Fundamentals of Market Regulation
Electricity Market Regulation

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TOPIC OUTLINE

1. **Why Regulate**

2. **Economic Analysis of Social and Economic Regulation**

3. **Impact of Regulation**

4. **Regulation of Electricity Markets**

Why Regulate?

Why Regulate?

- Perfect Competition is ideal. Basic rules: perfect information; many buyers and many suppliers; free entry.

- An utility company operating in an network industry (e.g., electricity sector, postal services, telecom) has a situation of monopoly, natural monopoly or limited competition; provides essential services for the wellbeing of society — both individuals and businesses.

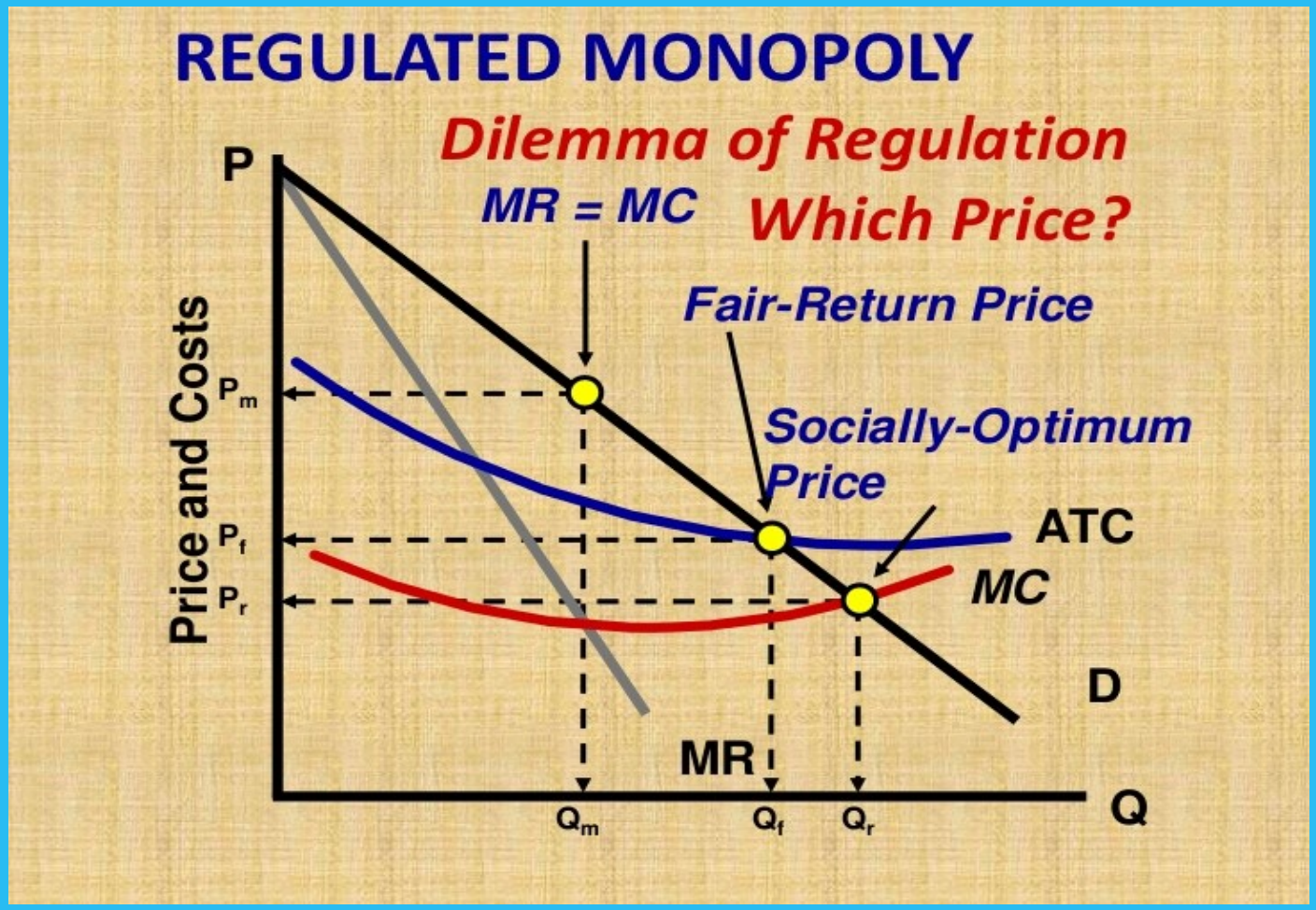
- In providing those services an utility company face the "public interest.", which includes a number of elements, e.g., universal service, safety, public health.

- The **rationale for regulating is that the public interest cannot be served in a situation of so-called** "*market failure*" (i.e., market "*fails*" because competition is insufficient), with particular reference to monopolies and natural monopolies; windfall profit (also known as "*economic rent*"); externalities (or "*spillovers*"); information asymmetries; inadequacies; continuity and availability of service; anti-competitive behavior and predatory pricing; public goods and moral hazard; unequal bargaining power; scarcity and rationing; rationalization and coordination, and planning.

- Regulation is expected to protect the "public interest" and improve economic welfare

Why Regulate?

Monopoly Price



Why Regulate? - Monopoly

1.5.3 Pure Monopoly

Natural Monopoly

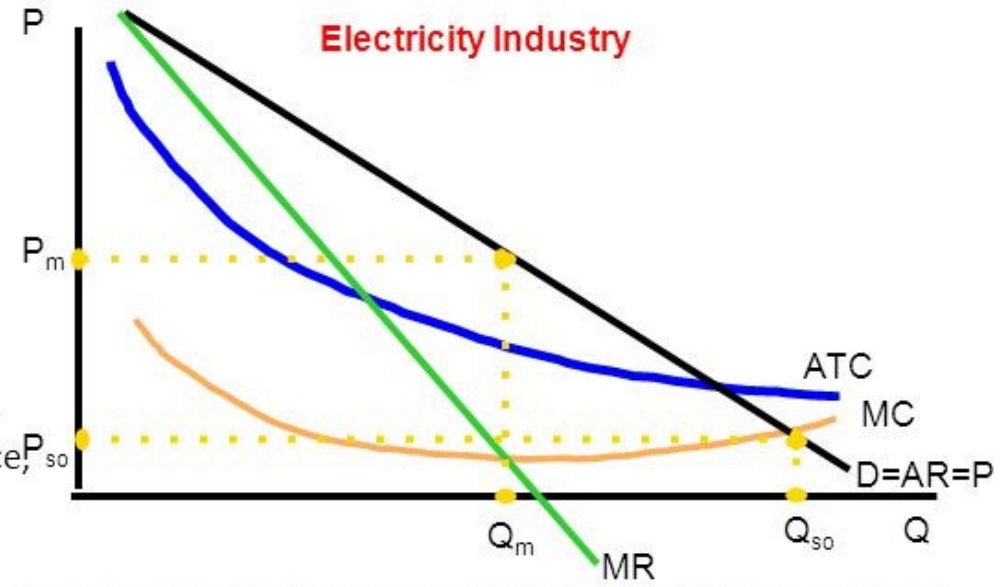
by Welker's Wikinomics

Natural Monopoly and the need for Government Regulation:

A monopoly in a key industry like electricity generation can potentially be very harmful for consumers of the product being produced. Monopolists tend to charge a price that is higher, and produce a quantity that is lower than what is socially optimal.

Assume the market for electricity is a natural monopoly:

- To maximize its profits, the electricity company will produce where MC=MR, at a quantity of Qm, and charge a price of Pm
- The socially quantity (where P=MC) is Qso. This is the *allocatively efficient* level of output, at a price of Pso.
- Unregulated, there the industry will under-produce electricity and charge a higher price, leaving many households unable to afford this important product.



To ensure a more socially optimal level of output and price, government regulation is needed. Either subsidies or price ceilings (or both) will increase output and reduce price.

Why Regulate? Monopoly

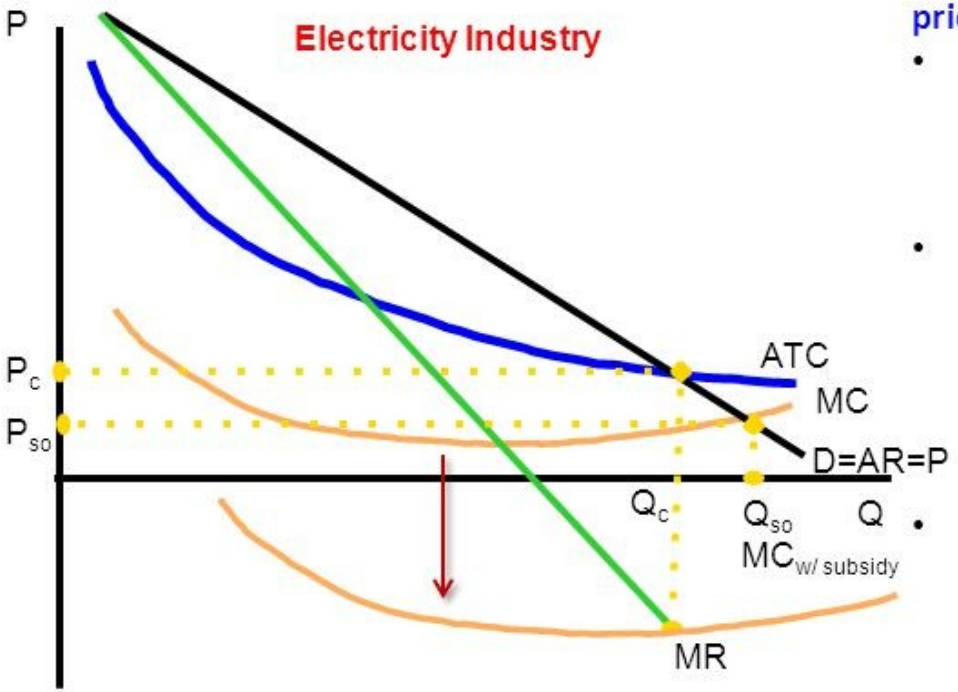
1.5.3 Pure Monopoly

Natural Monopoly

by Welker's Wikinomics

Natural Monopoly and the need for Government Regulation:

To ensure that a naturally monopolistic industry produces at a level closer to the *allocatively efficient* price and quantity (where P=MC), either subsidies or price controls can be imposed by the government.



Regulations to increase output and decrease price of a natural monopoly:

- A price ceiling of Pso is below the firm's ATC, so the firm will be earning economic losses and will shut down in the long-run. This is *not a good regulation*.
- A price ceiling of Pc, which is equal to the firm's average total cost, will increase the firm's level of output (to Qc) and lead a price closer to Pso. The firm will break even, and earn a *fair return* for its services. *This is a commonly used regulation*
- A subsidy which reduces the firm's MC will lead to the firm producing more electricity and lowering its price. *Subsidizing natural monopolists is a commonly used regulation.*

Economic Analysis of Economic and Social Regulation

Economic Analysis of Regulation

- **Two Types of Market Regulation:**
  Economic regulation and Social regulation

Economic regulation is the traditional form of regulation: it sets prices or conditions on entry of firms into an industry. It is usually industry-specific. The deregulation movement of the last two decades has been primarily focused on reducing *economic regulation* of markets, i.e., deregulation.

Social regulation is a newer form of market regulation that grew up during the 20th century, mostly since the 1960's. It includes environmental controls, health and safety regulations, and restrictions on labeling and advertising; it involves the correction of externalities. While economic regulation has been declining, *social regulation* has grown rapidly.

Economic Analysis of Regulation

- **A. Economic Regulation of Markets**

Economic regulation puts restrictions on entry, price, quantity, and market share

Economic regulation limits entry into a market or sets prices, restricts quantities, and allocates market shares among sellers.

Examples of economic regulation that often limit competition include

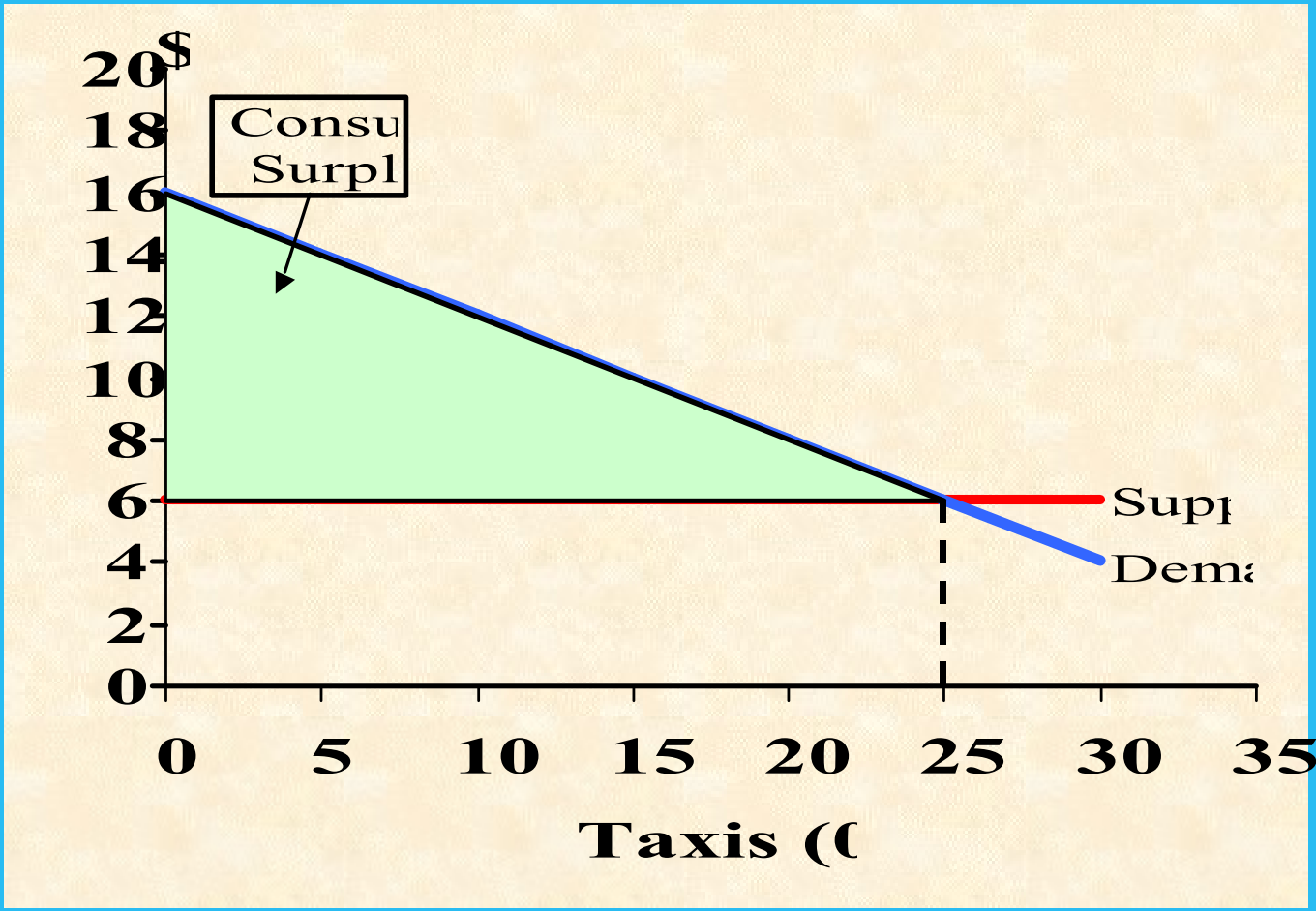
- Public franchises
- Occupational licensing
- Other licensing requirements

Economic Analysis of Regulation

Market Effects of Economic Regulation

If the taxi market is unregulated, the equilibrium number of taxis is 25,000 and the equilibrium average fare is $6.

