

Fact Book Incentive Regulation for German Energy Networks

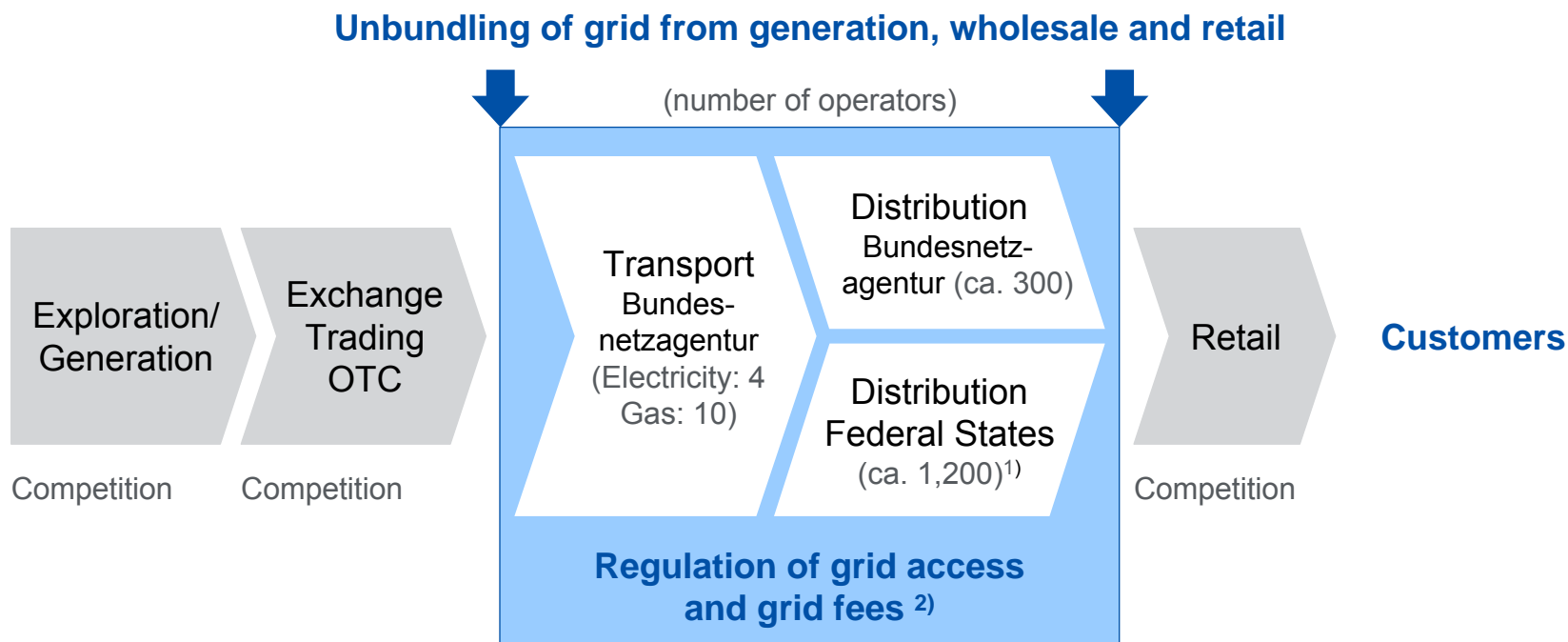
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The German Energy Industry Act of 2005: Regulating Grid Access and Grid Fees in the Electricity and Gas Markets



¹⁾ Utilities with fewer than 100,000 electricity or gas customers can be regulated by one of the 16 federal states.

The federal states may delegate responsibility to the BNetzA (federal grid agency).

²⁾ Exemption of gas Transport System Operators from regulation if effective competition between Transport System Operators exists. This has been since overruled by the Federal Regulator in late 2008.

