BLOCK II: WHY REGULATE AND HOW?

MEB443 - Introduction to fundamentals of energy regulation

Martin Šik

SOME CAVEATS

My background is public policy and law

Most of what I am going to talk about is based on the EU experience

I specialize in energy regulation and especially in the power sector as opposed to gas

WHY REGULATE ENERGY AND NETWORK INDUSTRIES IN GENERAL?

Economic regulation:

> *'Economic regulation, a form of government intervention designed to influence the behaviour of firms and individuals in the **private sector**.'*

Specialized term best defined in terms of its main components:

- Market entry (licensing)
- **Price control**
- Quality control
- Fostering markets in liberalized segments

Economic regulation is distinct form other forms of state intervention/regulation

- Fiscal policy
- Command and control
- Public ownership

It's closely linked with the concepts of **natural monopoly and network industries**

Also defined as **ex-ante regulation** as opposed to ex-post regulation → competition rules

WHY REGULATE ENERGY AND NETWORK INDUSTRIES IN GENERAL?

Network industries vs. natural monopolies → the two concepts largely overlap

- Natural monopoly → mostly an economics concept
- Network industry → mostly a technical concept

In the past, the network industry category was a sub-set of natural monopolies:

- Network industries are dependent on **physical infrastructure** (networks) → high CAPEX and lock-in effect
- Not to be confused with network effect (externality) → related concept
- Many of the technical features of network industries result in properties which qualify them as (natural) monopolies → high cost of entry, low variable costs relative to fixed costs
- Network industries very often provide **essential services** → public utilities

Currently, some industries traditionally depending on networks are not considered monopolies → case for liberalization

WHY REGULATE ENERGY AND NETWORK INDUSTRIES IN GENERAL?

Justification for economic regulation of network industries → remedying the shortcomings of monopoly

- The vices of '**non-natural**' monopolies are best prevented by not allowing monopolization → competition/anti-trust law, merger control and forced divestment, prohibition of exploitative abusive, etc.
- **Natural** monopolies are actually desirable from an economic point of view → economic regulation aims at making sure that the society as a whole enjoys the ensuing economic benefits
- By approximating allocative efficiency (**quantity argument**) → produced quantity up to the point where the last unit provides a marginal benefit to consumers equal to the marginal cost
- By preventing the extraction of monopoly rent (**price argument**)

I would argue that this justification may simply serve to provide a scientific augment (compatible with the neoliberal discourse) for a natural urge to subject essential services to public control

- Is this true in the if done by non-democratic institutions (independent regulators)?

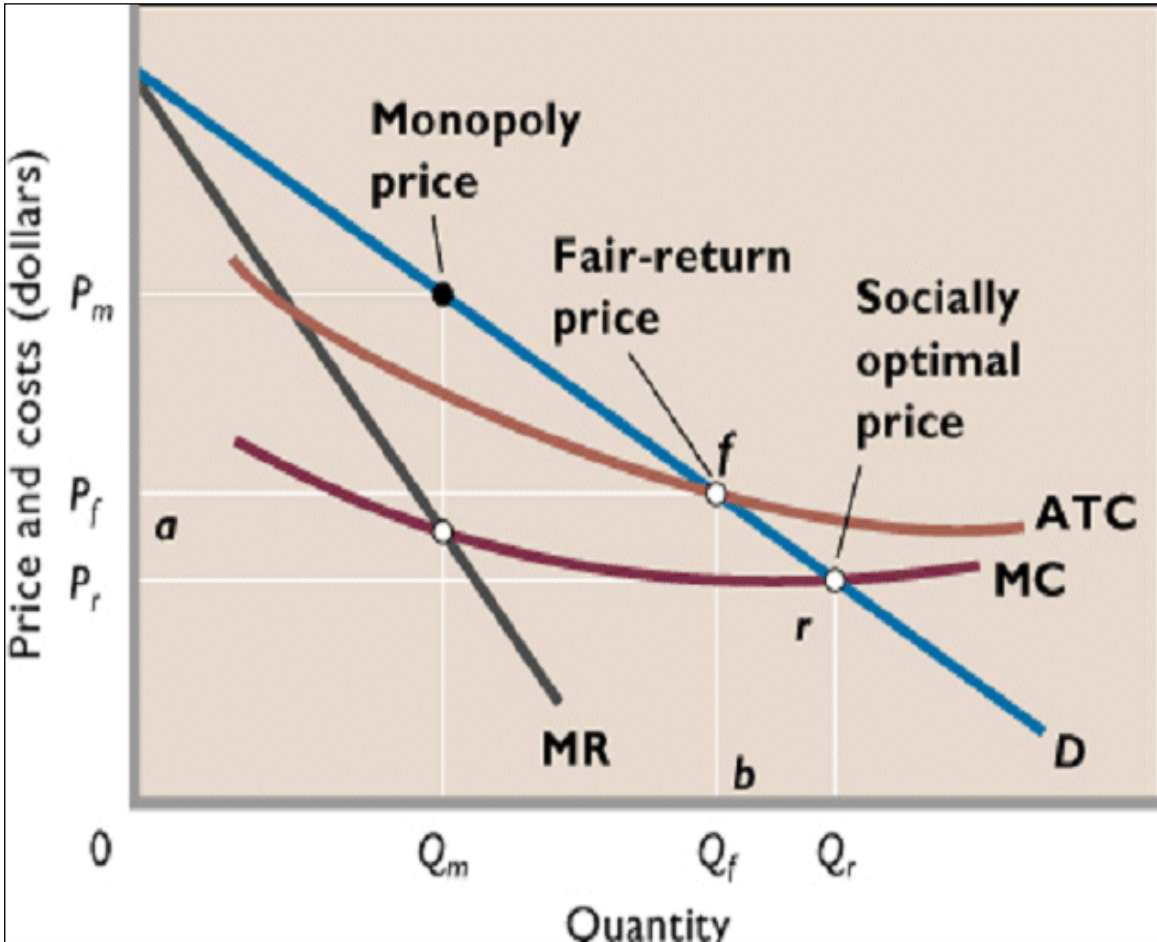
MARKET FAILURE RATIONALES, THE RISE, VICES AND VIRTUES OF NATURAL MONOPOLIES

Microeconomics

Monopolies are generally considered **a market failure** → public policy intervention

Natural monopoly → an industry in which multi-firm production is more costly than production by a monopoly

- **economies of scale** that are large in relation to the size of the market
- high fixed costs (ie. high capex) and constant or decreasing variable costs → **decreasing average costs**
- **Inelastic demand** is an



WHAT IS A NETWORK INDUSTRY/NATURAL MONOPOLY?