Consumer Surplus, shown by the green triangle, is $125,000. **Consumer surplus** is the difference between the total amount that **consumers** are willing and able to pay for a good or service (that the demand curve indicates) and the total amount that consumers actually do pay (i.e., the market price).



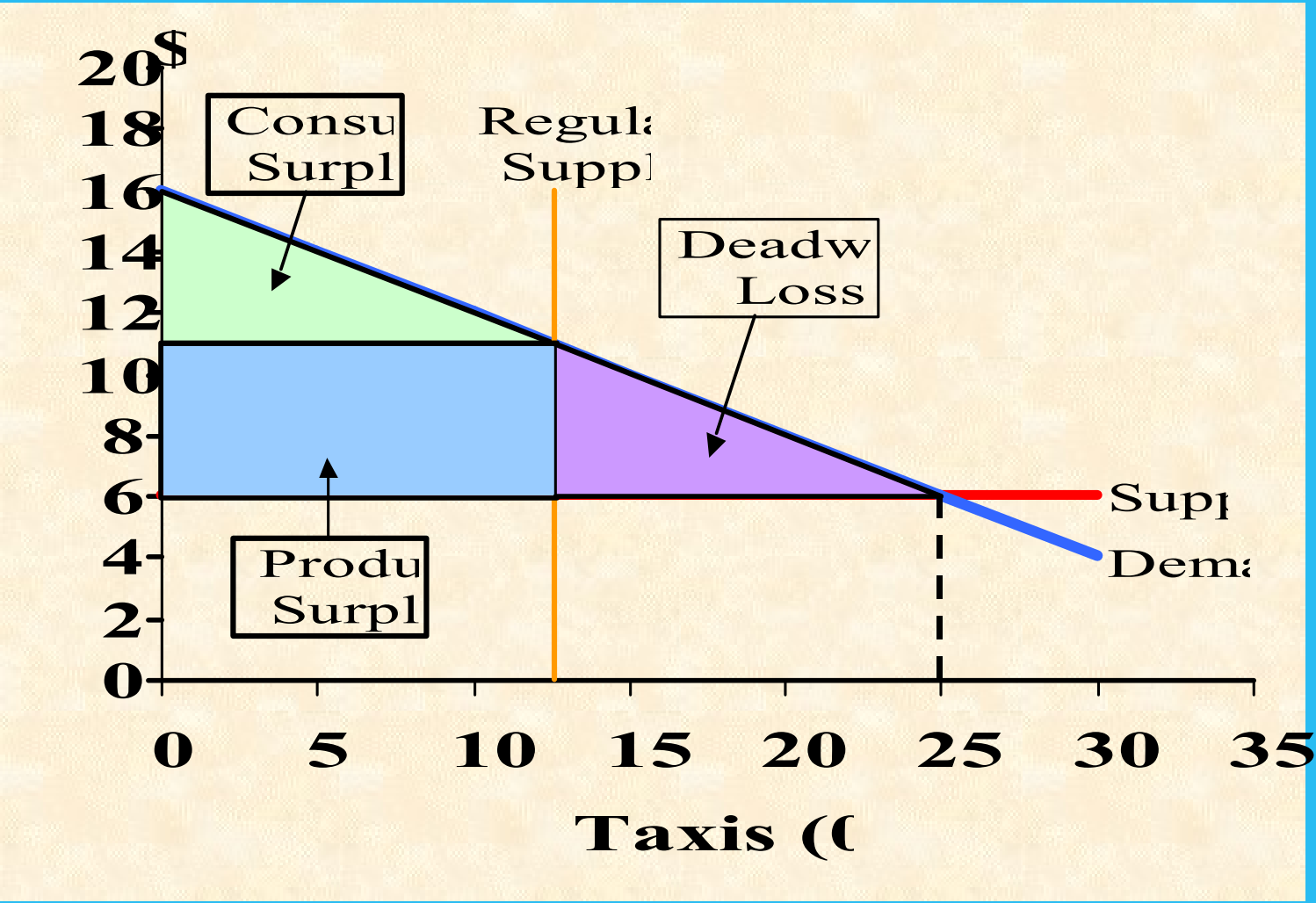
Economic Analysis of Regulation

1.If the government limits the number of taxis to 12,500 through licensing, the regulated supply is perfectly inelastic.

2. Equilibrium price rises to $11 and quantity falls.

3. A portion of consumer surplus, shown in blue, is transferred to taxi owners as producer surplus. Another portion is simply lost, a deadweight loss, i.e., a **loss** of economic efficiency when equilibrium for a good or service is not achieved or is not achievable.

Market Effects of Economic Regulation



Economic Analysis of Regulation

- **B. Social Regulation of Markets**

Social regulation prescribes how products must be designed, or how they must be produced, or mandates the inclusion of specific features in the product.

Economic Analysis of Regulation

Market Effects of Social Regulation

If the taxi market is unregulated, the equilibrium number of taxis is 25,000 and the equilibrium average fare is $6.

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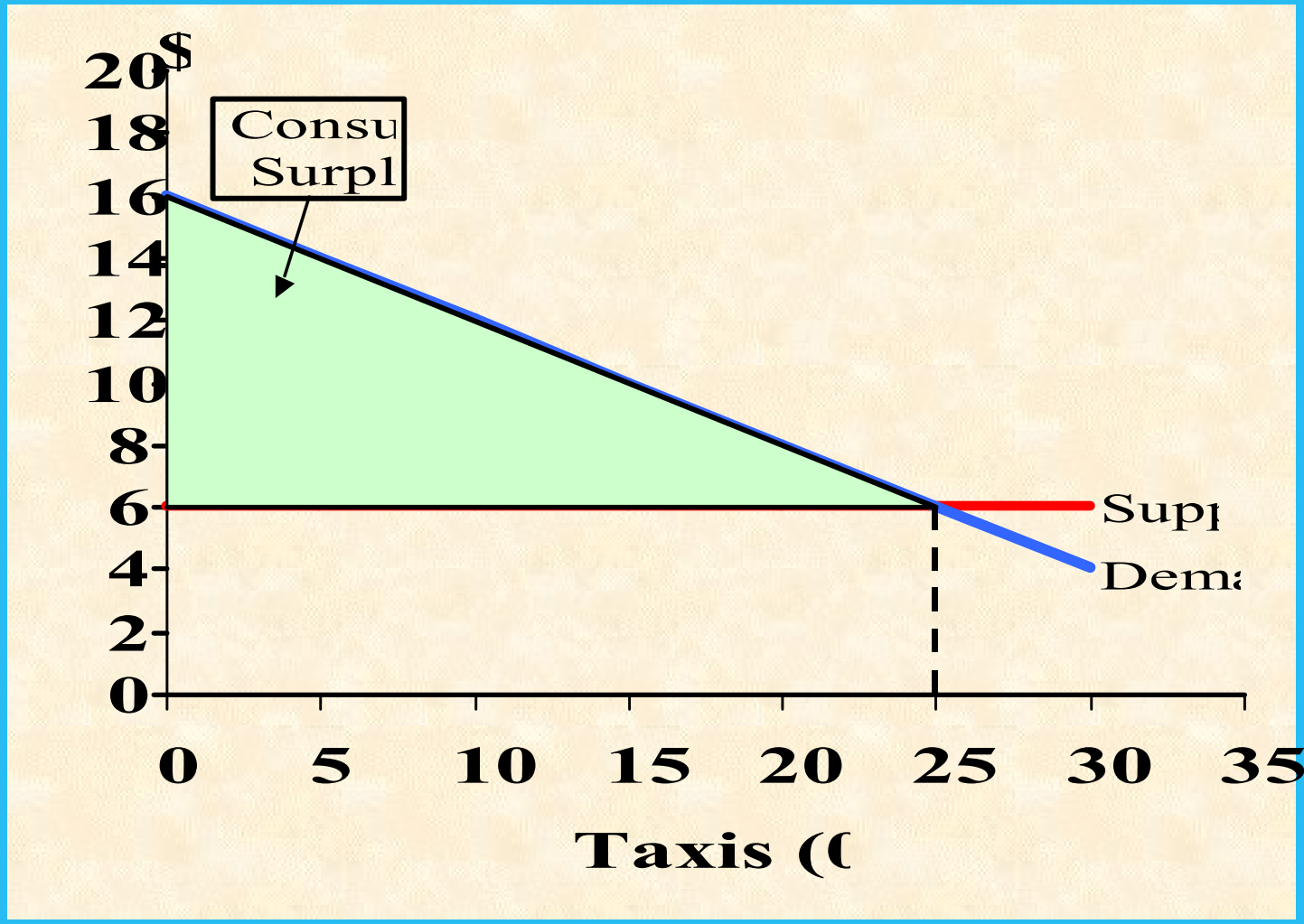


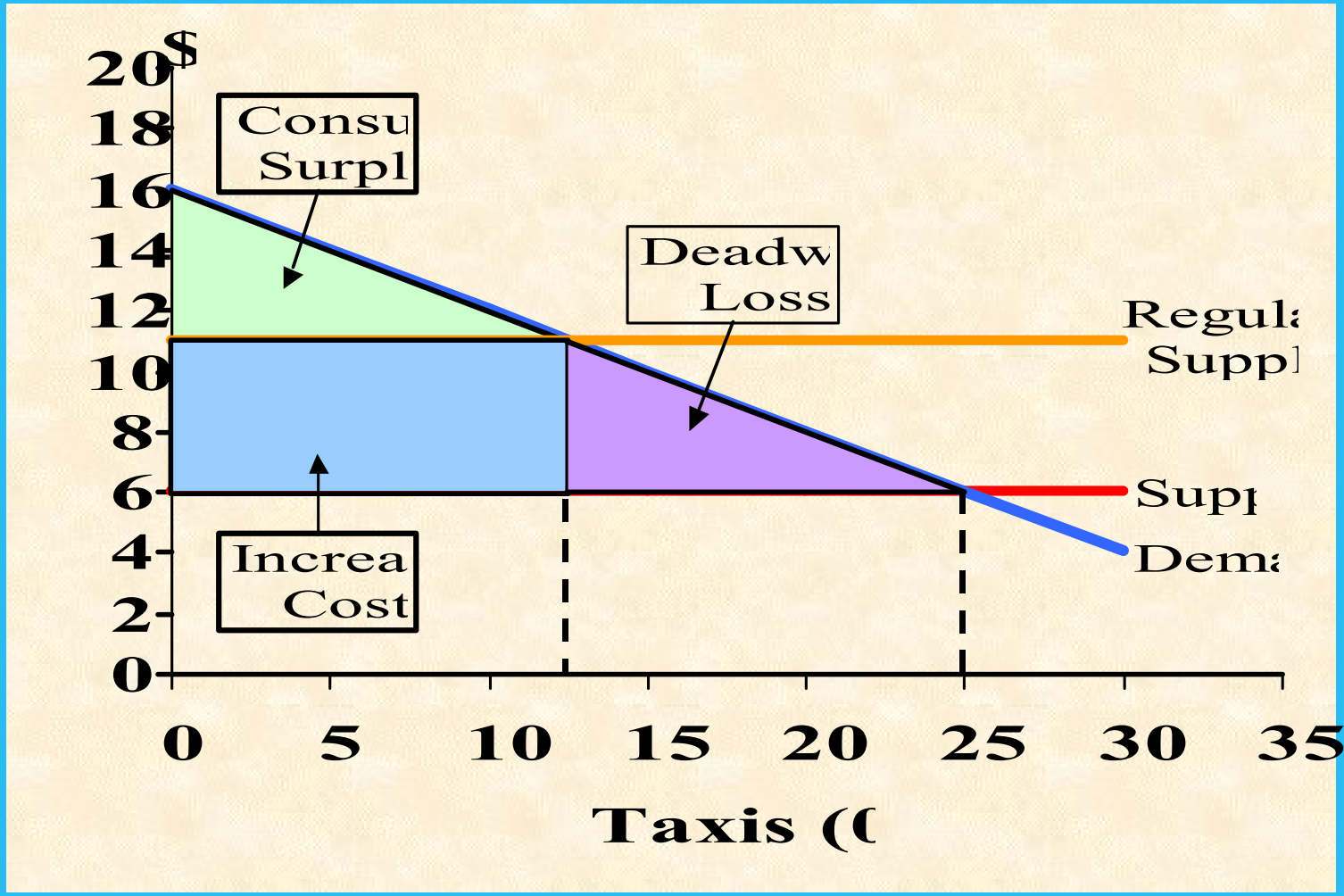
Economic Analysis of Regulation

Market Effects of Social Regulation

If the government mandates that all taxis have a partition separating drivers and passengers, operating cost increases as shown by the gold supply curve.

Equilibrium price rises to $11 and quantity falls to 12,500.

A portion of consumer surplus, shown in blue, is absorbed by the **increase in cost.** Another portion, a **deadweight loss**, shown in purple constitutes a loss of economic efficiency.



Economic Analysis of Regulation

- **Economic Consequences of Market Regulation**

A. Economic Regulation

Economic regulation has the same effects on economic efficiency as monopoly.

- Higher prices
- Smaller quantities
- Redistribution of consumer surplus from consumers to producers
- Deadweight loss.

Because of the deadweight loss, economic regulation is inefficient from an economic point of view.

Economic Analysis of Regulation

- **Economic Consequences of Market Regulation**

B. Social Regulation

Social regulation results in:

- Higher prices
- Smaller quantities
- Increased cost to consumers and producers
- Deadweight loss.

Because of the deadweight loss, social regulation is also inefficient from an economic point of view.

Economic Analysis of Regulation

Comparison of the market effects of Economic regulation and Social regulation

Economic and Social regulation have similar effects on the market: higher prices, smaller quantities, deadweight loss.

- **Economic regulation redistributes some of the surplus** remaining after the deadweight loss from consumers to producers but does not affect cost.

- **Social regulation increases cost** and reduces the total surplus remaining after the deadweight loss, but social regulation does not redistribute surplus from consumers to producers.

Economic Analysis of Regulation

- **Views about Economic and Social Regulation**

  Negative economic effects of market regulation

  Economic and Social regulation:

  •Limit competition and consumer choice, reduce innovation; raise costs and price to pay for regulation

  •Impose administrative costs on society; it costs to implement, administer, and enforce regulation

  •Have unintended consequences, i.e., consumers take fewer actions of their own to provide for safety and quality

Economic Analysis of Regulation

Views about Economic and Social Regulation

The Process of Regulation, Liberalization and Competition

- Traditionally, most network industries used to be dominated by state-owned "regulated" monopolies. During the past twenty years, governments in many parts of the world have started liberalizing their network industries, e.g., post offices, telecommunications, electricity, and transport. The liberalization process started in the United States in the late 1970s and in the UK in the early 1980s. Since then, sectors such as telecommunications and air transport have become fully liberalized and are becoming increasingly competitive. The electricity sector, postal services, and railways are not yet fully liberalized.