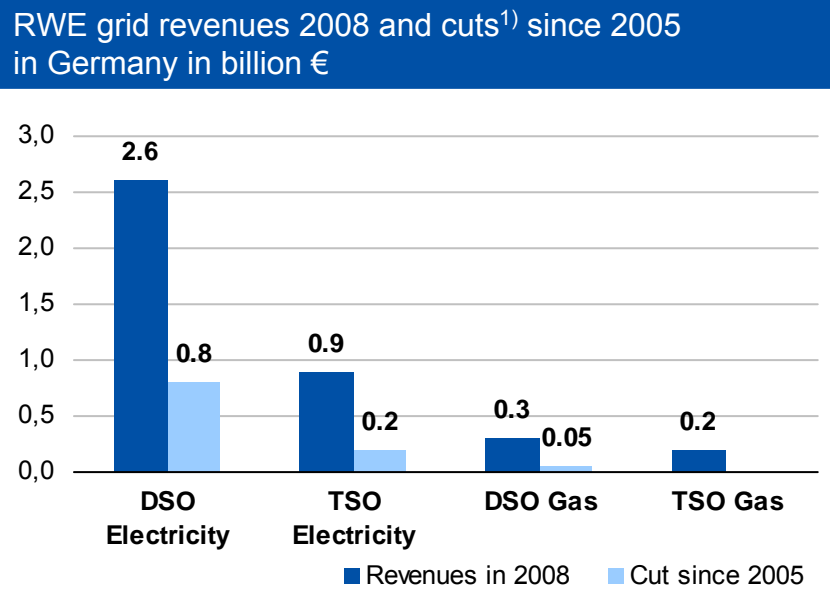
The German Energy Industry Act of 2005: Key Elements

- > Act on the regulation of the German electricity and gas markets (Energiewirtschaftsgesetz – EnWG) became effective on July 13, 2005.
- > Under the Act, the German Federal Grid Agency ("Bundesnetzagentur" (BNetzA)) is in charge of regulating grid access as well as electricity and gas grid fees.
- > Grid operators with fewer than 100,000 electricity or gas customers can be regulated by one of the 16 federal states. Several federal states have delegated this responsibility to the BNetzA.
- > All grid fees are subject to prior approval (ex-ante regulation).
- > The historic method of calculating grid fees – based on current cost accounting – is maintained for existing assets. Since 2006, investment in new assets is subject to regulation based on historic cost accounting with inflation-adjusted returns.
- > Incentive regulation, on the basis of a legal directive, to become effective in January 2008 (later postponed to 2009). Directive on Incentive Regulation (ARegV) can be found under: <http://www.bundesrecht.juris.de/bundesrecht/aregv/gesamt.pdf> (only available in German language)
- > The tariff-rate approval by the federal states for residential customer's electricity tariffs was abolished as of July 1, 2007.

RWE Energy Grid Revenue Cuts¹ in Germany - equivalent to average grid operator cuts

Electricity	Cost cuts 06/07	Cost cuts 08
TSO Electricity		
RWE Transportnetz Strom	-9%	-16%
Region North		
RWE Westfalen-Weser-Ems	-10%	-8%
Region Center		
RWE Rhein-Ruhr	-11%	-13%
Region South West		
Süwag Energie AG	-14%	-1%
Region West		
energis	-13%	-7%
Region South		
Lechwerke	-12%	-1%
Region East		
enviaM	-12%	-5%