Based on the foregoing description, what would you consider a network industry/natural monopoly?

POWER AND GAS

Gas – more interesting from a geopolitical point of view and energy security in terms of international relations

- Few sources – less variable mix of marginal and investment costs
- International implications

Power – more interesting in terms of regulatory policy and security of supply in terms of technical aspects

- a great variety of sources – a very diverse mix of possible marginal and investment costs
- Mostly domestically produced with limited cross-border trade
- *'Electric power systems are generally regarded to be the largest and most complex industrial systems ever built'*

HOW TO REGULATE?

In terms of allocative efficiency price should be set at the level of marginal cost, however these are by definition below the average total cost → loss making and market exit

Price should be set at the level of **average total cost** (retrospective approach) → the firm can recover both its fixed and variable costs without subsidization

- Political control over price is believed to lead to prices below this level and chronic underfinancing of public utilities → argument for independent regulation

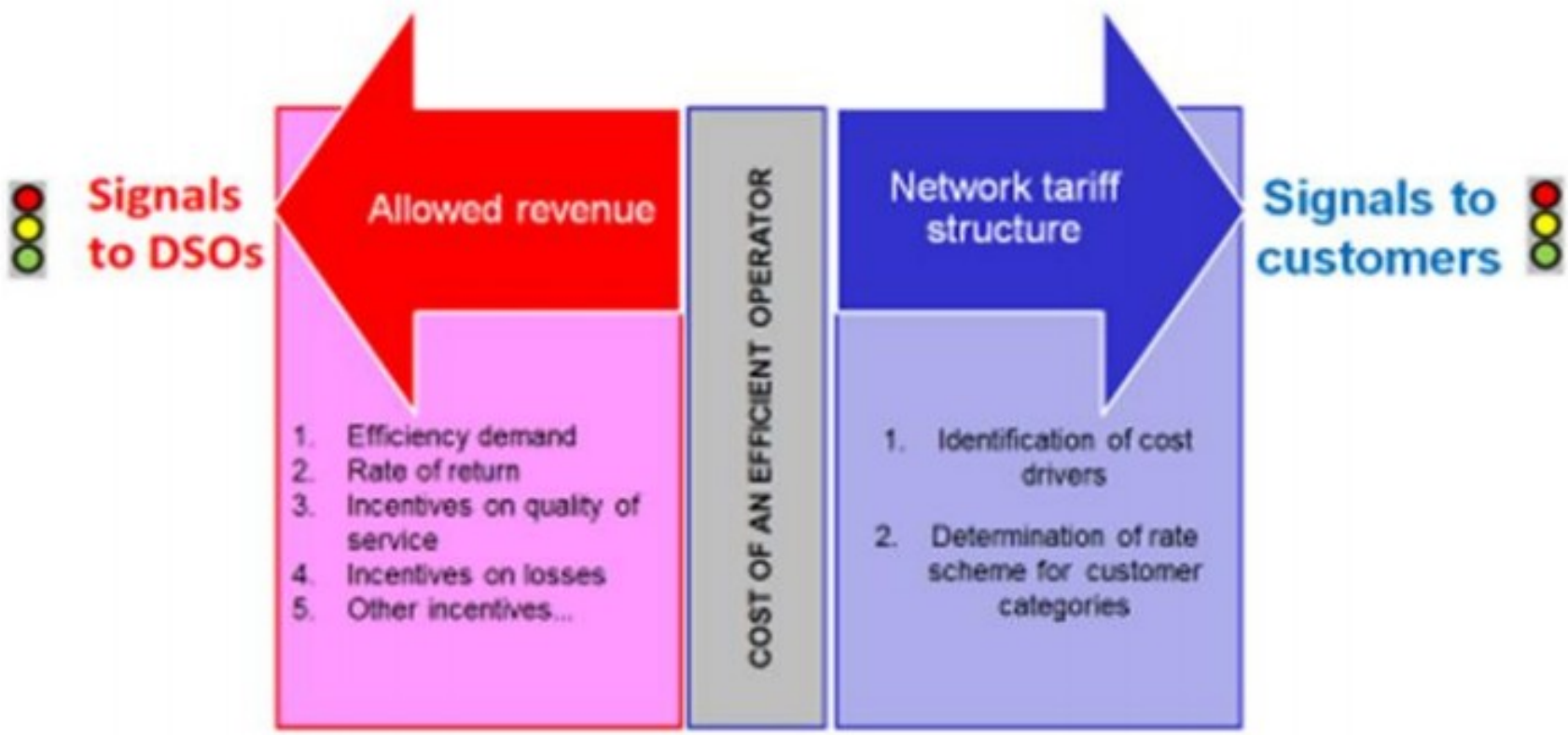
From a purely economics point of view it's even better to set the price at the level of long-run marginal costs (LRMC) → prospective approach

- Better allocative efficiency → provides correct investment signals
- But difficult in terms of regulatory accounting

In practice it is rather difficult to determine a regulated firm's cost function

HOW TO REGULATE?

Regulator has **two jobs**: (1) to estimate what are the costs of operating a system and (2) determine which customer groups will pay what tariff to cover the system cost