- In parallel with liberalization, sector-specific regulation in network industries has taken place. The issue is whether such regulation is necessary and if so what its optimal design should be. Some argue for complete deregulation (i.e., the complete abolishment of sector-specific regulations), whereas others propose regulations, that is the replacement of pre-existing (monopoly) regulations by new regulations aiming at safeguarding service levels and competition. The resulting compromise is often somewhere in between: the liberalization process usually entails the partial replacement and realignment of sector-specific regulatory intervention by the disciplining forces of competition protected by competition law. Consequently, competition law and sector-specific regulation play complementary roles (Christian Jaag and Urs Trinkner, p.1).

Economic Analysis of Regulation

Competition changes *nature* of regulation, but does not eliminate *need* for regulation

- **Traditional structure (monopoly) emphasizes price setting, rate design, engineering, resource planning**
- **Competition focuses on market oversight, level playing field, market power, information**
- **Coordination among national regulators and/or anti-monopoly offices critical to avoid anti-competitive behavior**

Impact of Regulation

Impact of Regulation

- Regulatory Impact Analysis (RIA) is a systemic approach to critically assess the positive and negative effects of proposed and existing regulations and non-regulatory alternatives. As employed in OECD countries RIA encompasses a range of methods. It is an important element of an **evidence-based approach to policy making.**

- OECD analysis shows that conducting RIA within an appropriate systematic framework can support the capacity of governments to ensure that regulations are efficient and effective in a changing and complex world. Some form of RIA has now been adopted by nearly all OECD members, but they have all nevertheless found the successful implementation of RIA administratively and technically challenging.

Impact of Regulation

RIA in the United States

- US Executive Orders 13563 and 12866 require agencies to provide to the public and to OMB a careful and transparent analysis of the anticipated consequences of economically significant regulatory actions. This analysis includes an assessment and (to the extent feasible) a quantification and monetization of benefits and costs anticipated to result from the proposed action and from alternative regulatory actions.

- US Executive Order 13563 specifically requires agencies "*to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible.*" Normally the technique used is Cost-Benefit Analysis (CBA).

- The purpose of the RIA is to inform agency decisions in advance of regulatory actions and to ensure that regulatory choices are made after appropriate consideration of the likely consequences. To the extent permitted by law, agencies should proceed only on the basis of a reasoned determination that the benefits justify the costs (recognizing that some benefits and costs are difficult to quantify).

Impact of Regulation

- **Regulation: Principles and Practice**

Limitations of CBA

- Several Issues

  - Choice of the Discount rate
  - Valuing Lives
  - Distribution of wealth
  - Weights
  - Market Prices
  - Rationality Assumption

Cost-benefit analysis provides a summary statistic for the efficiency of a given project, but efficiency is only one consideration of many. Nonetheless we need cost-benefit analysis to know the trade-offs involved in policy choice, such as how much efficiency we must sacrifice to achieve other values. Cost-benefit tells us the menu of trade-offs, which policymakers face.

Impact of Regulation

- **Regulation: Principles and Practice**

Regulation often benefits producers, not consumers

In principle, regulation is supposed to improve consumer welfare. In practice, regulation may have negative effects on consumer welfare.

- Even when regulation does benefit consumers, the benefit to consumers might be less than the costs of the regulation.
- Even when the benefits to consumers are greater than the costs, regulation often has unintended consequences that harm consumers.
- Regulation often promotes the special interests rather than the public interest

Impact of Regulation

- **Regulation: Principles and Practice**

Because of the *special interest* effect, regulations are often adopted even when the total costs to consumers exceed the benefits. Why?

- The benefits are concentrated on a small number of individuals (the special interests) so that the benefit to each member of the special interest group is larger than the cost of lobbying for the regulation.

- The costs of the regulation are dispersed across a much larger number of consumers so that the cost of the regulation to each consumer is less than the cost to the consumer of lobbying against the regulation.

Therefore, the special interests out-lobby and outspend consumers, and regulations that are inefficient and harmful to consumers are often adopted. This is another example of rent-seeking.

Impact of Regulation

- **Regulation: Principles and Practice**

  Capture Theory of Regulation

  George J. Stigler in 1971 entitled The Theory of Economic Regulation. The main idea of the article can be summarized in Stigler's (1971: 3) affirmation that: "…as a rule, regulation is acquired by the industry and is designed and operated primarily for its benefits. "*The basic hypothesis is that an industry may use—or rather abuse—the coercive public power of the State to establish and enforce rules in order to obtain private benefits.*"

  Even when the initial demand for regulation does come from consumers, over time consumers lose interest. Control over the regulatory process passes from consumers to the regulated special interests. The special interests with the most to gain or lose from the regulation eventually "*capture*" or take control of the regulatory process.

  Corruption; Revolving Doors; Fraud.

Impact of Regulation

- **Regulation: Principles and Practice**

  Regulators are themselves a special interest

  - Regulation often promotes the self-interest of the regulators, especially where less regulation would narrow the scope of their authority or threaten their jobs. The regulators themselves are a special interest. For this reason, regulation is often inflexible, slow to respond to changes in consumer demand, market conditions, and technology, and not conducive to innovation.

  - **Public Choice** is an approach based on the the application of economic methods of analysis to political institutions and governmental decision-making, (Lemieux, 2004: 22).

  - According to Public Choice all government actors, politicians and bureaucrats, are self-interested actors following they own interests, and the government is not able to correct market failures - or, at least, to correct them at lower costs than the costs issued by the market failures in the first place.

Impact of Regulation

- **Markets as an Alternative to Regulation**

Markets and prices are often superior to regulation

Some studies (O'Driscoll Jr. and Hoskins) argue that even when the benefits of regulation are greater than the costs, markets and prices are often more effective and more efficient than regulation in promoting consumer interests and achieving socially desirable objectives.

Markets and prices alter incentives, encouraging individuals to act in socially beneficial ways. Regulation imposes costs that only encourage individuals to waste scarce resources in an effort to avoid or circumvent the regulations.

Impact of Regulation

- **Evidence-based approach to policy making**

Regulation should be undertaken based on evidence supported by studies, analyses.

Public Policy including regulation is not always based on theoretical and empirical evidence.

The analysis, information, and data used to promote and support regulations and public policies might not be supported by scientific studies, and might not favor the public interest but rather special private interests and agendas.

Transparency to Improve Regulation

- Transparency will reduce informational asymmetries and does not only protect from corrupt abuses of the informational advantages but will also enhance the overall outcome of regulation.
- The best way to fight against informational asymmetry is data collection.
- Intents to increase our knowledge of the regulated sector, and making this information transparent and available to everyone including civil society organizations, will have positive effects in deterring from collusive practices but also in enhancing the efficiency and effectiveness of public service provision.

Impact of Regulation

Example: Motorcycle Registrations and Fatalities in Helmet Law States and in Non-Helmet Law States

	Helmet-Law States	Non-Helmet Law States
Motorcycle registrations per 1000 population	1.30	2.60
Fatalities per 10,000 registered motorcycles	3.38	3.05
Fatalities per 1000 accidents	2.93	2.89

Does the data support the proposition that motorcycle helmet laws reduce motorcycle accident fatalities?

Regulation of Energy Markets

Regulation of Electricity Market

Attributes of Electricity

- While electricity can be produced from a number of input sources – nuclear, coal, natural gas, hydropower, wind, solar, etc. – electricity is **highly standardized at the point of production.**

- Electricity is generally **a non-storable product**, which implies that any electricity that is produced needs to be consumed almost immediately, i.e., it is not normally possible to build up stocks and storage electricity.

- Following the point 2, to keep the electricity system in balance and prevent risks of outages or blackout, it is necessary that **supply and demand be kept in constant equilibrium at every point during the day**, i.e., demand has always to equate supply.

- Electricity production is a large provider of greenhouses gases (e.g., Carbone Dioxin) that contributes to pollution and even to climate change.

- The demand for electricity is **highly inelastic in the short term**, i.e., price is not fluctuating in the short-term and consumers of electricity have little room to reduce consumption in the short run.

Primary Energy

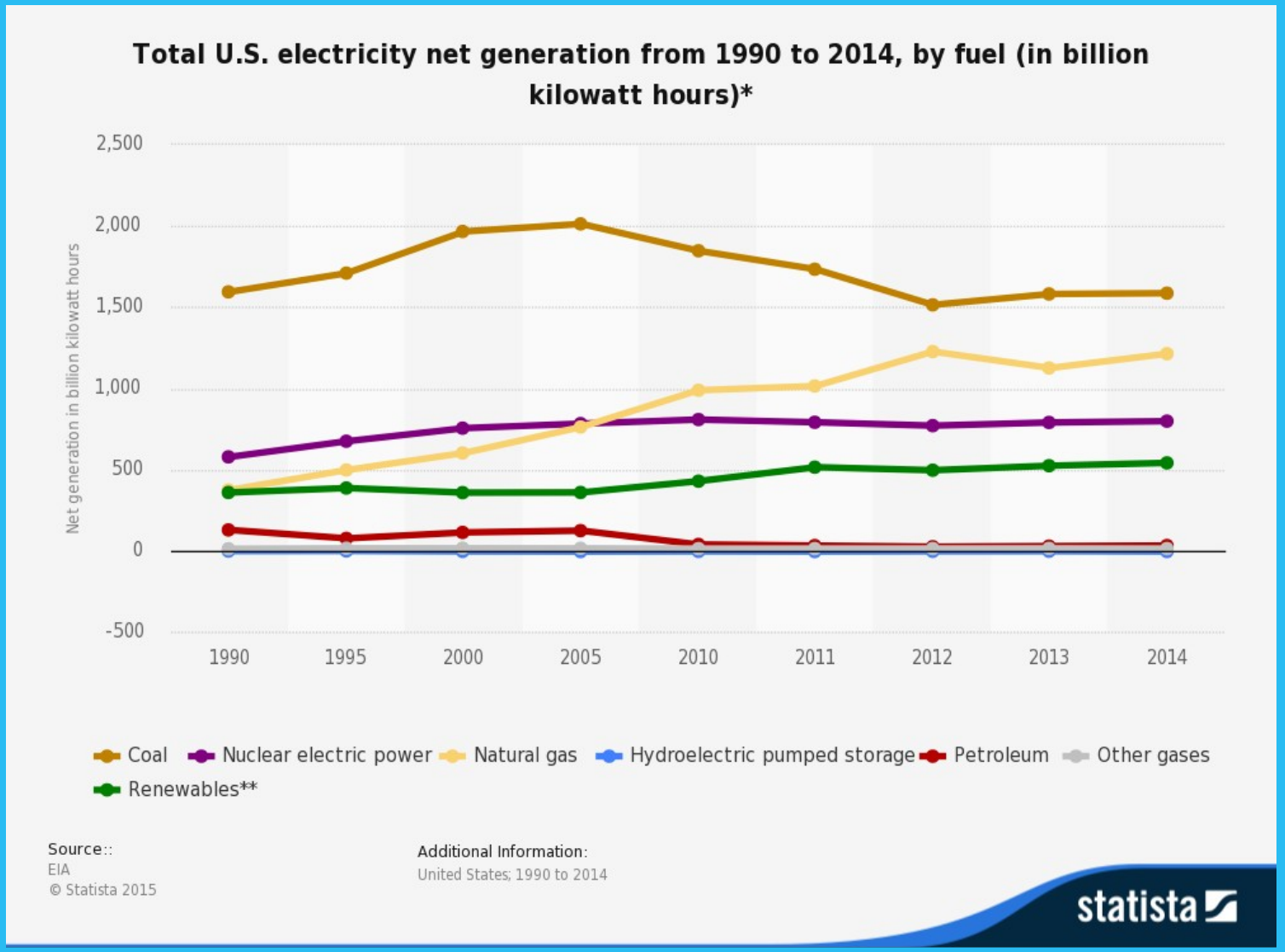
Primary Energy Overview Quadrillion BTU												
	Production				*Trade*			*Stock Change and Other*	*Consumption*			
Year	Fossil Fuels (Coal, Natural Gas dry, Crude Oil, and Natural gas plant liquids)	Nuclear Electric Power	Renewable Energy	Total	Imports	Export	Net Imports		Fossil Fuels (Coal, Natural Gas dry, Crude Oil, and Natural gas plant liquids)	Nuclear Electric Power	Renewable Energy	Total
1950	32.563	0	2.978	35.54	1.913	1.465	0.448	-1.372	31.632	0	2.978	34.616
1955	37.364	0	2.784	40.148	2.79	2.286	0.504	-0.444	37.41	0	2.784	40.208
1960	39.869	0.006	2.928	42.803	4.188	1.477	2.71	-0.427	42.137	0.006	2.928	45.086
1965	47.235	0.043	3.396	50.674	5.892	1.829	4.063	-0.722	50.577	0.043	3.396	54.015
1970	59.186	0.239	4.07	63.495	8.342	2.632	5.709	-1.367	63.522	0.239	4.07	67.838
1975	54.733	1.9	4.687	61.32	14.032	2.323	11.709	-1.065	65.357	1.9	4.687	71.965
1980	59.008	2.739	5.428	67.175	15.796	3.695	12.101	-1.21	69.828	2.739	5.428	78.067
1985	57.539	4.076	6.084	67.698	11.781	4.196	7.584	1.11	66.093	4.076	6.084	76.392
1990	58.56	6.104	6.041	70.705	18.817	4.752	14.065	-0.284	72.332	6.104	6.041	84.485
1995	57.54	7.075	6.558	71.174	22.18	4.496	17.684	2.174	77.262	7.075	6.56	91.032
2000	57.366	7.862	6.104	71.332	28.865	3.962	24.904	2.583	84.735	7.862	6.106	98.819
2001	58.541	8.029	5.164	71.735	30.052	3.731	26.321	-1.883	82.906	8.029	5.163	96.172
2002	56.834	8.145	5.734	70.713	29.331	3.608	25.722	1.211	83.7	8.145	5.729	97.647
2003	56.033	7.96	5.946	69.938	31.007	4.013	26.994	0.989	83.992	7.96	5.948	97.921
2004	55.942	8.223	6.067	70.232	33.492	4.351	29.141	0.721	85.754	8.223	6.079	100.094
2005	55.049	8.161	6.226	69.436	34.659	4.462	30.197	0.56	85.709	8.161	6.239	100.193
2006	55.935	8.215	6.594	70.744	34.649	4.727	29.921	-1.173	84.57	8.215	6.645	99.492
2007	56.436	8.459	6.52	71.415	34.679	5.338	29.341	0.27	85.928	8.459	6.533	101.027
2008	57.59	8.426	7.206	73.223	32.97	6.949	26.021	-0.338	83.178	8.426	7.189	98.906
2009	56.672	8.355	7.641	72.667	29.69	6.92	22.77	-1.3	78.042	8.355	7.624	94.138
2010	58.217	8.434	8.112	74.764	29.866	8.176	21.69	1.026	80.891	8.434	8.066	97.48
2011	60.531	8.269	9.155	77.955	28.748	10.373	18.375	0.571	79.447	8.269	9.059	96.902
2012	62.279	8.062	8.813	79.155	27.068	11.267	15.801	-0.469	77.487	8.062	8.777	94.487
2013	64.173	8.244	9.33	81.747	24.626	11.787	12.839	2.655	79.44	8.244	9.356	97.241
2014	69.379	8.33	9.692	87.4	23.221	12.308	10.913	0.177	80.341	8.33	9.656	98.491
10-month total 2015	59.123	6.972	7.999	74.095	19.663	10.866	8.797	-1.378	66.361	6.972	7.988	81.514