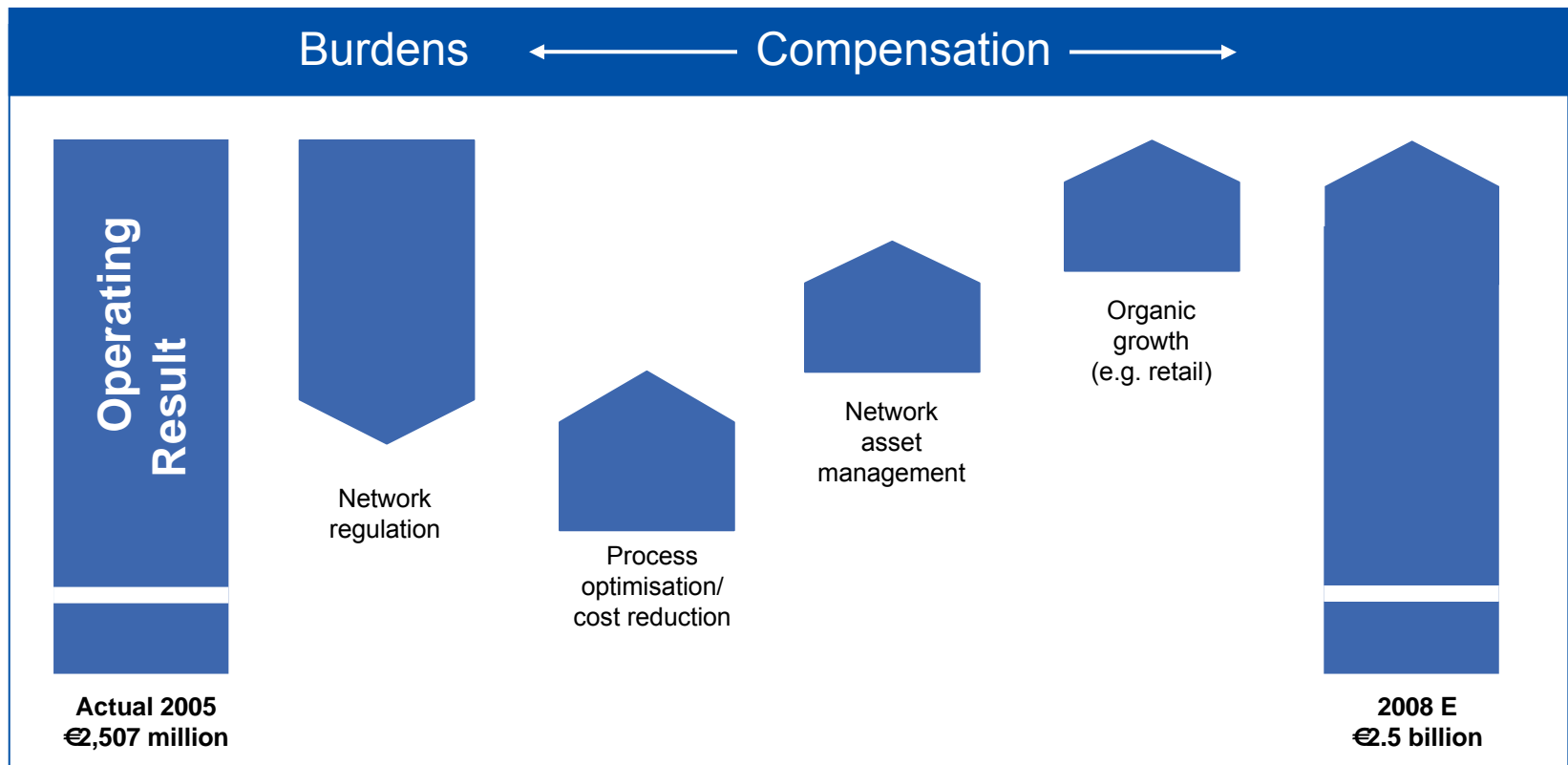
Gas ²	Cost cuts 06/07	Cost cuts 08
TSO Gas	Exempted due to competitive pricing	
RWE Transportnetz Gas		
Region North		Due to restructuring no regional values available.
RWE Westfalen-Weser-Ems	-26%	
Region Center		
RWE Rhein-Ruhr	-19%	
Region South West		
Süwag Energie AG	-14%	



▶ Results of cost audits 2008 (based on 2006 costs) are of particular importance because they also will be the starting point for the revenue path of the incentive regulation.

1) Disclosed external revenue significantly higher due to transferred subsidies for renewables and CHP, concession fees and other services not exposed to regulation.
2) Excluding Region East (Mitgas) as it is not consolidated anymore.

Ca. €1bn reduction in grid fees 2006 – 2008 has already been compensated within RWE Energy



Cost Audit by the Regulator – The Model before Incentive Regulation

+	Expense-like Costs	<ul style="list-style-type: none"> > OPEX (cost of raw material, staff cost, maintenance, cost of other purchased material and services, allocated overhead costs etc.) > Real debt expenses
+	Imputed Depreciation	<ul style="list-style-type: none"> > Method of linear depreciation > For the equity share of old assets (capitalised before 01/01/2006), depreciation is based on current cost accounting > All other depreciation based on historic cost accounting
+	Imputed Return on Equity	<ul style="list-style-type: none"> > For old assets (capitalised before 01/01/2006) the RoE is applied as a real value (current cost accounting) > For new assets (capitalised after 01/01/2006) the RoE is applied as a nominal value (historic cost accounting)
+	Taxes	<ul style="list-style-type: none"> > Calculated trade tax
-	Cost-reducing Revenue	<ul style="list-style-type: none"> > Operating liabilities (provisions) > Advances and construction grants
+/-	Period-overlapping Balancing	<ul style="list-style-type: none"> > Amount the grid operator has over- or undercharged e.g. because of fluctuating volumes for consumption rate
=	Cost (basis for grid fees)	