FINDING THE RIGHT COST FUNCTION AND TRANSLATING IT INTO ALLOWED REVENUE

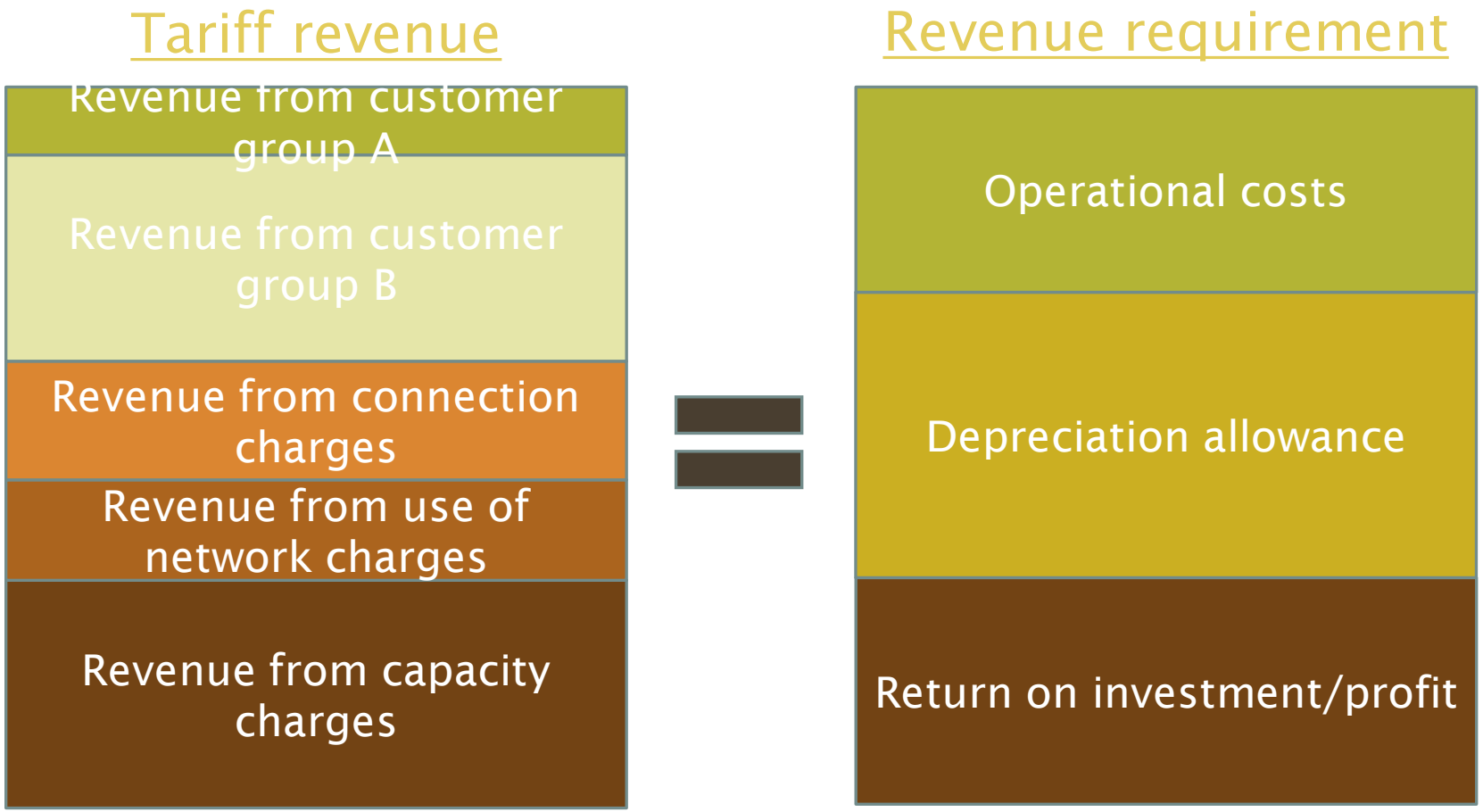
Apart from making sure that a regulated company doesn't make an excessive profit (monopoly rent), the regulator also needs to ensure that it can operate and finance future investments → **financeability**

- a regulated company need to cover its operational and capital costs → establishing revenue requirement and allowed revenue through a regulatory formula:

Allowed revenue = operational costs + depreciation allowance + return on investment

- The individual components are also called **building blocks** → regulatory framework is a series of design decisions about the individual blocks
- All of these are, in economics terms, fixed costs in the short run
- **Variable costs** are typically losses and are often treated separately

FINANCEABILITY



BUILDING BLOCKS – REGULATORY ASSET BASE

Regulatory asset base (RAB) is the regulatory value of investments made in long term assets necessary to operate a regulated business

- Usually based on the book value of tangible fixed assets

It drives two of the building blocks → think of it as a **principal** on which the company earns interest (**return on investment**) and which it is repaid in yearly instalments (**depreciation allowance**)

Regulation is many ways **reverse engineering finance**

- Finance → estimating future cash-flows in order to determine if an investment is profitable
- Regulation → establishing future cash-flows in order to ensure that an investment is profitable

The regulators should make a judgement on the

BUILDING BLOCKS – DEPRECIATION ALLOWANCE

Depreciation allowance = RAB / depreciation rate

There are some important regulatory decisions to be made:

In terms of **ATC vs. LRMC approach** →

- Historic value
- Indexation
- replacement value

In terms of **inter-generational fairness** → assets with long useful life which are expected to serve both current and future customers. Who should bear the costs?

- Speed of depreciation → straight line vs. front-loaded
- implications for risk profiles of infrastructure projects

BUILDING BLOCKS – RETURN ON INVESTMENT

Return on investment is meant to cover a regulated company's cost of capital and is basis of its profit in accounting terms

It provides funds to compensate shareholders for equity and for debt servicing → it is composed of a return on equity and a return on debt.

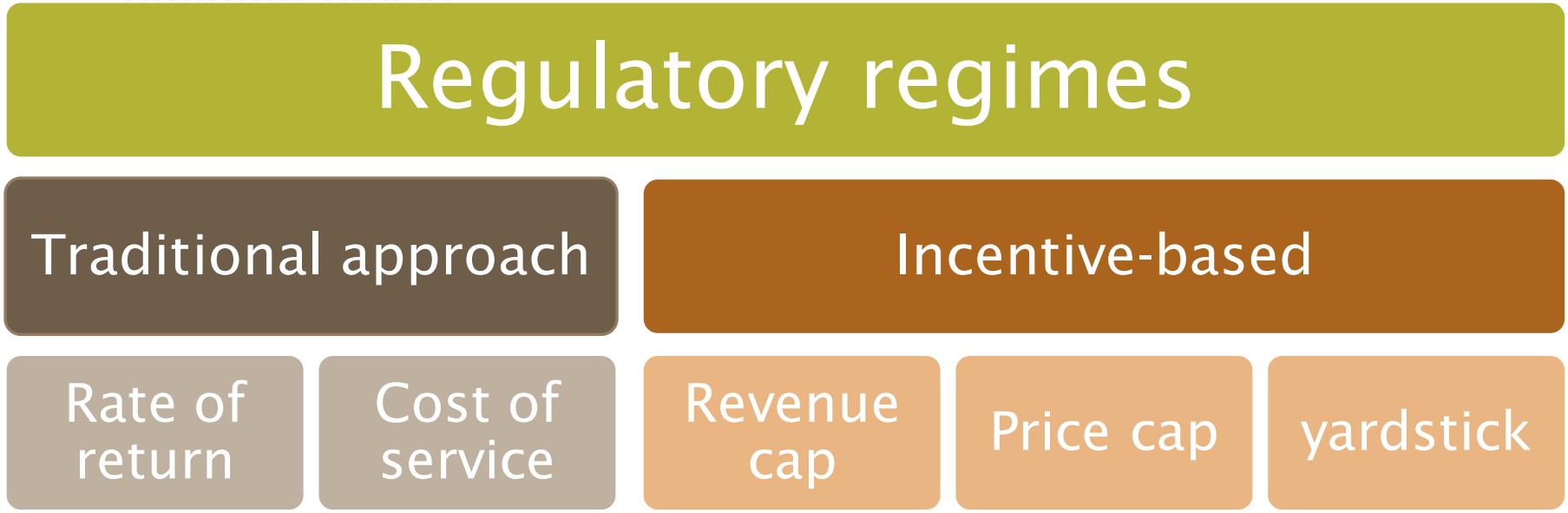
The most common method is to calculate Weighted Average Cost of Capital (WACC).