Source : EIA - US Energy Information Administration

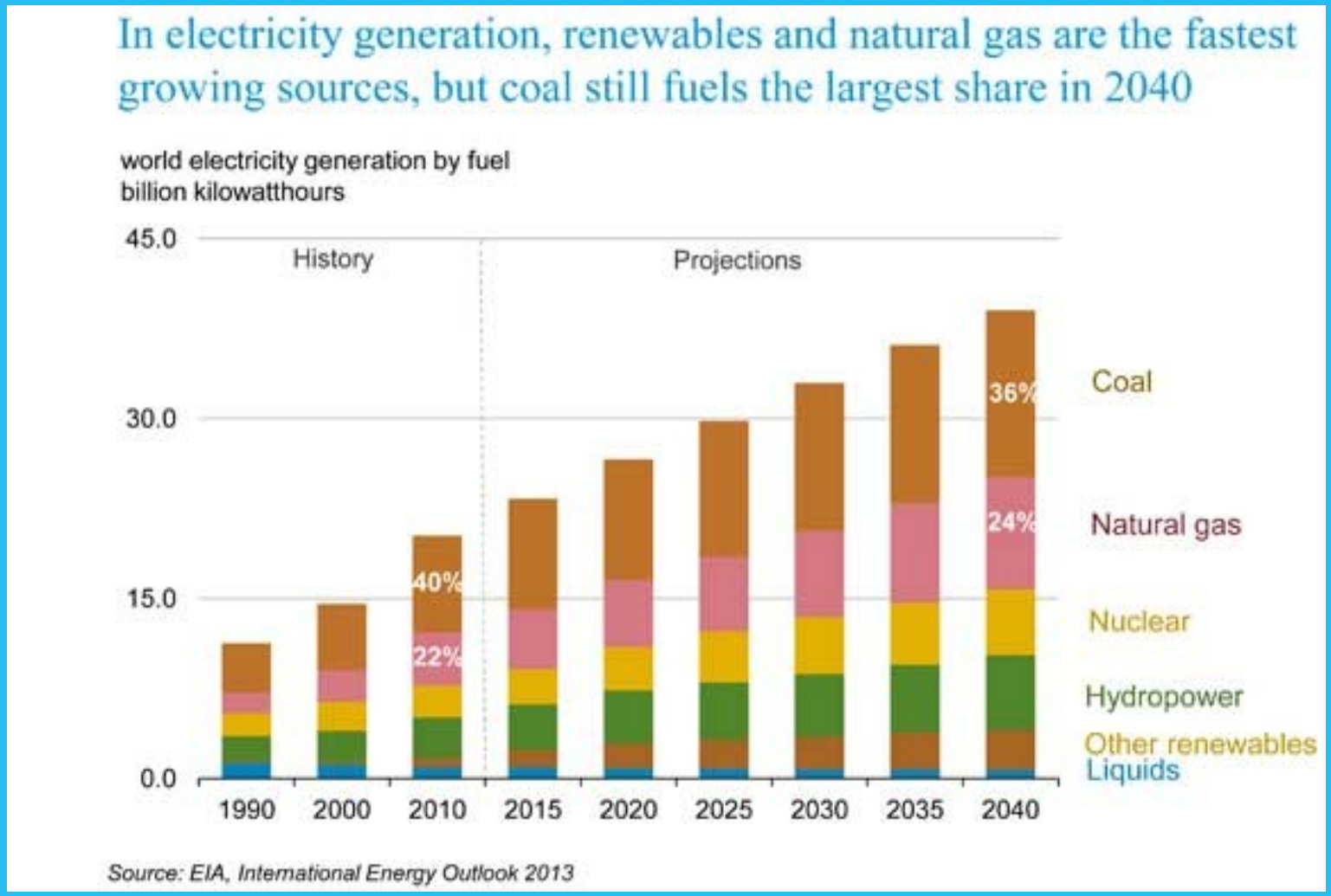
Electricity Net Generation

Year	Coal	Petr											
1950	154.520	33											
1955	301.363	37											
1960	403.067	47											

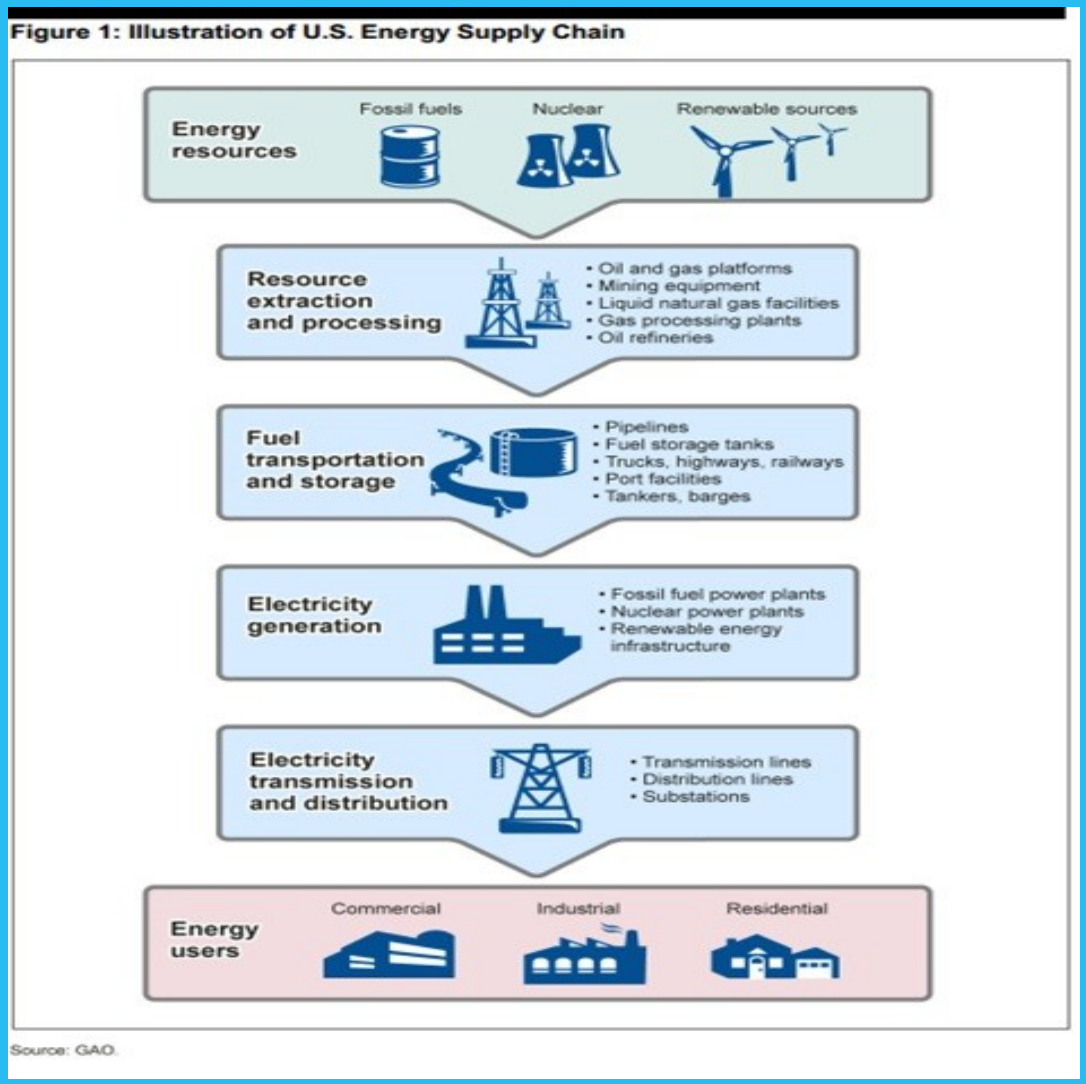
Sources of Electricity Generation



Sources of Electricity Generation



Electricity Industry Structure

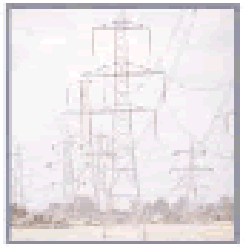


Electricity Industry Structure

Key Elements Within The Electricity Industry

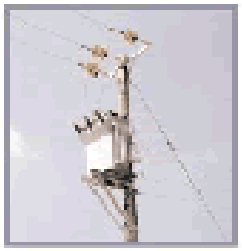
Grid - connected Generation

Major power stations generate electricity which flows directly into the transmission network.



Transmission

National Grid transmits electricity around a nationwide transmission network of high voltage 400 KV and 275 KV lines.



Distribution

Distribution network operators (DNOs) carry electricity through local networks of 132 KV and lower voltage lines.

Distributed Generation

Distributed generation plant, including most renewables and CHP, connect to their local distribution network. They may also serve end-users directly.

Local Suppliers

Local suppliers compete to sell power to businesses and domestic consumers.

Electricity Structure and Regulation

Electricity Markets: Restructuring Utilities

- Beginning in about 1990, UK began the restructuring of their utilities to allow direct access by letting customers choose a power supplier competitively and pay the utility only for distribution service.

- Over the last two decades, the old idea that electric power generation, transmission and distribution represent a "*natural monopoly*" best handled centrally, has given way to a general consensus among policy-makers, regulators, industry analysts and economists that the generation and retailing elements of the power supply industry would be more efficiently delivered by firms operating in freely competitive energy markets.

- A number of factors have contributed to this change in theoretical stance, and become forces for change. In addition to the current focus on economic efficiency, these forces include a shortage of capital in rapidly industrializing nations, recent technological and information management innovations, emerging global competition, and consumer demand for more sophisticated and diversified products and services.

- Trevino, Luis Liberalization of the Electricity Market in Europe: An overview of the electricity technology and the market place. January 2008 MIR-Working Paper-2008-002

Electricity Markets: Restructuring Utilities

The electric power industry in European Union is undergoing profound regulatory and operational changes.

The underlying rationale behind these transformations is to move only highly monopolized vertically-integrated industry from a centralized operation approach to a competitive one. European energy liberalization is underway to develop an internal market for electricity. Energy initiatives for EU are occurring in conjunction with measures to implement energy efficiency, renewable energy, and emissions trading of greenhouse gases.

In response to EU Directives and policies and national initiatives, the EU market is evolving at the same time as environmental measures for energy are being considered.

Countries of the EU have restructured their electricity markets. The restructuring process has focused on legal and organizational issues, but it doesn't contain specific prescriptions for economic design of the market. Apparently, the lack of regulatory framework harmonization is particularly harmful to the economic design of the market handling market power problems.

EU Electricity Markets: The Future

FINGRID

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EU energy union:

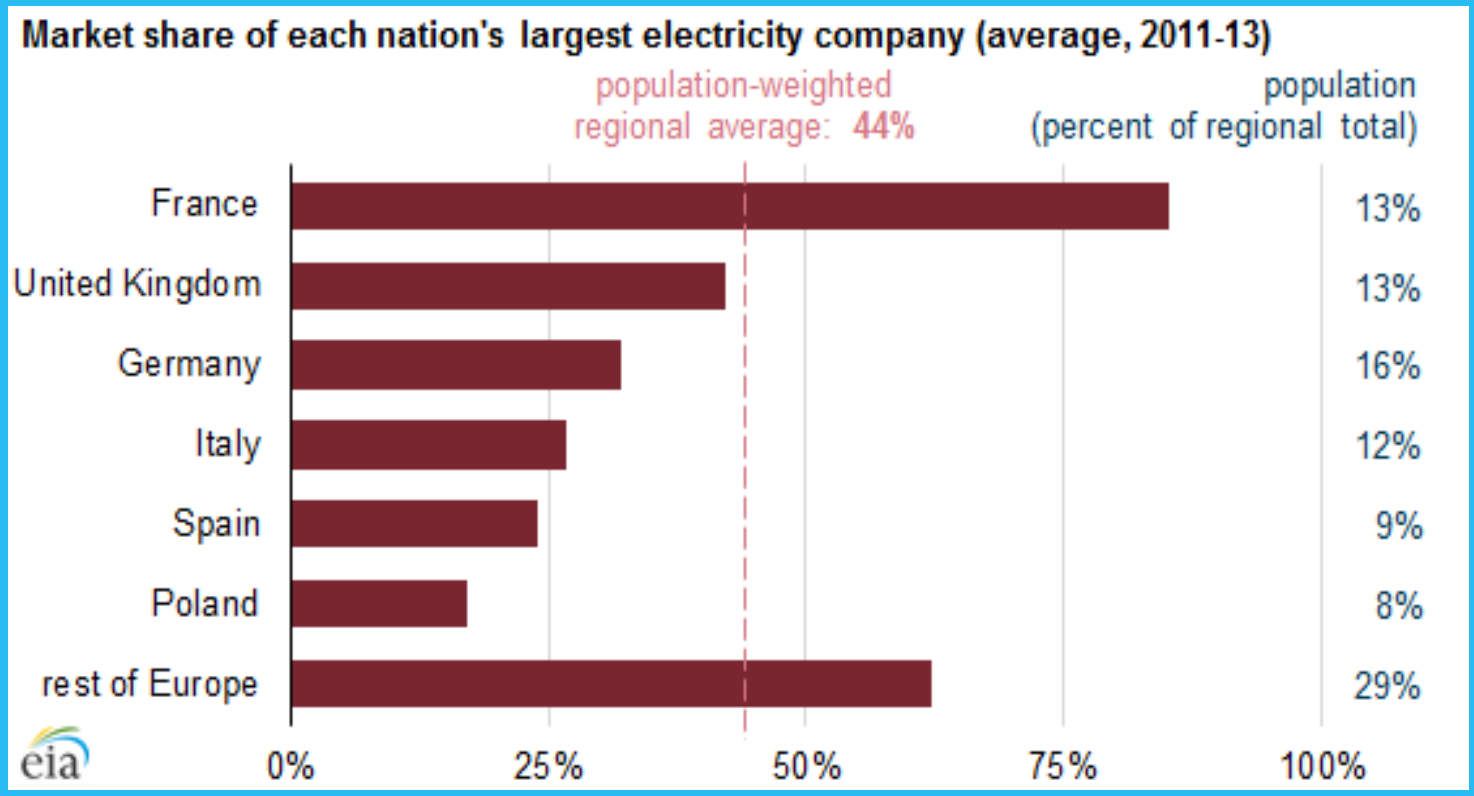
Towards a fully developed internal electricity market

- Integrated markets in all time frames and participation of both large and small resources
  - Stronger link between the wholesale and retail prices
  - Integration of flexible resources
- Energy transition
  - Market rules suited to intermittent production
  - Transition made at minimum cost
- Correct price signals are crucial
- Market-based solutions
  - subsidies
  - capacity mechanisms
- Empowering customers

ENTSO-E member countries 2014:
- 34 countries and about 740 million citizens served
- Generation 1024 GW
- Transmission lines 307 000 km
- Demand 3210 TWh/year
- Exchanges about 424 TWh/year