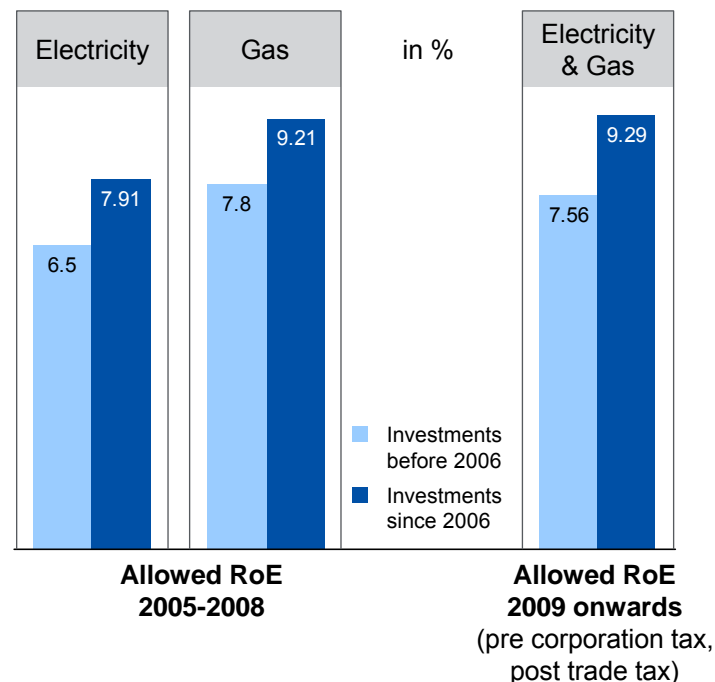
Treatment of Return on Equity and Taxes

RoE

- > The permitted proportion of equity financed assets is restricted to 40%.
- > Current cost accounting for rate of return and imputed depreciation will continue to apply for all investments until December 31, 2005.
- > All investments as from January 1, 2006, will yield interest based on the method of inflation-adjusted historic cost accounting and be subjected to imputed depreciation.

TAXES

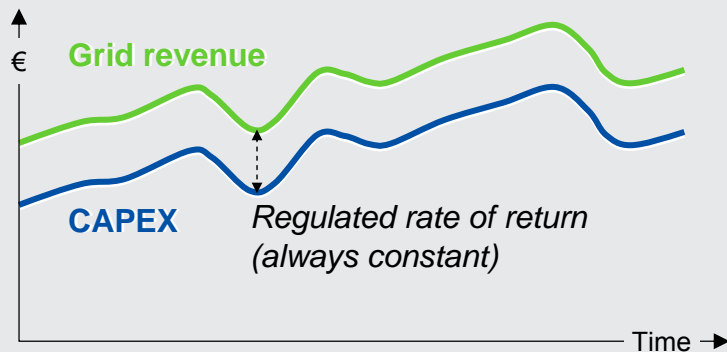
- > **Corporation tax:** No recognition until incentive regulation has become effective (then reflected in higher RoE)
- > **Trade tax:** full recognition (pass-through)



Cost vs. Incentive-based Regulation

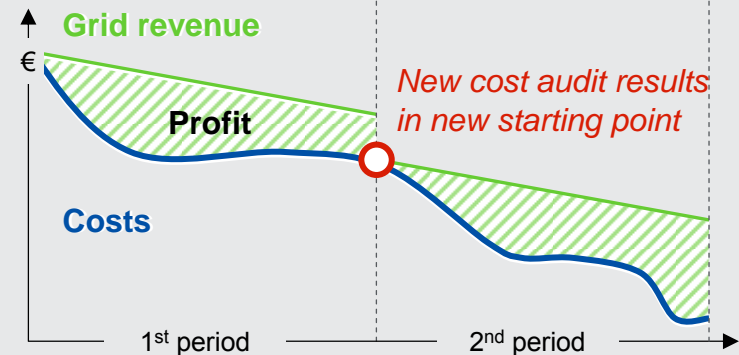
Cost-based Regulation

- > A grid operator's revenue cap is determined by its CAPEX and a specified rate of return:
Revenue = CAPEX + RoE
- > Efficiency gains resulting from cost reductions are directly passed through to the end consumer.
- > Problem: Since grid operators are always reimbursed for their costs, **they do not have any incentive to reduce costs.**