As part of finding the right cost function, the regulator also has to find the right WACC

- Competitive interest rates on debt
- Capital asset pricing model (CAMP) → cost of equity
- The right capital structure → cost of capital minimizing debt to equity ratio

REGULATORY REGIMES

There are a great variety of regulatory regimes which differ in terms of how they approach the different building blocks



Rate of return vs. cost of service → ex-post vs. ex-ante adjustment of rates

Price cap vs. revenue cap → treatment of volume risk

Caps vs. yardstick → actual or benchmarked costs

Profit sharing vs. the rest → sharing of risk of under/over spent

INCENTIVE-BASED REGULATION

Averch-Johnson effect (aka '**gold-plating**') → the tendency of regulated companies to engage in excessive amounts of capital accumulation in order to expand the total volume of their profits.

Without the discipline of competition, regulated companies are generally likely to become **inefficient**, increase both their OPEX and CAPEX to make their life easier

Traditional regulatory approaches (ie. rate of return and cost of service) rely on detailed cost auditing to discover and prevent inefficiencies → **information asymmetry**

Incentive-based regulation has been the answer to

INCENTIVE-BASED REGULATION

The idea is to partially decouple the regulated company's actual costs from its allowed revenue → it can retain all or part (sliding-scale/profit sharing) of the extra profit resulting from increased efficiency

The company knows its cost function best → removing information asymmetry

This regime is generally applied for a number of years (**regulatory period**) and the allowed revenue is re-set at the beginning of the next regulatory period according to actual costs → transfer of efficiency gains to the customer

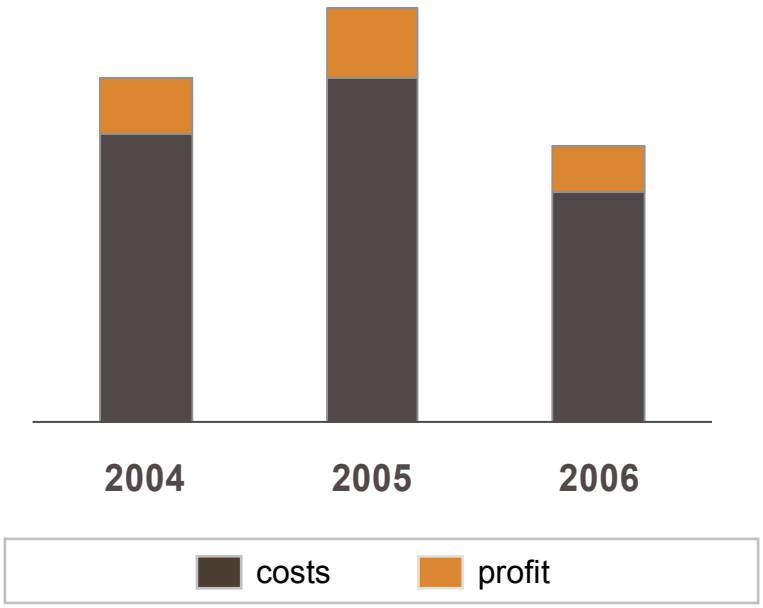
- The allowed revenue is set at the beginning of a regulatory period based on actual costs
- The allowed revenue is adjusted for inflation and efficiency targets (RPI-X) and other elements

Should be applied only to controllable costs

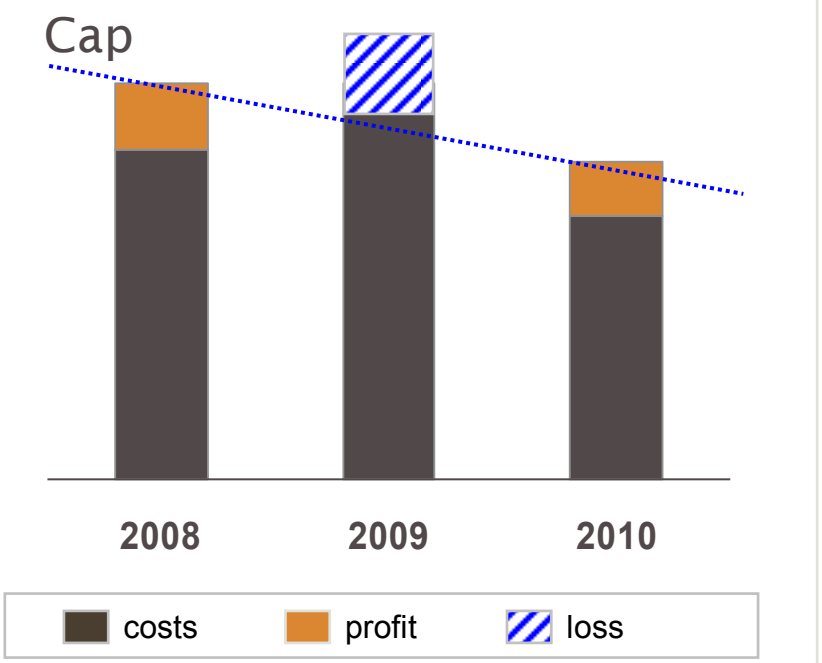
Often complemented with cost benchmarking and efficiently targets (X factor)