November 2015 Jukka Ruusunen

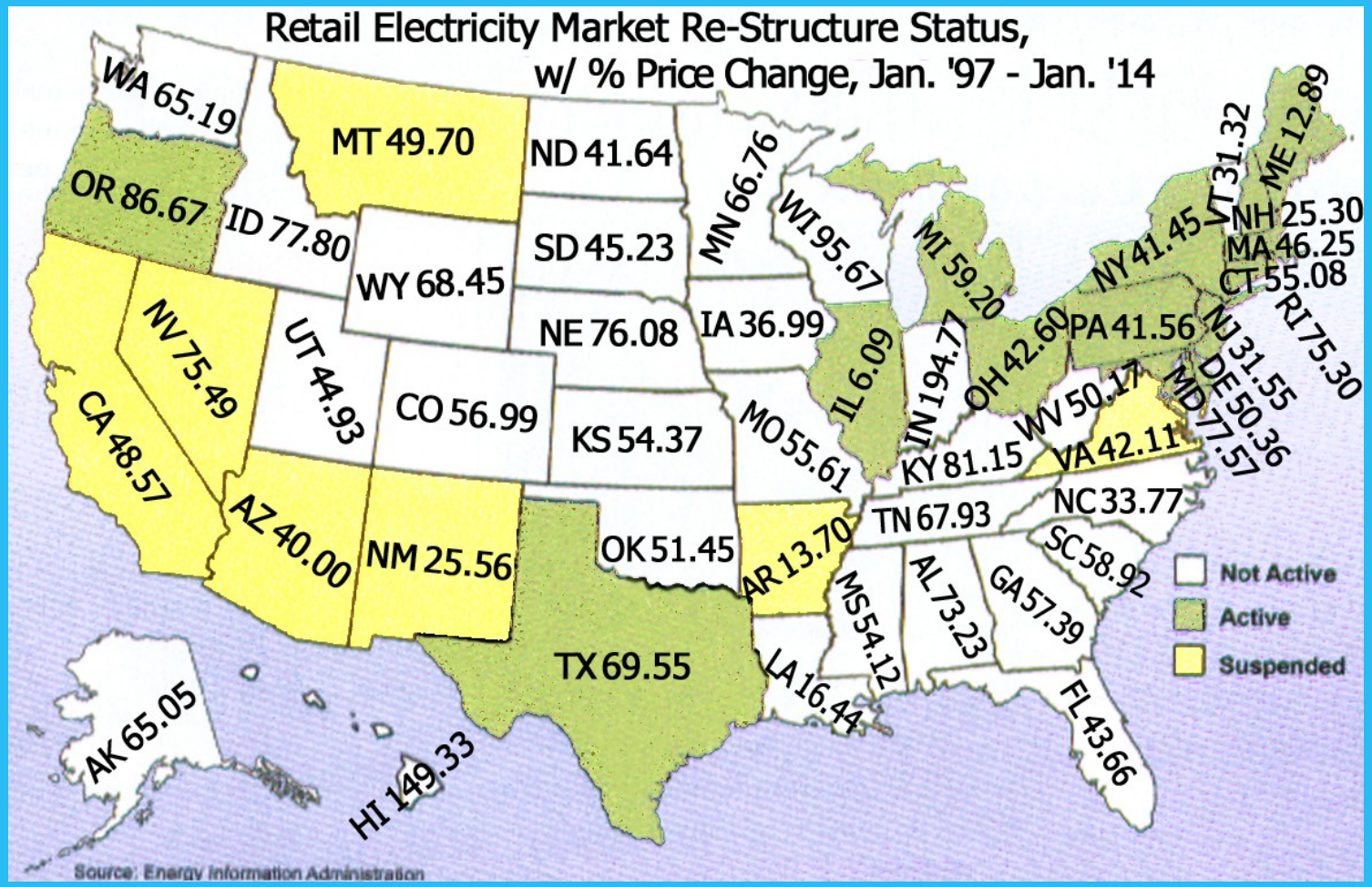
EU Electricity Markets: The Present



Electricity Markets: Restructuring Utilities

- In 1994, the US started its own restructuring following the British model.
- The current legal framework in the USA is based on the principle that certain industries – Electricity and natural gas- are "affected with public interest" (term used by the Supreme Court in 1877, Munn v. Illinois).
- A competitive Wholesale generation needs a adequate transmission capacity. Under restructuring, utilities may provide combined billing for both the **distribution service** (which they provide) and for the **power** (which is supplied by others).
- States made provisions for a **default supply - i.e., basic service** - for those consumers that do not select a competitive supplier, or whom the competitive market simply does not serve.
- A significant percentage of large industrial-power users are direct-access customers, most residential and small-business consumers are served by the default supply option.

Status of the Restructuring of Electricity Markets in the USA



Status of the Restructuring of Electricity Markets in the USA

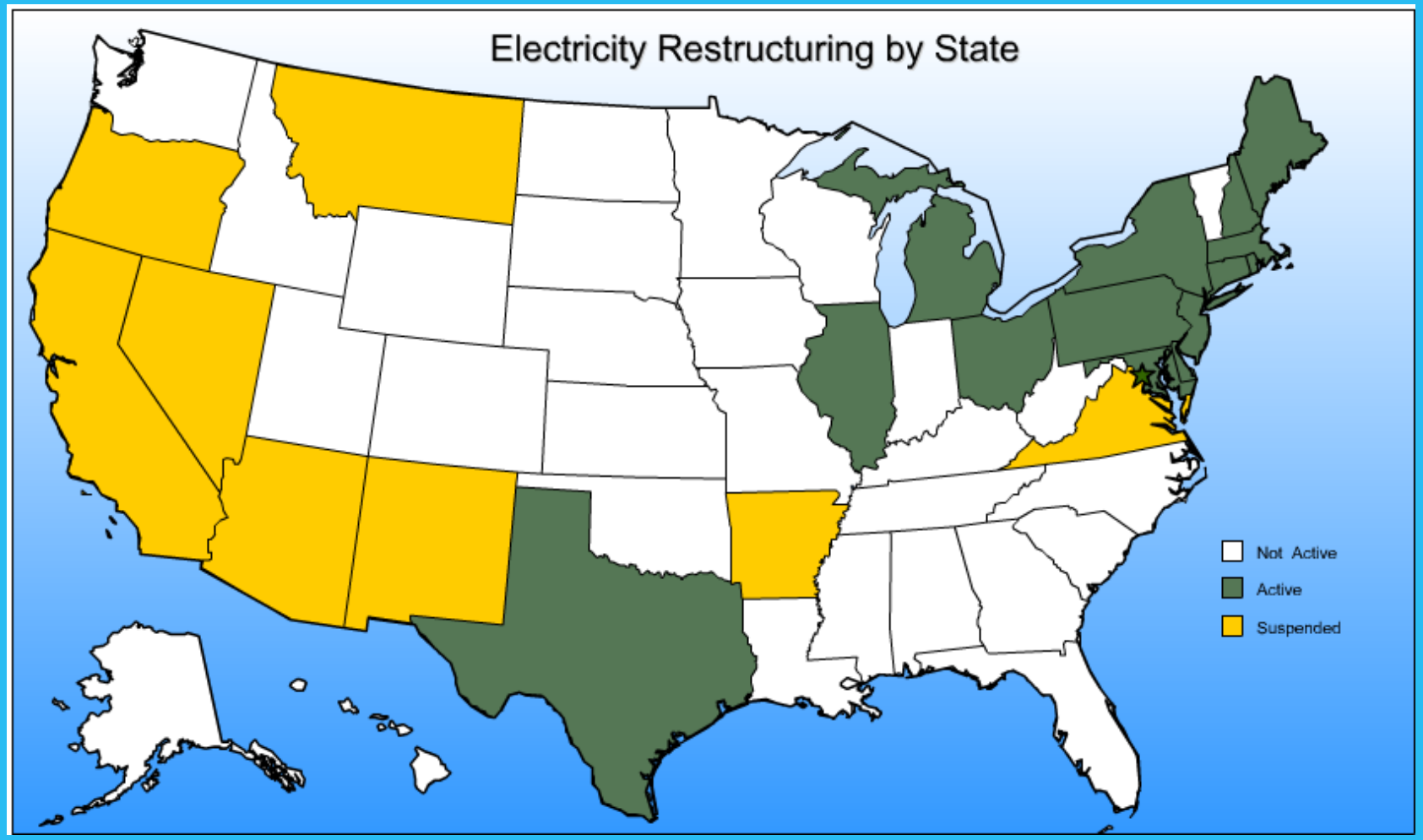
- The map shows which states were actively restructuring, suspended restructuring, or did not restructure their respective energy markets.

- "…While electric rates have risen in every state since the '90s, they have risen more in the states that restructured than in the ones that did not." Dave Hoopman "You can't go back: Better infrastructure won't make restructuring a winner", March 2014 issue of *Wisconsin Energy Cooperative News*.

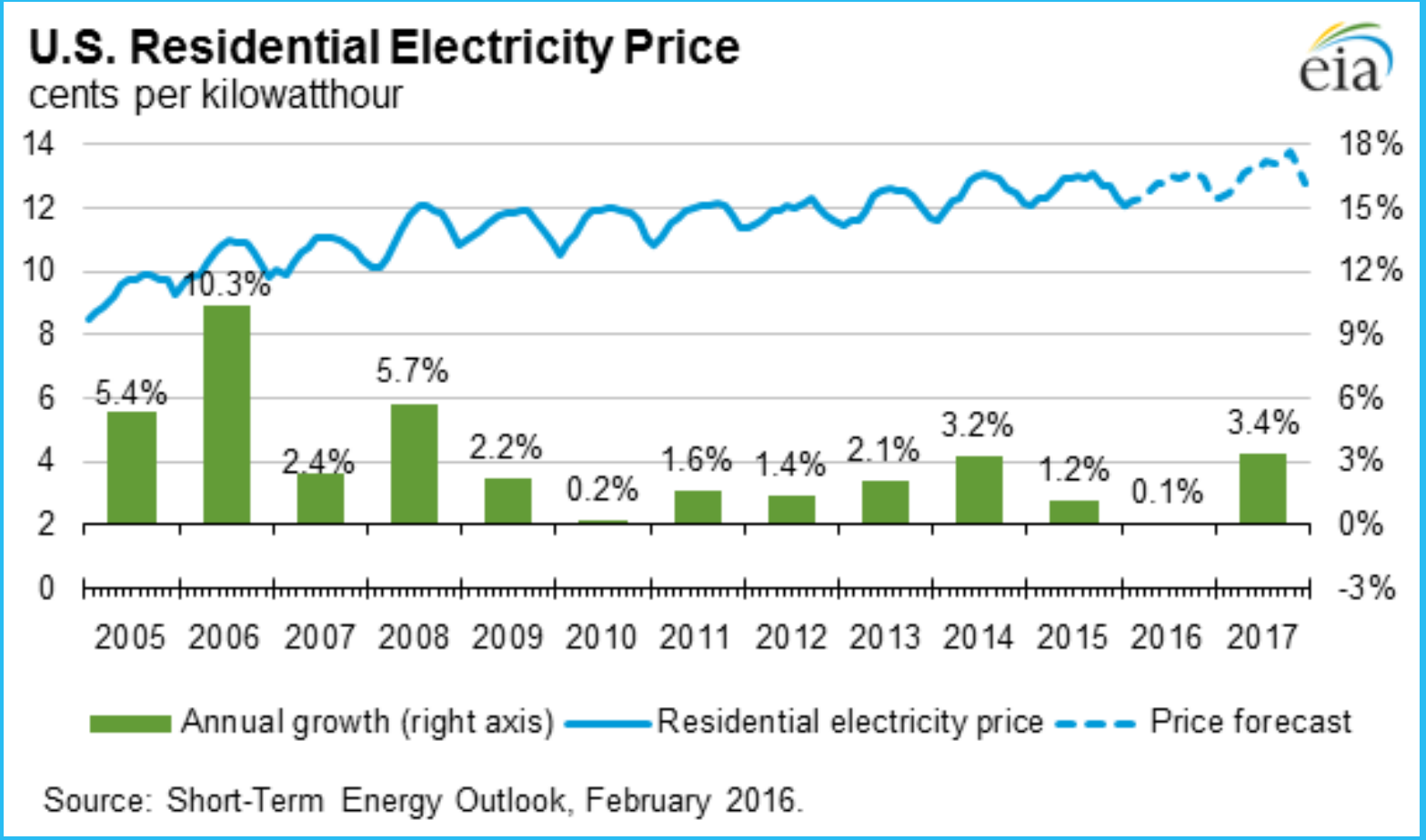
- A combination of events such as the energy debacle in California in early 2000 and the perception by consumers that the benefits of retail choice are small seemed to have limited the interest in retail competition among those states that haven't already enacted retail competition.

- Balkanization of the US Electricity Market.

Electric Utility Regulation Remains a Hybrid System at the Retail Level



Electricity Prices



Unbundling

- Policy implemented by State legislatures and Commissions to disaggregate generation from delivery
- Two Models – "Functional" unbundling (G and T are separate but under common ownership); and "Structural" unbundling (G and T placed in separate corporations)
- Creation of affiliate interest issues – precursor of more systematic market monitoring by Commissions

PURPA Public Utility Regulatory Policies Act (1978) and Energy Policy (EP)Act (1992)

- PURPA and EP promote energy conservation (reduce demand), support greater use of domestic clean and renewable energy (increase supply), increase energy efficiency.

- **EP Act --** The **Energy Policy Act** (1992) is a United States Government Act. Congress passed it. EP Act set goals, created mandates, and amended utility laws to increase clean energy use and improve overall energy efficiency in the United States.

- The Act consists of twenty-seven titles detailing various measures designed to lessen the nation's dependence on imported energy, provide incentives for clean and renewable energy, and promote energy conservation in buildings.

