers with load > 5 MW
   - Funded by wholesale sales of power
   - $100/KW of summer peak
   - Audit required
4. DOE
   - EERE Save Energy Now Program - Partner with states - Auditing services
   - Some funding under stimulus package but minor compared to total stimulus funding ($155M of total DOE $36.7B)

US Funding for Industrial Energy Programs



Source - **Barriers to energy efficiency investments and energy management in the U.S. industrial sector, ACEEE Oct 2008**

What Does Industry Need to Drive Energy Efficiency

- Regulatory support for combined heat and power
  - Utilize waste heat
  - Net metering
  - Backup power
  - Interconnection
  - Equal access to transmission (FERC Order 888)
  - Economic dispatch
  - Currently 9% total generating capacity – opportunity to increase to 20% by 2030 (ORNL 2008 Study)
    - Increasing to 20% would save half total energy currently consumed by US households
- Funding for research
  - DOE funding for industrial EE is insignificant compare to utility funding
    - Recent stimulus package
    - EPRI take on industrial EE as part of mission
- Capital support for projects
  - Support to meet hurdle rates
  - Not detrimental to industrials (e.g. decoupling, utilize self-directed)
  - Go beyond just electricity (e.g. heat recovery for boiler feedwater preheat)
- Established industry standards
  - ANSI MSE 2008 (transition to ISO Standard?)
- Industrial firm accept energy as a controllable variable cost vs a fixed overhead cost
  - Apply QM tools (Six Sigma)

How does TVA Stack Up on Energy Efficiency?

Not a strong advocate of CHP

- not subject to FERC rules that level playing field

Some collaboration with industry on research and development

Energy Efficiency Program

Economic Reinvestment Support

Demand Response

DEFINITION (Northwest Power and Conservation Counsel)

A voluntary and temporary change in consumers' use of electricity when the power system is stressed.

- Usually a reduction but can be increase (voltage support)
- Voluntary may become mandatory through contract (voluntarily enter contract)
- Primarily needed to shave peaks

What is Demand Response?

TWO TYPES

1. Emergency Demand Response – voluntary curtailment during a system reliability event. Customer is paid for reducing load (may be capacity payment, energy payment or both).

2. Economic Demand Response– voluntary curtailment during an economic event. Customer is paid for reducing load (may be capacity payment, energy payment or both).

Types of Programs

Emergency Demand Response

- Direct Load Control
- Interruptible Programs
- Ancillary Services – e.g. voltage support

Economic Demand Response

- Demand bidding
- Pricing Products – TOU, RTP, Block Offer

US Demand Response Potential

Residential DR	2010	2020	2030
DLC – Central AC	3,128	8,194	11,742
DLC – Water Heating	1,431	2,868	3,931
Price Response	1,539	6,918	10,967
Commercial DR	**2010**	**2020**	**2030**
DLC – Cooling	1,336	3,833	4,822
DLC – Lighting	364	1,049	1,358
DLC – Other	256	824	1,159
Interruptible Demand	4,337	8,806	19,450
Price Response	771	4,018	8,368
Industrial DR	**2010**	**2020**	**2030**
DLC – Process	413	1,124	2,245
Interruptible Demand	2,550	3,973	8,701
Price Response	515	2,765	5,697
TOTAL	16,639	44,372	78,441
Percentage of Peak	2.0%	4.6%	7.0%

Table 6
Summer Peak Demand Savings from Demand Response – Maximum Achievable Potential (MW)

Residential DR	2010	2020	2030
DLC – Central AC	4,119	9,498	12,558
DLC – Water Heating	1,960	3,473	4,503
Price Response	4,318	13,122	16,093
Commercial DR	**2010**	**2020**	**2030**
DLC – Cooling	1,766	4,309	5,099
DLC – Lighting	516	1,377	1,698
DLC – Other	508	1,316	1,623
Interruptible Demand	8,536	13,680	26,410
Price Response	2,180	7,600	12,418
Industrial DR	**2010**	**2020**	**2030**
DLC – Process	824	1,826	3,129
Interruptible Demand	3,572	4,554	9,142
Price Response	1,451	5,154	8,422
TOTAL	29,750	65,910	101,093
Percentage of Peak	3.6%	6.8%	9.1%

Source: EPRI Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S. (2010–2030) January 2009

How does TVA Stack Up?

Emergency Demand Response

- Direct Load Control
- Interruptible Programs
- Ancillary Services – e.g. voltage support

Economic Demand Response

- Demand bidding (have product but pricing issues)
- Pricing Products – TOU, RTP, Block Offer

Conclusions

- Opportunities exist to increase energy efficiency and demand response in industrial sector
- TVA has developed some programs but pace is too slow and those developed often do not meet customer requirements
  - Development process occurs in a vacuum
- Behavioral changes needed – industrial customers need to embrace EE and DR
  - TVA has a role to educate/support
- Potential opportunity to jointly develop programs with other Southeast IOUs

QUESTIONS