TRADITIONAL VS. INCENTIVE-BASED REGULATION

Cost-plus regulation



Revenue cap



PROSCRIBING HOW ALLOWED REVENUE IS EARNED

The second part of the regulatory job

Traditional approach → tariffs charged by vertically integrated utilities have included both the cost of operating the network and the cost of producing/purchasing energy

Deregulation → only **access tariffs** covering network costs plus any other regulated charges

Tariffs should be based on the cost-causality principle → cost of infrastructure investments charged to those network users who benefit from them or have been responsible for incurring the network investment costs

- In practice some proxy – such as network utilization – may have to be used to determine causality

PROSCRIBING HOW ALLOWED REVENUE IS EARNED

The cost-causality principle dictates that there should be no cross-subsidization between the various customer groups

- The emphasis on cost-causality stems from concerns about allocative efficiency
- This is well illustrated in the case of DER (e.g. rooftop PV) → total volume consumed may decrease significantly but the demanded peak capacity is likely to remain unchanged

Tariffs usually comprise multiple (most typically three) prices

- Per kWh (volumetric) → to cover variable costs
- Per kW (capacity based) → to cover the capital costs
- Per connection point → to cover direct costs incurred in servicing a customer (e.g. metering or billing)
- even tough the biggest share of costs is capacity-related, tariffs

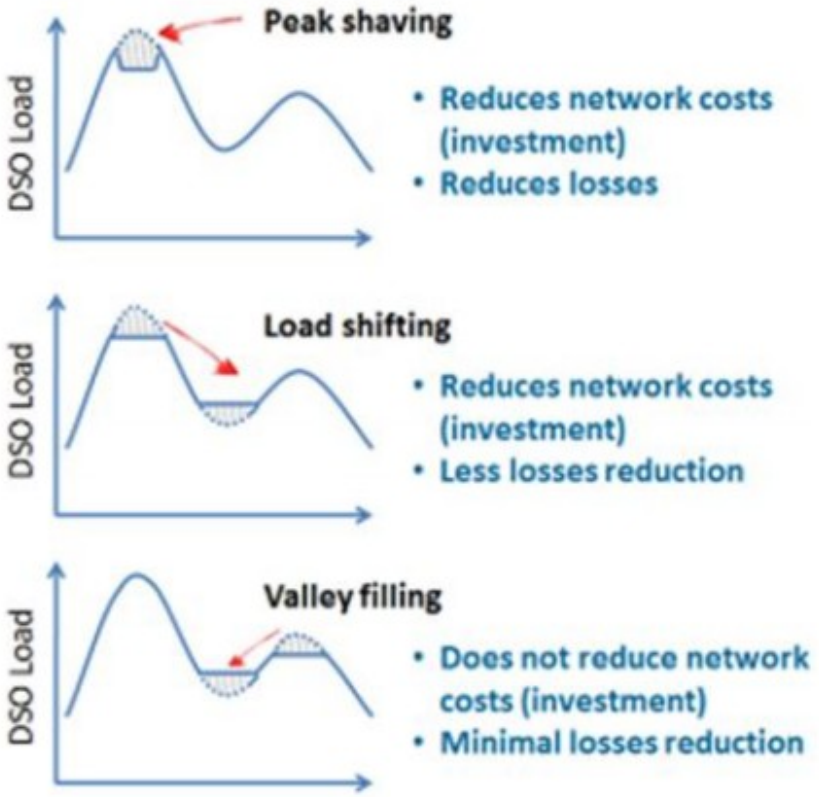
PROSCRIBING HOW ALLOWED REVENUE IS EARNED

Networks have been traditionally designed in a **fit-and-forget** fashion

- Ability to meet the peak load which occur only in a limited number of hours
- A lot of redundancy

Tariffs may provide incentives for efficient network use → according to economics theory, fixed costs should be recovered during congestion

- Politically not acceptable, but some approximation:
- Time-of-use tariffs
- Critical peak pricing



Q&A

BLOCK III: REFORMING AN INDUSTRY

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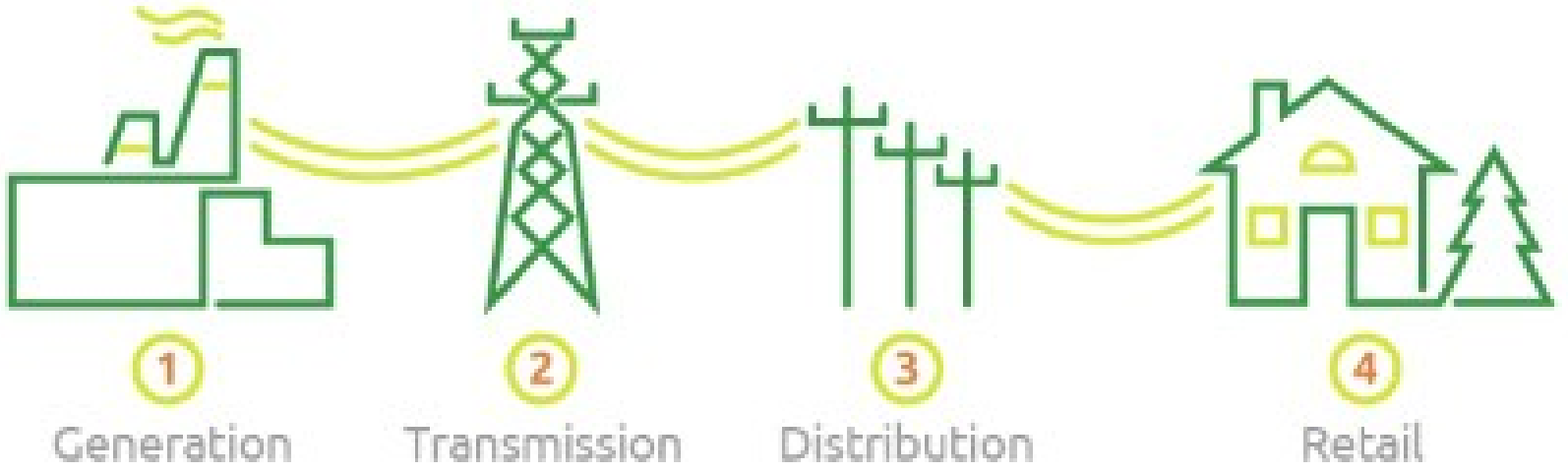
TRADITIONAL ORGANIZATION OF THE POWER INDUSTRY

Ever since the electricity industry reached maturity and until recently, regulation around the world was uniformly of the sort applied to a public service provided under monopoly arrangements:

- guaranteed franchise (legal monopoly) for the – typically vertically integrated – electricity utility
- price regulation based on the costs incurred to provide the service.