- **State implementation of 5 new standards:**

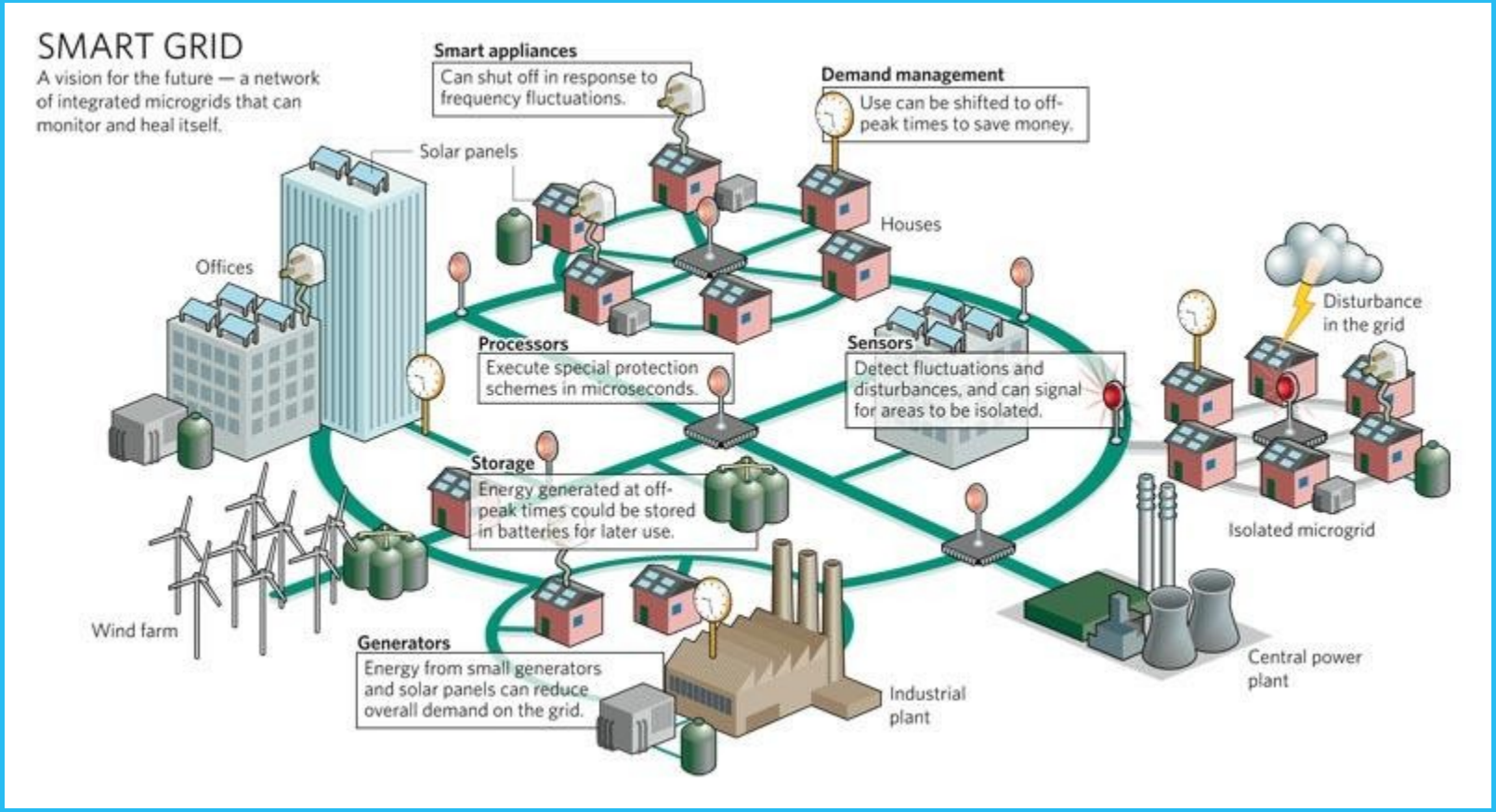
1. **Net metering**
2. **Fuel Diversity**
3. **Generation Efficiency**
4. **Smart Metering**
5. **Interconnection**

Highlights of American Recovery and Investment Act ("Stimulus")

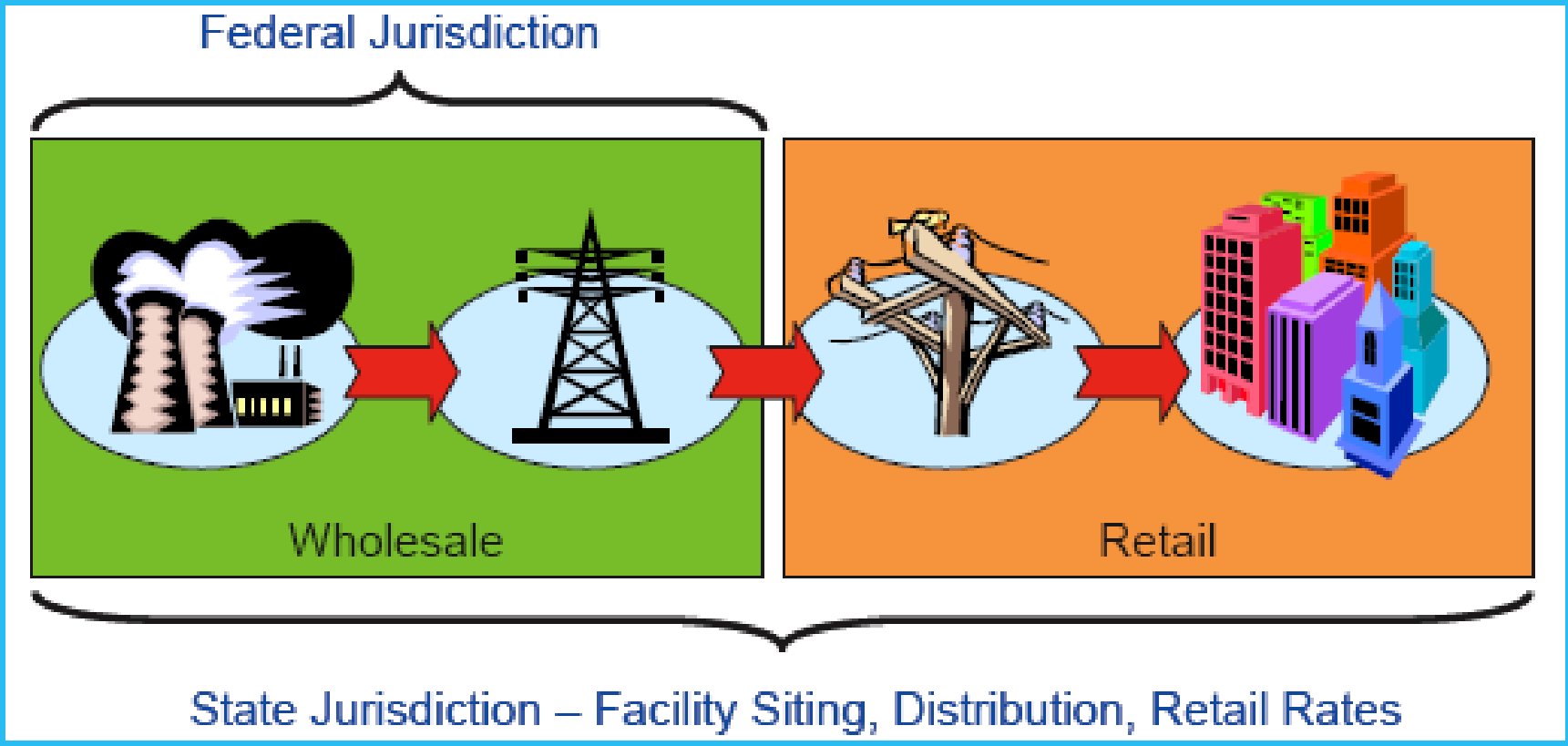
Energy-related Funding

- Smart Grid Deployment
- Broadband Deployment
- Transmission Planning
- Energy Efficiency – "Green Jobs"
- Regulatory Support – Training, Capacity Building

Electricity Markets: the Future that is happening



Electricity Industry and Regulation



Source: ISO-NE

Electricity Industry and Regulation

- Regulation is intended to protect the "public interest," which includes various elements, e.g., universal service, safety, public health.

- Utilities are expected to offer service to anyone who requests it and can pay for it at the regulator's (or government's) approved prices. In this sense, service is "universal." A connection charge may be imposed if providing service involves a significant expenditure by the utility, but even that is subject to regulation and, in many cases, is subsidized in some manner by other customers or taxpayers.

- The natural monopoly concept still applies to at least the network components of utility service (i.e., to their fixed transport and delivery facilities). However, even where there is sufficient competition among the providers of energy supply and/or retail billing service, the utility sector's critical role in the infrastructure of modern, technological society justifies its careful oversight.

Regulation Replaces Competition as the Determinant of Prices

- For most businesses, the prices of goods or services that are sold are determined by what the customer or market will bear. In economic terms, markets will "clear" at the point where marginal costs equal the value that consumers, in the aggregate, set for the good or service; that is at the point where supply intersects with demand.

- A different approach to price-setting is required for utilities, since competition and free entry into markets does not exist in natural monopolies. Regulators use a cost of service approach to determine a fair price for electric service, by which the aggregate costs (including a reasonable return of, and on, investment) for providing each class of service (residential, commercial, and industrial) are determined.

- Prices are set to recover those costs, based on the sales volumes for each class.

What Do the State Regulatory Commissions Do?

- **Traditional Role** - Regulate the Rates, Terms and Conditions of Service of "Fixed Utilities" – Telecommunications, Electricity, Natural Gas, and Water
- **New Role** - Manage the Development of Competitive Markets for Energy Services; Monitor Market Performance
- **Even Newer Role** - Help Ensure Safety, Reliability and Security of Utility-based Critical Infrastructure Facilities; Factor Environmental Factors into Utility Planning and Operation
- **Coordinate** - State Policies and Procedures with Federal Counterparts – FERC (Federal Energy Regulatory Commission and the FCC (Federal Communications Commission)

Key Characteristics of Regulatory Commissions (1)

Autonomy

I. Appointment of Commissioners

- Staggered terms
- Quality criteria
- Who makes appointments (i.e., the most common process for selection of State regulatory commissioners is for the Governor to appoint the person and he/she then be subject to approval of the State Senate).

II. Exemption from civil service/government salary rules

III. Financing Commission

- License fees
- Budget approval

IV. Removal from office – for cause only

Key Characteristics of Regulatory Commissions (2)

Authority

I. Full Tariff Authority

II. License Issuance

III. Market (design)

IV. Information Collection, Monitoring, Enforcement

Key Characteristics of Regulatory Commissions (3)

Accountability

I. Public Participation & Transparency

II. Annual Report & Audit

III. Appeal of Decisions to Courts Only or International Arbitration

IV. Budget Review

V. Code of Ethics

VI. Removal from Office – for cause only

Key Characteristics of Regulatory Commissions (4)

Ability/Capacity

I. Capable Trained Staff

II. Procedures & Management

III. Sound Tariff Methodologies & Prices

IV. Licensing Practices

V. Monitoring & Enforcement

State and Federal Jurisdiction

Authority	Generation	Transmission	Distribution	Retail Customer Interface
Federal	➢Wholesale sales ➢Ancillary services ➢Merger authority ➢No authority over facilities	➢Rates, terms, conditions for wholesale and unbundled retail interstate transmission ➢Transmission reliability rules ➢Siting in national interest corridors (1 year after filing)	N/A	N/A
State -traditionally regulated	➢Rate-based facilities ➢Adequacy of generation ➢Reserve margins ➢Siting	➢ Rates, terms, conditions of bundled retail transmission or purely intrastate transmission ➢Siting	➢Retail rates ➢Terms ➢Conditions ➢Service quality ➢Outage mgmt. ➢Outage indices ➢Portfolio standards	➢Billing ➢Collection ➢Disconnection policy ➢Metering ➢Demand-side mgmt.

Source: NRRI, Electric Tutorial, 2006.

State and Federal Jurisdiction cont.

Authority	Generation	Transmission	Distribution	Retail Customer Interface
State -restructured	➢Siting	➢Siting ➢Unless purely intrastate, all transmission is unbundled, and so is under FERC authority	➢Same authority as traditionally regulated states, plus: ➢Standard offer service (a.k.a. provider of last resort)	➢Same authority as traditionally regulated states
RTO (Authority only over transmission – delegated from FERC)	➢N/A	➢Operational authority over transmission in a region ➢Maintenance of short term reliability ➢Administration of own tariff and pricing system ➢Management of congestion ➢Plan and coordinate transmission upgrades and additions ➢Market monitoring ➢Operate computerized site for sharing available capacity ➢Contract for a supplier of last resort for ancillary services ➢Address parallel path flow issues		

Source: NRRI, Electric Tutorial, 2006.

Energy Regulation: Federal Responsibilities

The Federal Energy Regulatory Commission (FERC) is composed of up to five commissioners who are appointed by the President of the United States with the advice and consent of the Senate. Commissioners serve five-year terms, and have an equal vote on regulatory matters. The FERC:

- regulates the interstate transmission of electricity, natural gas, and oil;
- reviews proposals to build liquefied natural gas (LNG) terminals and interstate natural gas pipelines;
- licenses hydropower projects.

Energy Regulation: State Responsibilities (1)

- Regulation of retail electricity and natural gas sales to consumers
- Approval for the physical construction of electric generation, transmission, or distribution facilities
- Facility siting of electric generation and transmission
- Regulation of activities of the municipal power systems, federal power marketing agencies, and most rural electric cooperatives

Energy Regulation: State Responsibilities (2)

- Regulation of local distribution pipelines of natural gas
- Resource planning, including regional activities
- Power supply acquisition
- Infrastructure investment, including security measures
- Environmental impacts of utility operations
- Market monitoring

State Regulatory Authority

- **State public service commissions**
  - **Retail rates- Tariffs**
    - In traditional states: revenue requirement, cost allocation, and rate design for each customer class
    - The dominant methodology has been cost based rate of return regulation
    - In restructured states: provider of last resort or standard offer service rates for non-choice customers

Source: NRRI, Development & Evolution of Electric Deregulation, March 2008

Traditionally Structured States Operating in Vertically Integrated Markets

- State Regulators Use Cost-based, Average Price Methodologies – Southeast, Southwest, Northwest
- Integrated Resource Planning of All Aspects of Utility Operations – Generation, Transmission, Distribution, Load Management/Demand Response
- Some Regional Coordination – WECC; Southern States Energy Board

Regulatory Structure – Things to Remember

1. Regulation is based on the principle that electricity sector is affected with public interest

2. Various regulators in the electricity field: Electric Utilities are Regulated at both State and Federal Levels: FERC regulates wholesale sales and interstate transmission services; States regulate everything else.

3. Environmental Protection Agency (EPA) regulates all the environmental aspects (e.g., sites of generation and transmission).

4. Generation is competitive;

5. Economic regulation focuses on two models: “Organized Markets” and “Vertical Integration”

6. Setting of tariffs and electricity prices is still central for regulation.

Setting of Tariffs

- The Regulatory Commission follows an analytical process in setting tariffs.

- Commissions are supposed to set tariffs that provide utilities an opportunity to earn a reasonable rate of return after expenses, thus they need to determine the utility's costs for providing service in their state.

- The are at least three regulatory regimes to set tariffs:
  1. Cost Regulation (COSR);
  2. Performance –Based Regulation (PBR);
  3. Yardstick Competition.

Cost of Service Regulation (COS)

- The Cost of service Regulation (COSR)- otherwise called the cost to do business - is the most common - includes the costs associated with the so-called "**Rate Base**" (the utility's investment in facilities and related capital costs, interest on debt and return on equity), operating expenses (labor, fuel, taxes, and other recurring costs) and the capital structure of the utility company.

Rate Regulation: the *Rate Base*

- The *"Rate Base"* is the total of all long-lived investments made by the utility to serve consumers, net of accumulated depreciation. It includes buildings, power plants, fleet vehicles, of office furniture, poles, wires, transformers, pipes, computers, and computer software.

Calculation of the ***Rate Base***:

Total Plant in Service at Original Cost (TC)
- Accumulated Provision for Depreciation (AD)
= Net Plant in Service (NP)
+ Working Capital Allowances (WC)
- Accumulated Deferred Taxes (ADT)
+/-Other Adjustments Approved by the Commission (OA)
= Rate Base (RB) or Capital Investment

Rate of Return

- Utilities are allowed to earn a regulated annual rate of return on their "*Rate Base (RB)*".

- Legal precedent requires that the Rate of Return (R) be sufficient to allow the utilities to attract additional capital under prudent management, given the level of risk that the utility business faces.

- Two key U.S. Supreme Court decisions, known as Hope41 and Blue eld42, set out the general criteria that Commissions must consider when setting rates of return.

Utility Total Revenue Requirement

- *Utility Total Revenue Requirement (UTRR)= Operating Expenses (OE) + (Rate Base)* R*

- R = Rate of Return a Utility Company is allowed to earn on its capital investment or on its Rate Base.

- Operating Expenses = the Utility Company's operating expenses, e.g., wages, salaries, supplies, maintenance, taxes, and research and development, must be recouped if the utility is to stay operational. Operating expenses often represent the largest component of the revenue requirement, and the easiest to determine.

Capital Structure

- The Utility Company needs financial resources to operate.
- The cost of these resources is different and **their mix** determine the Rate of Return of the Utility Company.
- The Commission **rules** on the **capital structure and the rate of Return,** which constitutes essential elements in the calculation of the Revenue Requirement for the Utility Company.
- There are **several different sources of funding** that provide capital for the utility, and the Commission sets different rates of return for each source (e.g., **shareholder equity, preferred equity, bondholder debt**).

Capital Structure

- **Debt** receives a lower rate of return than **equity,** because the debt holders bear less risk and they have the first call on the utility's revenues after operating expenses, before any dividends can be paid to stockholders.

- **Short-term debt** also generally carries lower interest rates, because the lender is not making a long-term commitment to the Utility Company.

- In addition, because the utility is subject to income tax on its return on equity, and gets an income tax deduction for its interest payments on debt, a **higher share of equity implies higher electricity prices for consumers.**

Capital Structure and Rate of Return

Rate of Return Calculation - Example			
Type of Source of Capital	Percentage	Cost of Capital	Weighted Cost of Capital
Common Equity	45.00%	10.00%	4.50%
Preferred Equity	5.00%	8.00%	0.40%
Long Term Debt	45.00%	7.00%	3.15%
Short Term Debt	5.00%	5.00%	0.25%
Other	0.00%	0.00%	0.00%
Rate of Return	100.00%		8.30%

Capital Structure and Rate of Return

Changing the Mix: Less Equity and More long-term Debt

Rate of Return Calculation - Example			
Type of Source of Capital	Percentage	Cost of Capital	Weighted Cost of Capital
Common Equity	10.00%	10.00%	1.00%
Preferred Equity	5.00%	8.00%	0.40%
Long Term Debt	60.00%	7.00%	4.20%
Short Term Debt	25.00%	5.00%	1.25%
Other	0.00%	0.00%	0.00%
Rate of Return	100.00%		6.85%

Capital Structure

- U.S. utilities have between 40%-60% debt, and between 40%- 60% equity.

- In Canada, equity ratios are more typically around 30%-35%, reflecting higher investor confidence in the certainty of utility earnings, so the utility can more easily attract bond investors and use lower-cost debt to provide a higher percentage of its total capital.

- In Continental Europe that has a tradition of State – Owned utilities the level of equity is higher, up to 90%.

Capital Structure, Rate of Return, Tariffs and Electricity Prices

- Tariffs and electricity prices stem from the *Utility Total Revenue Requirement,* which depends on the established rate of return.

- *Utility Total Revenue Requirement is then converted into tariffs or electricity prices charged to the final users of electricity.*

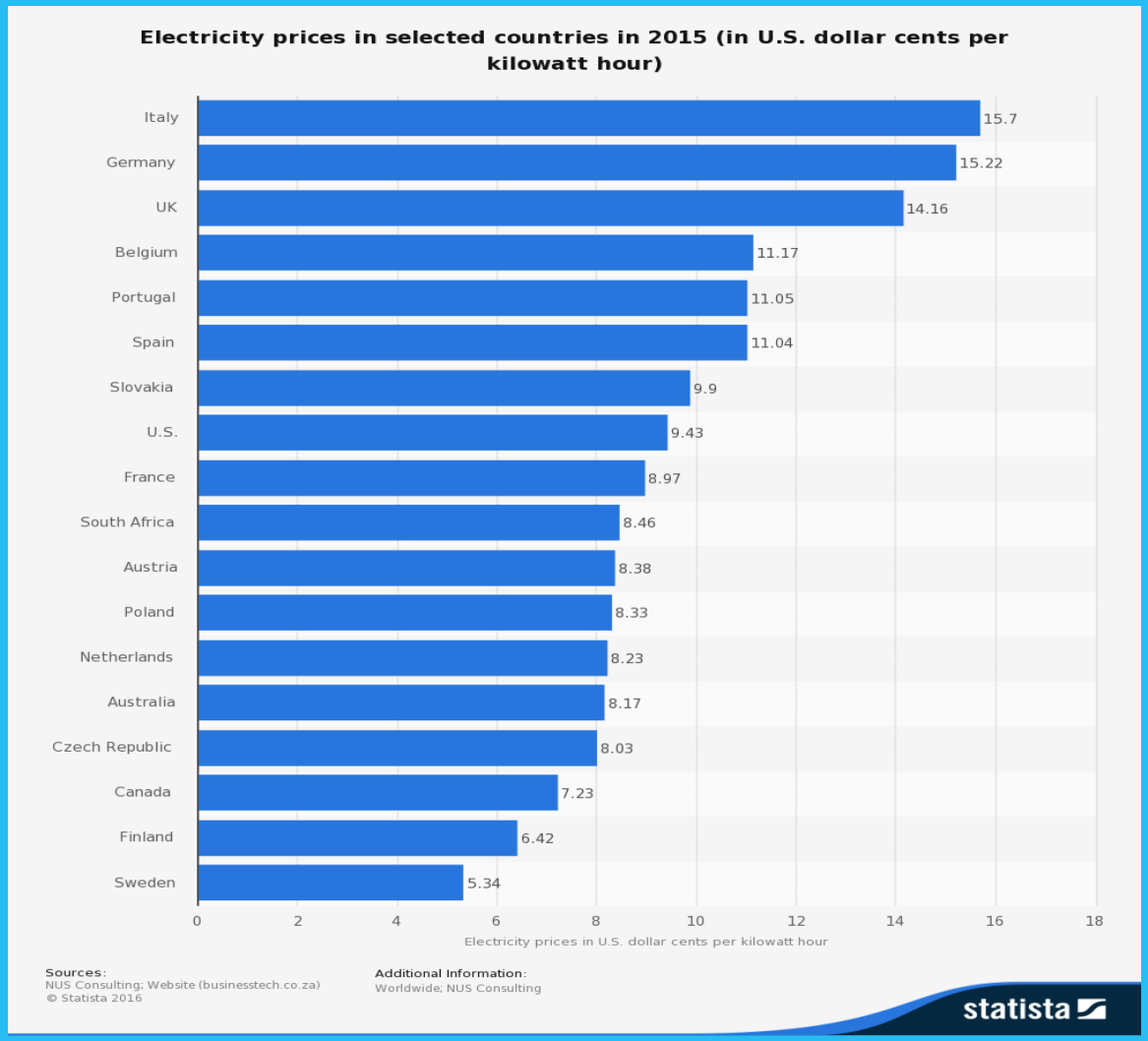
- Tariffs can take different forms including prices for peak or off-peak periods (sometimes referred to as time-of-use-rates).

- The establishment of Tariffs and electricity prices is a complex process that involves many steps and several interests that may lead to different outcomes in terms of tariffs (e.g., a capital structure with more debt and less equity normally implies a lower rate of return for the Utility, and in turn a lower Utility Total Revenue Requirement *and thus lower tariffs and* prices for electricity).

- Electricity prices, or tariffs, best serve the public interest when established through a process that is transparent, accountable, and participatory. Procedural clarity involves identifying legal frameworks, key decision-makers and procedures for setting and revising tariffs, and procedures and forums allowing consumers and other stakeholders to participate in decisions, appeal decisions and seek redress of grievances.

- Shantanu Dixit, Ashwini Chitnis, Davida Wood, Bharath Jairaj and Sarah Martin. 10 Questions to Ask about Electricity Tariffs. World Resource Institute. April 2014

Electricity Prices in Various Countries



Thank You!

Thanks

- **Principles of Microeconomics, Dr. McCaleb**
- **Charles Gray, Executive Director, NARUC, National Association of Regulatory Utility Commissioners.**

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Appendix

Electricity – Implementation of EPAct and EISA

Big Sets of Issues

- Reliability
- Infrastructure/Smart Grid
- Transmission Access/Wholesale Competition
- Energy Efficiency
- Increased Funding for Low Income Home Energy Assistance Program (LIHEAP)
- Third party access: Implementation of principle of non-discrimination

Basis and Goals of Competition

System where market forces make economic decisions, instead of regulators or central planners

- Attract Private Investment
- Increase Economic Efficiency
- Improve Service & Reliability
- Lower Prices
- Promote Customer Choice

Expectations of Strategic Investors

- Commercial Infrastructure (economic, regulatory, financial, legal)
- Predictable Rules
- Open & Transparent Decision-Making by Regulator (independence, public participation, objective, written decisions, appeal process)
- Non-Discrimination (Liability, Taxes, Profit Repatriation)
- Absence of Corruption or other Market Distortions
- Free Capital Flows
- Rules of Law/Justice System
- Adequate and Predictable Risk Management

Benefits of Cross-border & International Trade

- Improved efficiencies
- Fuel diversity
- Non-coincident peaks
- Greater system stability

What is NARUC?

- The National Association of Regulatory Utility Commissioners (NARUC) is a non-governmental non-profit organization founded in 1889.
- Members of NARUC include the state Commissions (government agencies) engaged in the regulation of American utilities and carriers in the 50+ states & territories. The Federal Energy Regulatory Commission and the Federal Communications Commission are also members.
- NARUC has Associate Members in over 20 other countries.
- NARUC member agencies regulate electricity, natural gas, telecommunications, and water utilities

What does NARUC do?

NARUC is not a *regulatory agency itself*; *it* provides:

- Forums and activities for the exchange of experience/policy, legal support, advocacy, and other forms of regulatory support.
- Education (Conferences, Trainings, Technical Workshops)
- Advisory Services & Outreach to Congress, Federal Agencies, Other Stakeholder Groups (testimony, resolutions/policy positions, briefings, etc.)
- Research & Information Exchange (Publications, Grant Projects)
- International Programs: regulatory partnerships, capacity building, technical assistance, study tours, job shadow placements (Funded by USAID, DOE, EPA, USTDA).

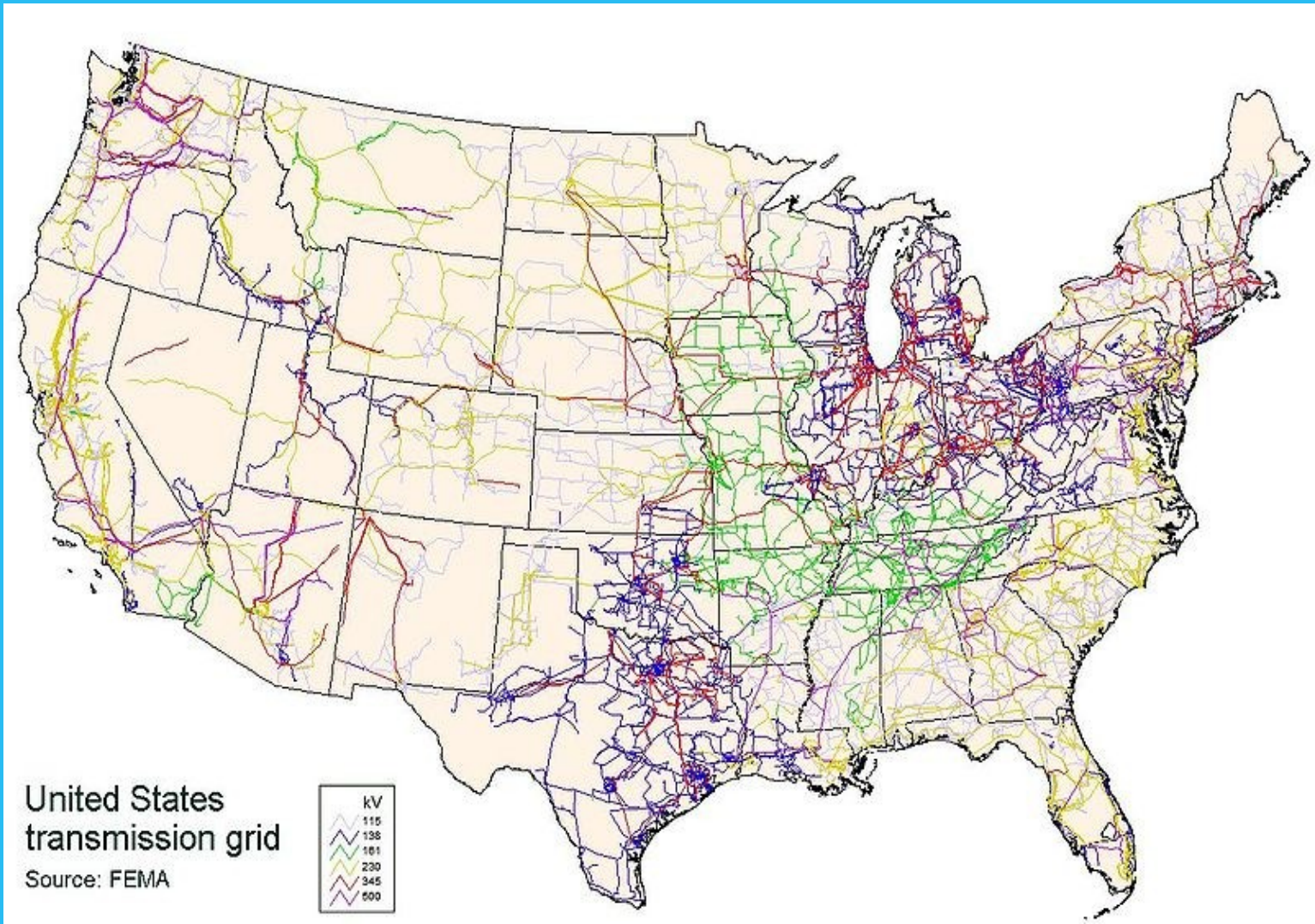
FERC / NARUC Collaborative

- **NARUC and FERC Participate in two "Collaborative Dialogues" on Issues of Common Concern**

  - **Demand Response – Focus on Coordinating Implementation of DR between Wholesale (FERC-regulated) and Retail (State-regulated) Markets**
    http://www.ferc.gov/industries/electric/indus-act/smart-grid/FERC-NARUC-collaborative.pdf

  - **Smart Grid – Focus on Coordination of State and FERC Policies to Promote/Regulate Investment in Smart Grid Technologies**
    http://www.ferc.gov/industries/electric/indus-act/smart-grid/FERC-NARUC-collaborative.pdf