POWER INDUSTRY VALUE CHAIN



Similar patterns are present also in other network industries

MARKET DISCIPLINE VS. MONOPOLY REGULATION

The neoliberal economics argues that state intervention in price formation and quality determination is only a second-best solution

Competition and market discipline should be the main regulator wherever possible → wave of economic liberalization affecting air travel, telecommunications, banking services, gas supply etc.

- Economic efficiency
- Innovation

Network industries have been traditionally vertically integrated along the value chain → but what if some parts actually are not natural monopolies and competition may exist and be beneficial?

- A mixture of **technological** → increased interconnection capacity, new generating technologies, metering, communications and information processing
- **And political** reasons → excess of governmental intervention, confusion over the State's dual role as owner and regulator, financial and technical management inefficiencies due to the lack of competition, or lack of investment capacity

MARKET DISCIPLINE VS. MONOPOLY REGULATION

Power industry reform first introduced in Chile in 1982

- Separation of the basic activities involved in the provision of electric power.
- Most of the industry was privatized
- An organized, competitive wholesale market was created, with centralized dispatching based on declared variable costs. All generators were paid a “system marginal price”, and long-term contracts were instituted to offset price volatility.

More similar reforms were not introduced until 1990 when the power industry was transformed in England and Wales, and shortly thereafter in Argentina (1991) and Norway (1991)

Than came EU liberalization packages and FERC

THE DEVELOPMENT OF A MARKET

Markets are institutuons → they are one of several means of allocating scarce resources and arguably the most efficient

As an organic process

- Agents realise that there are potential gains from trade
- Market institutions (trading rules, meeting places etc.) that reduce transaction costs are established
- Thus market institutions survive only until better alternatives become available (Example: trading floors vs. computers)

By discretionary decision

- Barriers to trade are reduced or abolished
- Market institutions are created through legislation, decision by regulator etc.
- Thus market institutions may survive even if better alternatives become available

A number of markets in Europe have been created by discretionary decision

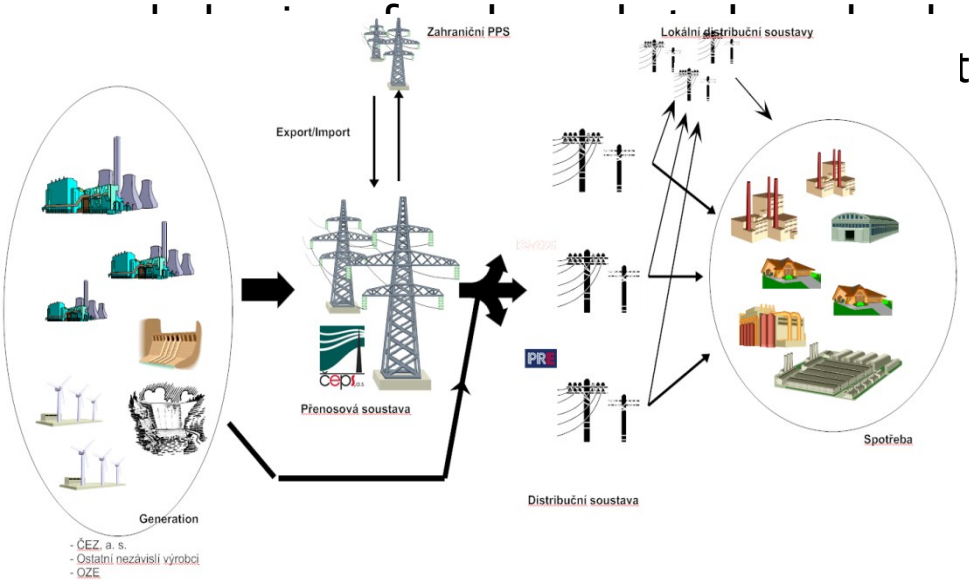
- Markets for allocation of radion spectrum, 3G licenses, emission permits, green certificates, etc.
- “New” markets for electricity, railway services etc.

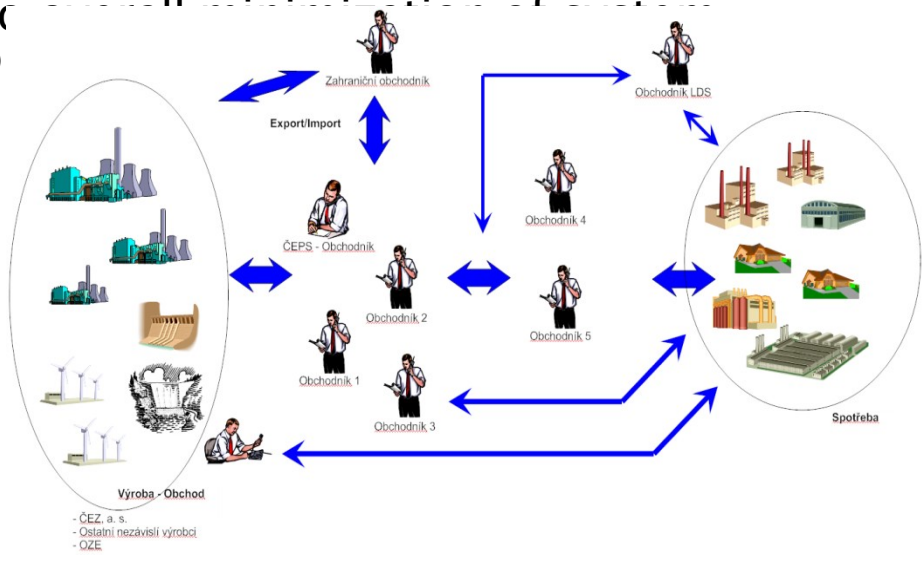
Competition in a market vs. competition for a market

MARKET DISCIPLINE VS. MONOPOLY REGULATION

Industry liberalization has gone hand-in-hand with dramatic decentralization of planning and operating functions:

- System expansion – now focused on investment – and operation are the result of individual company decisions based on the maximization of business earnings
- Economic and financial risk and anticipated returns on investment, instead of the traditional cost minimization criteria, drive decision-making.
- The challenge for administrative and regulatory authorities is to design liberalized market rules that ensure that the strictly entrepreneurial





POLICIES OF ENERGY INDUSTRY LIBERALIZATION AND DEREGULATION – THE ENABLERS

Liberalization as such and the enablers are mostly the result of **EU policies** → three liberalization packages (1996/8-2003-2009)

Liberalization could in theory work under competition rules → **ex-post regulation**

- Former monopolists (incumbents) as well as network operators will by definition have a **dominant position** → prohibition of certain anti-competitive practices such as refusal to deal, essential facilities doctrine, margin squeeze
- In practice however, enforcement is rather difficult and the implementation of a liberalization policy uncertain

To enable liberalization, three dedicated polices have been developed and implemented:

- **third party access**
- **unbundling**
- **independent energy regulators**

THIRD PARTY ACCESS (TPA)

TPA constitutes a statutory obligation on network operators to allow any interested party access to its infrastructures

Two types have emerged

1. Negotiated TPA → network operator is mandated to allow access on non-discriminatory terms at a price which is NOT set by the regulator but is subject to ex-post regulation ; it should charge the same price it would charge to its own downstream branch
2. Regulated TPA → access on terms and at a price determined by the regulator; ex-ante regulation

Access (incl. connection) can be refused only based on objective and non-discriminatory criteria → typically lack of capacity

UNBUNDLING

TPA is conceptually possible with a vertically integrated company, it is however deemed inefficient → those branches controlling essential facilities (ie. networks) are likely to favor their affiliates, thus hampering competition in the liberalized segments

Unbundling is the separation of natural monopoly businesses from the rest of the value chain

- Non/discriminatory treatment of all network users
- Prevention of cross-subsidization between monopoly and competitive branches

It can take different forms:

The UNBUNDLING of NETWORK OPERATORS

- Accounting
- Functional
- Legal
- ISO – Legal w/o assets
- Ownership

INDEPENDENT ENERGY REGULATOR – ROLES AND RESPONSIBILITIES

Protecting the interests of energy consumers → what about regulatory capture?

Fostering markets in liberalized segments → regulation of competitive **wholesale markets**

- Deciding on 'the detailed rules' → network access, market organization
- Market monitoring and market manipulation prevention
- EU integration a major focus → cross-border issues
- Renewables and energy transition now central to many markets
- Many of the detailed rules are now enacted at the EU level (network codes) → generally following the Lamfalussy process

Fostering markets in liberalized segments → regulation of competitive **retail markets**

- Opening-up of retail markets to competition → every customer is free to chose their supplier
- Emphasis on easy supplier switching
- Active customers and customer protection an increasing focus

INDEPENDENT ENERGY REGULATOR – ROLES AND RESPONSIBILITIES

Economic **regulation of monopoly** energy networks → Ex-ante price and quality regulation

- Sets network revenues and tariffs → Regulated TPA and price controls
- Setting quality of supply requirements and their integration into the regulatory formula → both technical and commercial quality

License/certify and monitor market players → control of **market entry**

- Licensing generators, suppliers, network companies
- Network unbundling, certification of unbundled companies

Some ex-post role too

- Dispute resolution between market participants with special focus on consumer protection
- Some competition policy responsibilities → usually in cooperation with competition authorities

INDEPENDENT ENERGY REGULATOR – WHY INDEPENDENCE?

To provide a **predictable and stable climate for investors**

- to shield them from interference by politicians eager to reduce energy prices as part of their campaign
- To prevent discrimination and ensure a level playing field in an environment with a lot of public ownership
- Investor confidence and long-term stability leads to **low cost of capital** which, in a capital-intensive industry, benefits the end customers more than short-term price reductions

The introduction of independent regulators in the EU member states has been the result of **EU legislation** → it proves the growing EU-level involvement in regulatory activities

In line with the general trend of rise of **EU agencies**, a new agency (Agency for the Cooperation of Energy Regulators) has been established to assist and help the coordination of national regulators on cross-border, regional and pan-European issues

- It has rather limited powers but is , in accordance with Majone's assumption, mainly responsible for monitoring the internal market,

ELECTRICITY AND GAS CHALLENGES

Gas – uncertainty about future demand – risk of asset stranding

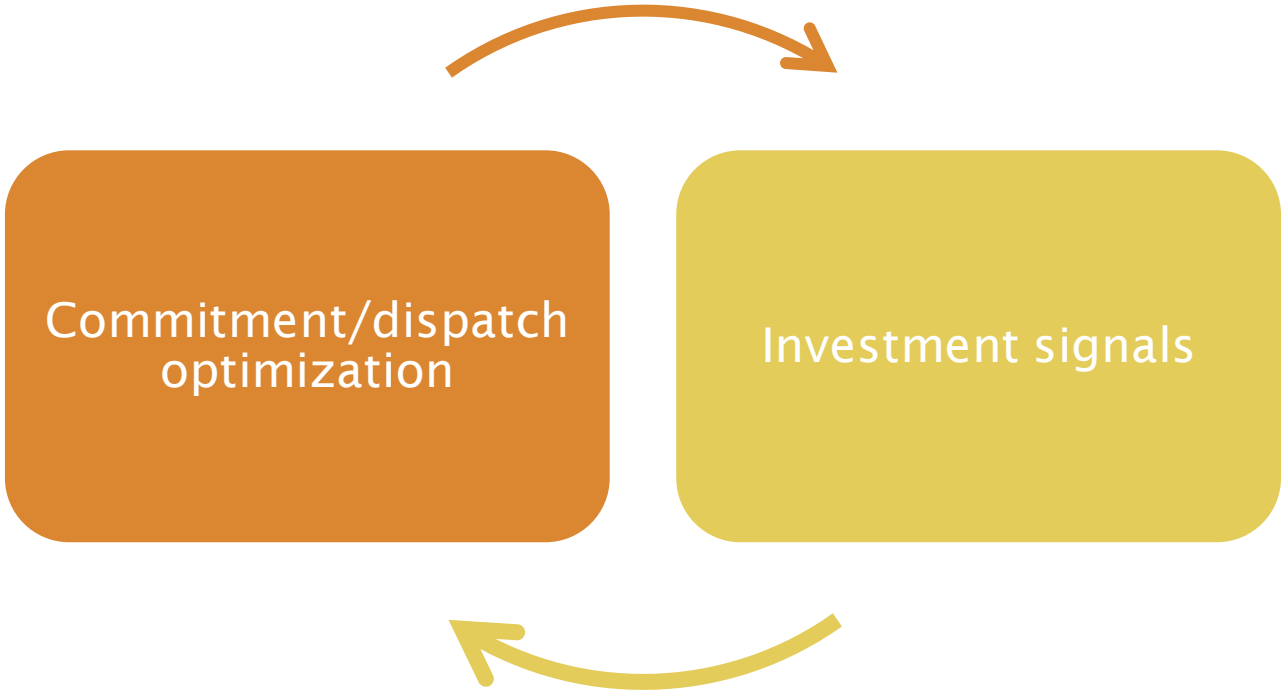
- Global LNG market?
- Is unbundling and liberalization (de-monopolization) inhibiting investment in large cross-border project due to lack of coordination and uncertainty about future revenue streams?
- Large pipeline project typically have a large carrying capacity→ more often than not used for transit → the transit courtiers want to have their slice of the cake, too → lack of coordination b/w countries
- Renewable gas