U.S. Transmission Grid

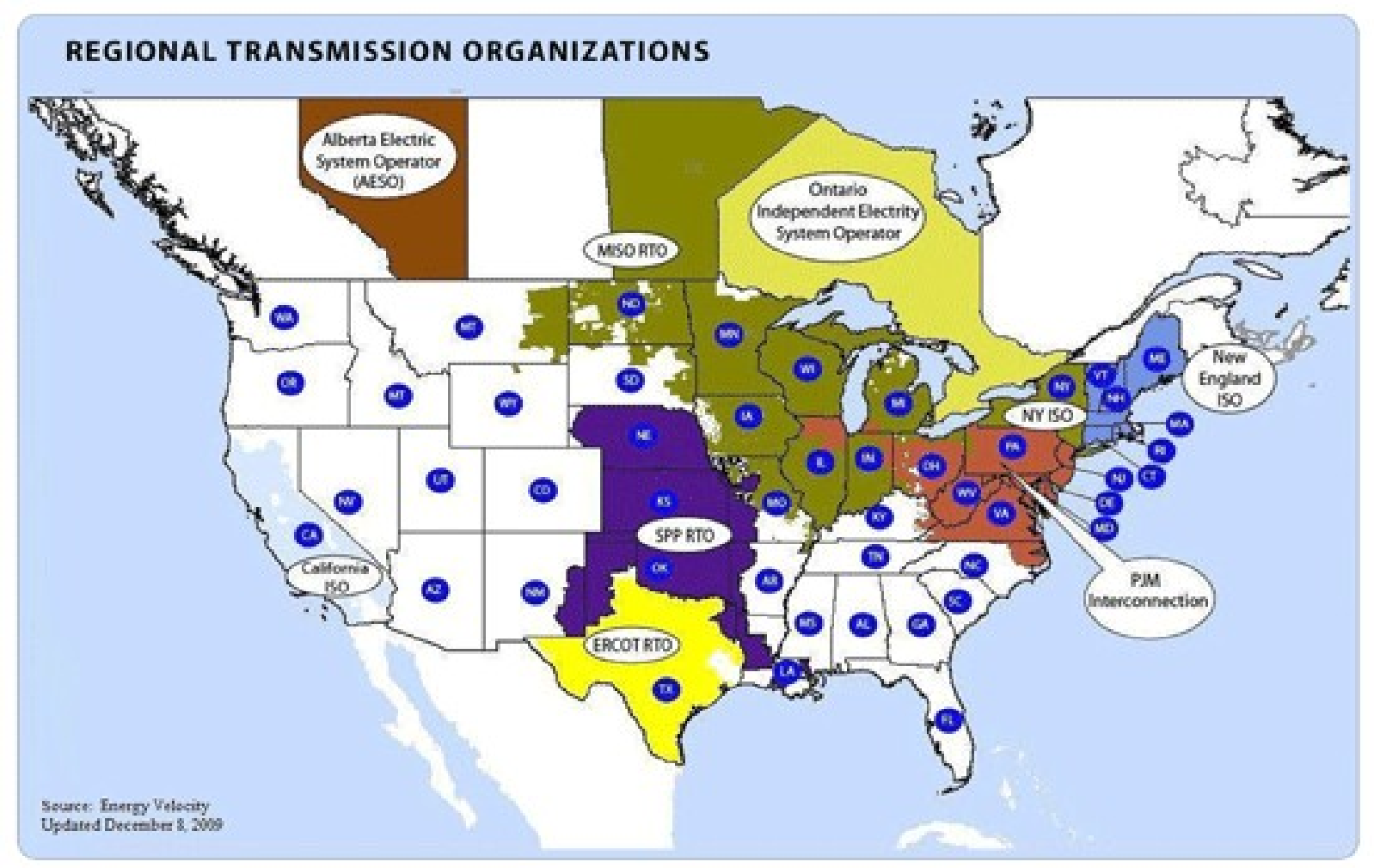


U.S. Interconnections

Source: EIA.
http://www.eia.doe.gov/cneaf/electricity/chg_str/booklet/images/fig4.jpg

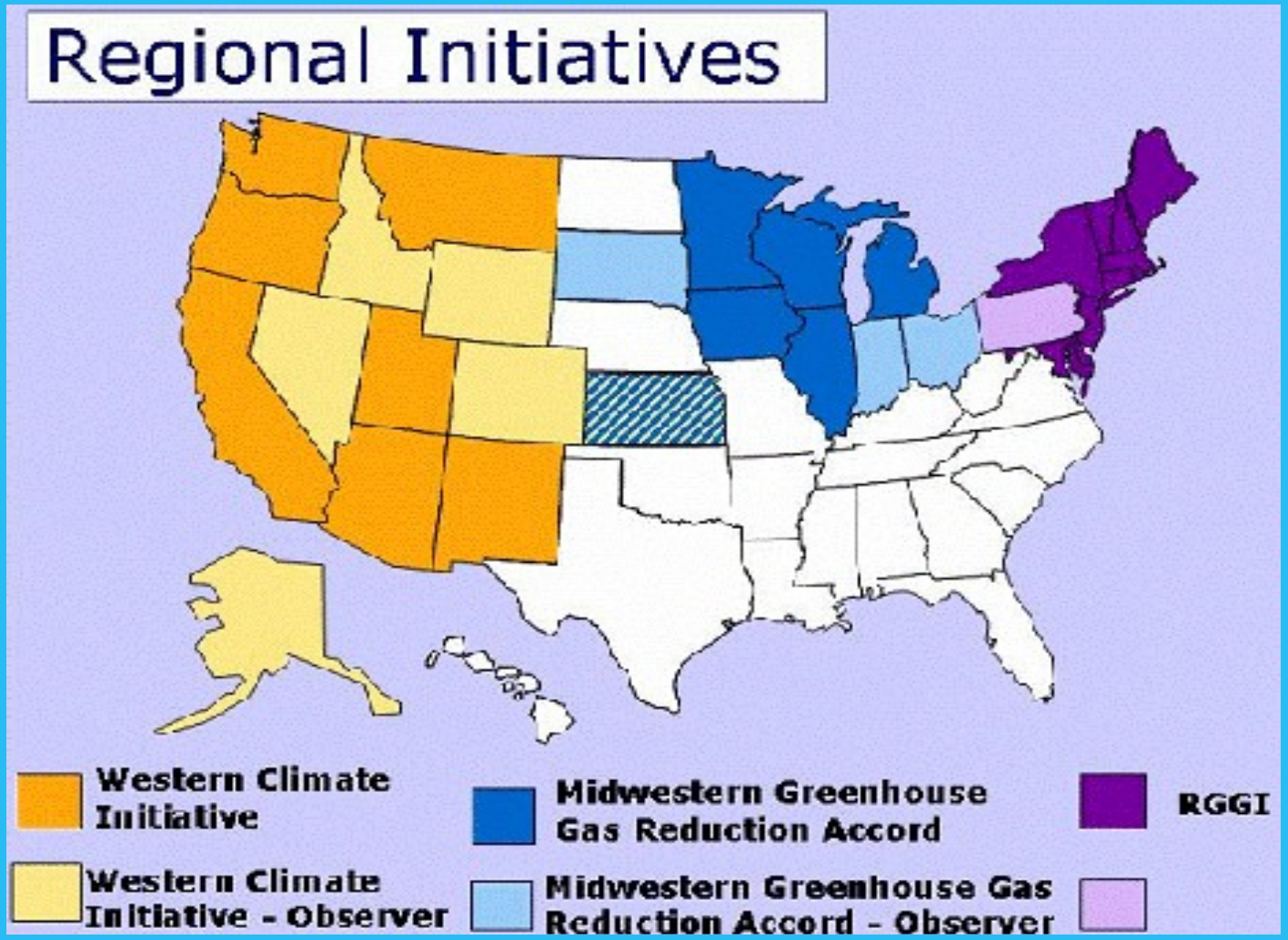
RTOs in the United States

A regional transmission organization or independent system operator (RTO or ISO) serves as a third-party independent operator of the transmission system. There is an inherent conflict of interest when the same single company owns all of the transmission and distribution system and some of the generation. These third-party independent operators, however, ensure that no preference is given in the dispatch of a utility-owned generator over a competitive generator



State Responses to Climate Change

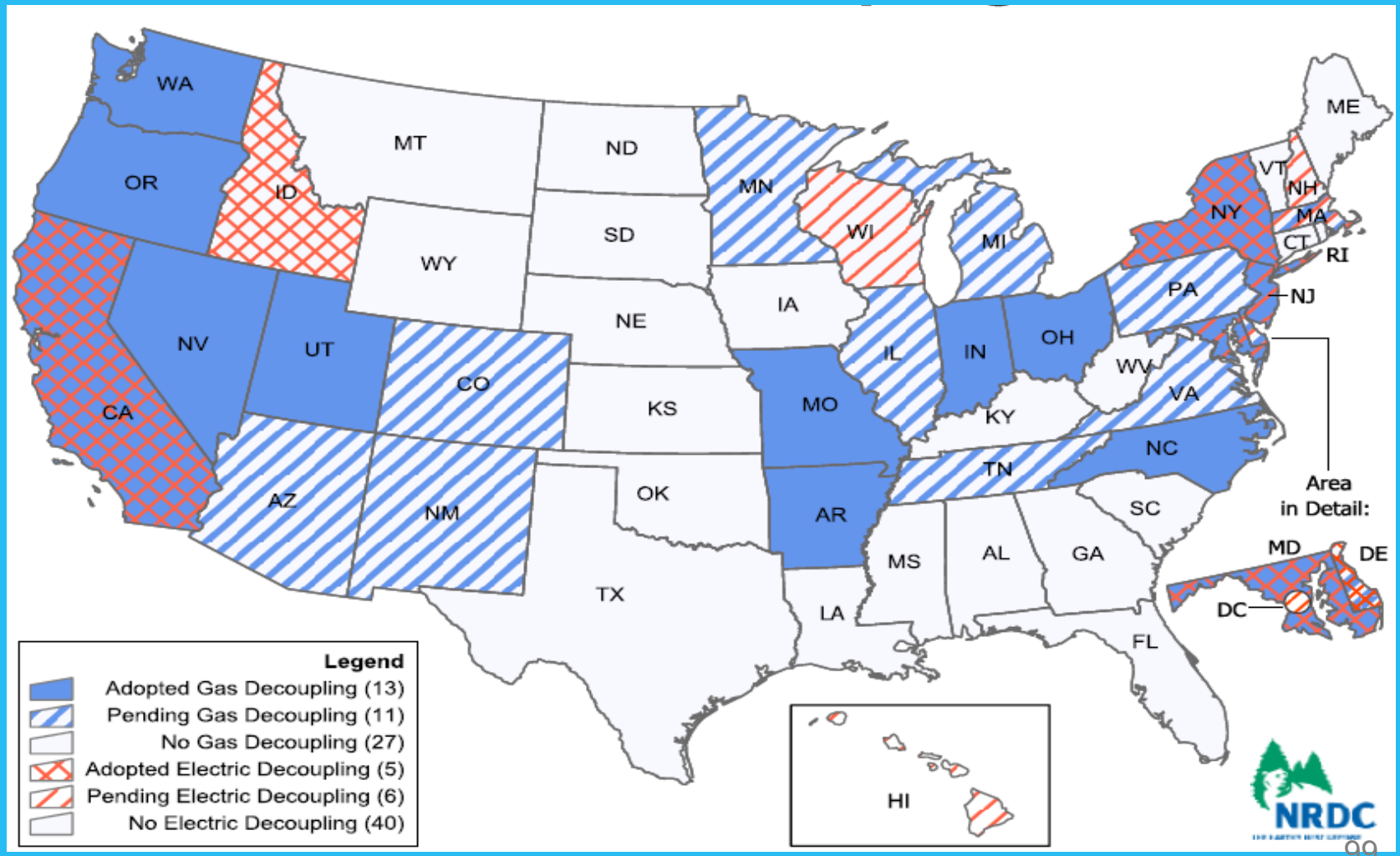
Implementation of Regional Cap-and-Trade Programs



Source: Pew Center on Global Climate Change

Efficiency Approaches

- Enhanced Commitment to Energy Efficiency – NJ, CA, NC;
- Commitment to Pursue National Action Plan for Energy Efficiency (NAPEE);
- Rate Reform-Decoupling

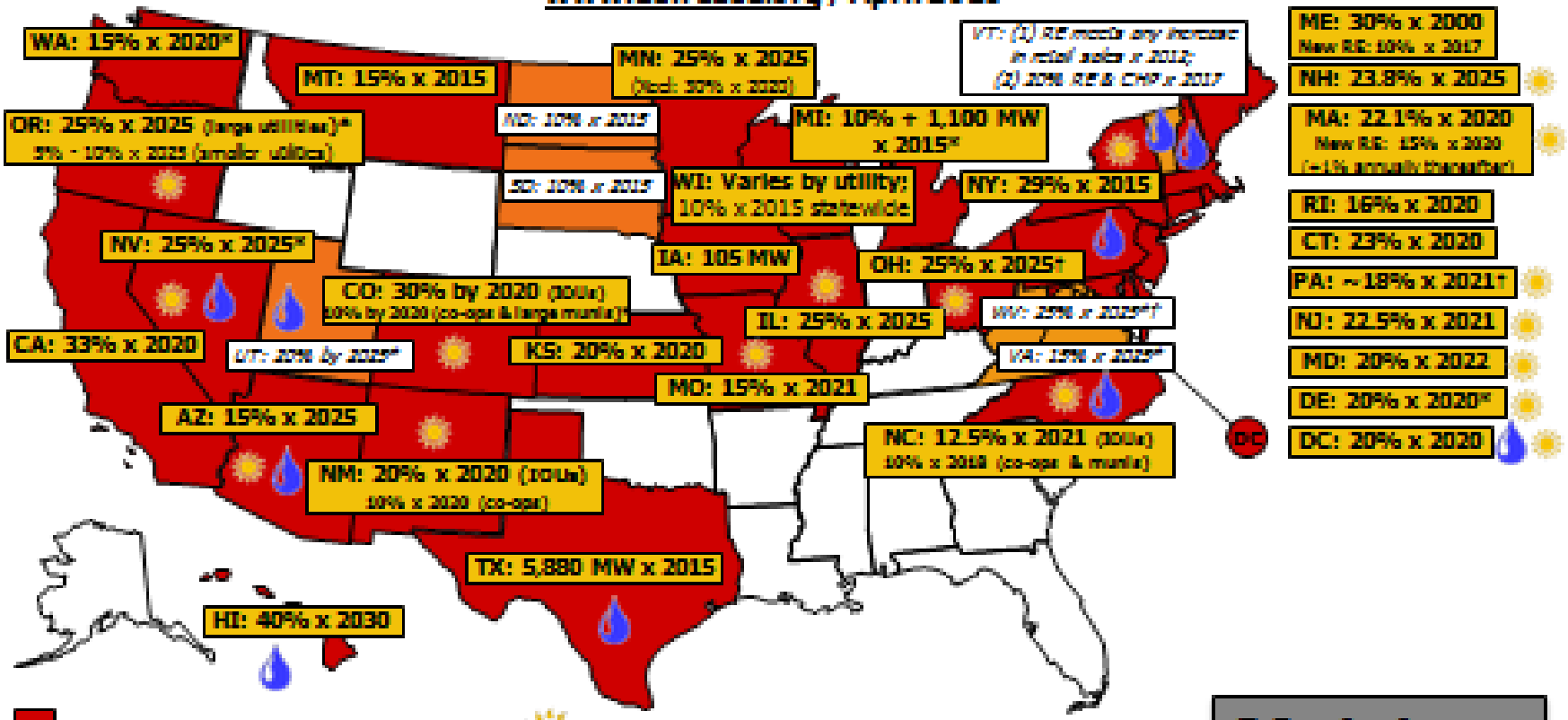


DSIRE

Database of State Incentives for Renewables & Efficiency

Renewable Portfolio Standards

www.dsireusa.org / April 2010



29 states + DC have an RPS

(6 states have goals)