Power – uncertainty about what the industry as such will look like a few years from

- DER ➔ decentralization
- RES ➔ intermittency
- The role of network companies
- Demand ➔ impact of e-mobility vs. energy efficiency
- Storage

Rise of uncertainty and complexity

WHY DO WE HAVE ELECTRICITY MARKETS?



CAN AN EOM ENSURE ADEQUATE GENERATION CAPACITY TO ENSURE SECURITY OF SUPPLY?

Security of supply is a public good ➔ underinvestment

Investment cycles ➔ installed capacity oscillates around a the long-term equilibrium

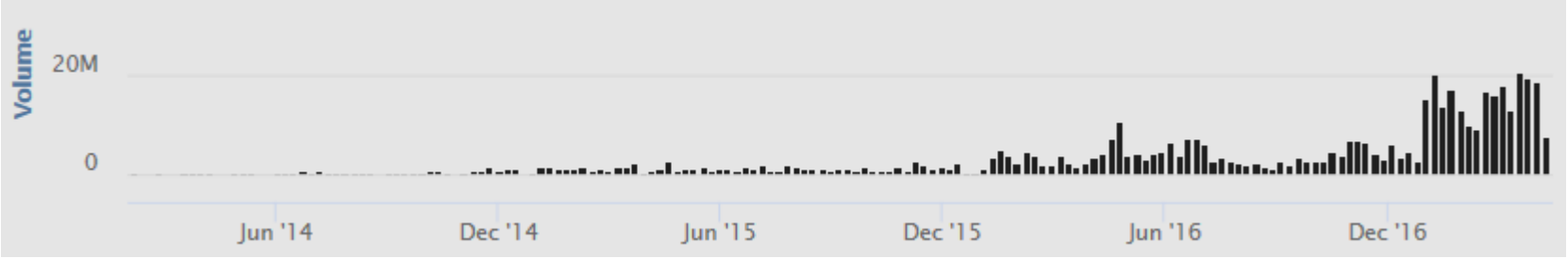
The right level of prices ➔ missing money problem and VOLL

INVESTMENT SIGNALS

Generation capacity is „chunky“ ➔ impossible to add in small increments

Long lead times (investment decision to commissioning) ➔ lack of reliable investment signals

A mismatch between project useful life (> 30 yrs) and forward curve liquidity (< 3 yrs)



INVESTMENT SIGNALS

A wide selection of available technology options with varying OPEX/CAPEX ration ➔ e.g. OCGT vs. Nuclear

Risk averse investors more likely to opt for the least risky options ➔ low CAPEX and short lead times

- May or may not coincide with the option which minimizes total system costs

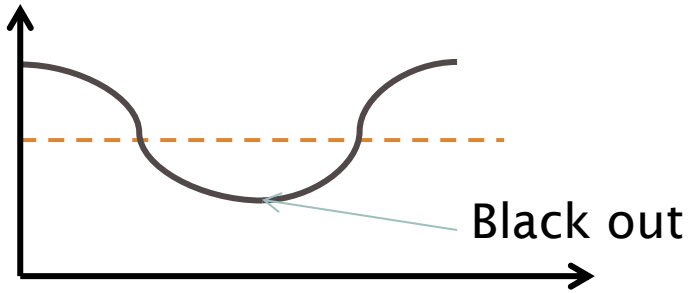
THE ROLE OF POLITICS

Power generation shares some features with other industries → high capital intensity, long lead times

- E.g. aluminum, oil
- „Boom and bust“ phenomenon

… But there are important peculiarities

- Limited storage possibilities
- Essential for modern society → high political sensitivity



THE ROLE OF POLITICS

Will politicians let go and let the market find an equilibrium?

- What are their risk acceptance levels?
- It contrary to the concept of politics to "sit down and kick back"

Influencing the policy-making

- Olson theory → concentrated groups, who stand to benefit significantly from a policy have a better chance of influencing the policy than disperse groups (e.g. customers) who are to bear the costs even if benefits overall outweigh costs for the society
- Information asymmetry → those who would benefit from a CRM supply information necessary for a policy analysis

The case of capacity mechanisms and the security of supply debate is an example of tension between expertise and politics

- the current developments make perfect sense form an expert point of view but are unacceptable politically
- Which should prevail? → expert knowledge or democratic legitimacy?

Q&A

STUDENT OUTREACH - COME WORK FOR US!

ABOUT ERO

Established in 2001

Independent regulatory body tasked with a wide range of responsibilities

Headed by a 5-member Board appointed by the Govermnebt of the Republic for a term of 5 years (staggering)

- Almost 250 staff (including several MUNI alumni)
- A budget of over € 11M
- Headquartered in Jihlava with subsidiary offices in Prague and Ostrava

REGULATORY MANDATE

Power

Natural Gas

District heating

Renewables

… more industries to come?

ERO‘s main tasks

- **Consumer protection**
- **Price regualation** with a view to ensuring effective operation of natural monopolies
- Promotion of **high-quality and reliable** energy supplies
- Promotion of **competition** and anti-trust oversight (in cooperation with the competition office)
- Promotion of **renewables and CHP**

MAIN AREAS OF COMPETENCE IN THE POWER SECTOR