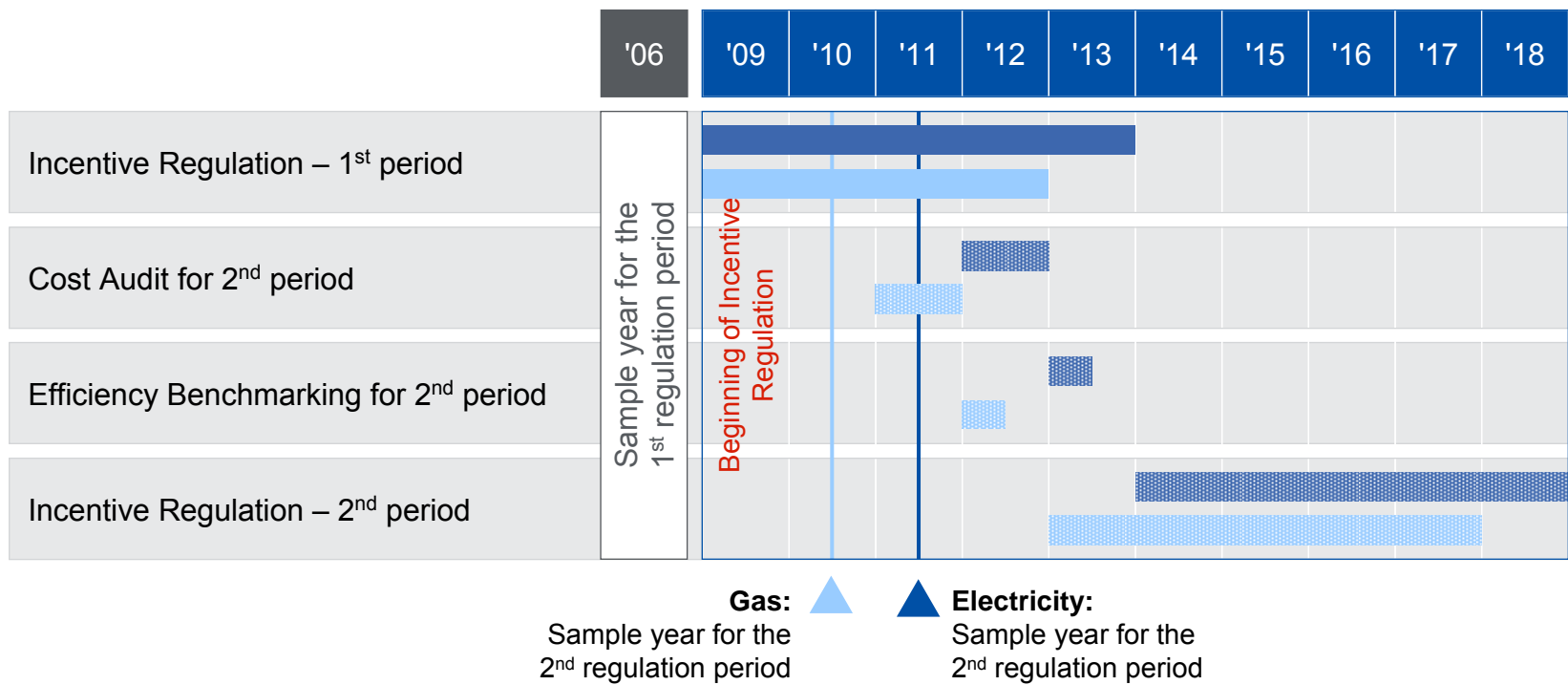
Incentive-based Regulation

- > Principle: Decoupling of revenue from costs
- > Incentive: Grid operators may temporarily generate higher profits if they release efficiency reserves and reduce costs.
- > Efficiency gains are initially delayed, but passed on to the customer permanently.



Incentive Regulation Timeline

- > Timeline for Electricity to be read as follows: In 2012, audit of costs of year 2011 (sample year) for benchmarking in 2013, first application of 2nd regulatory period in 2014
- > Gas and Electricity with different timelines to relieve the process of auditing



How Allowed Revenue is Calculated – The Regulation Formula

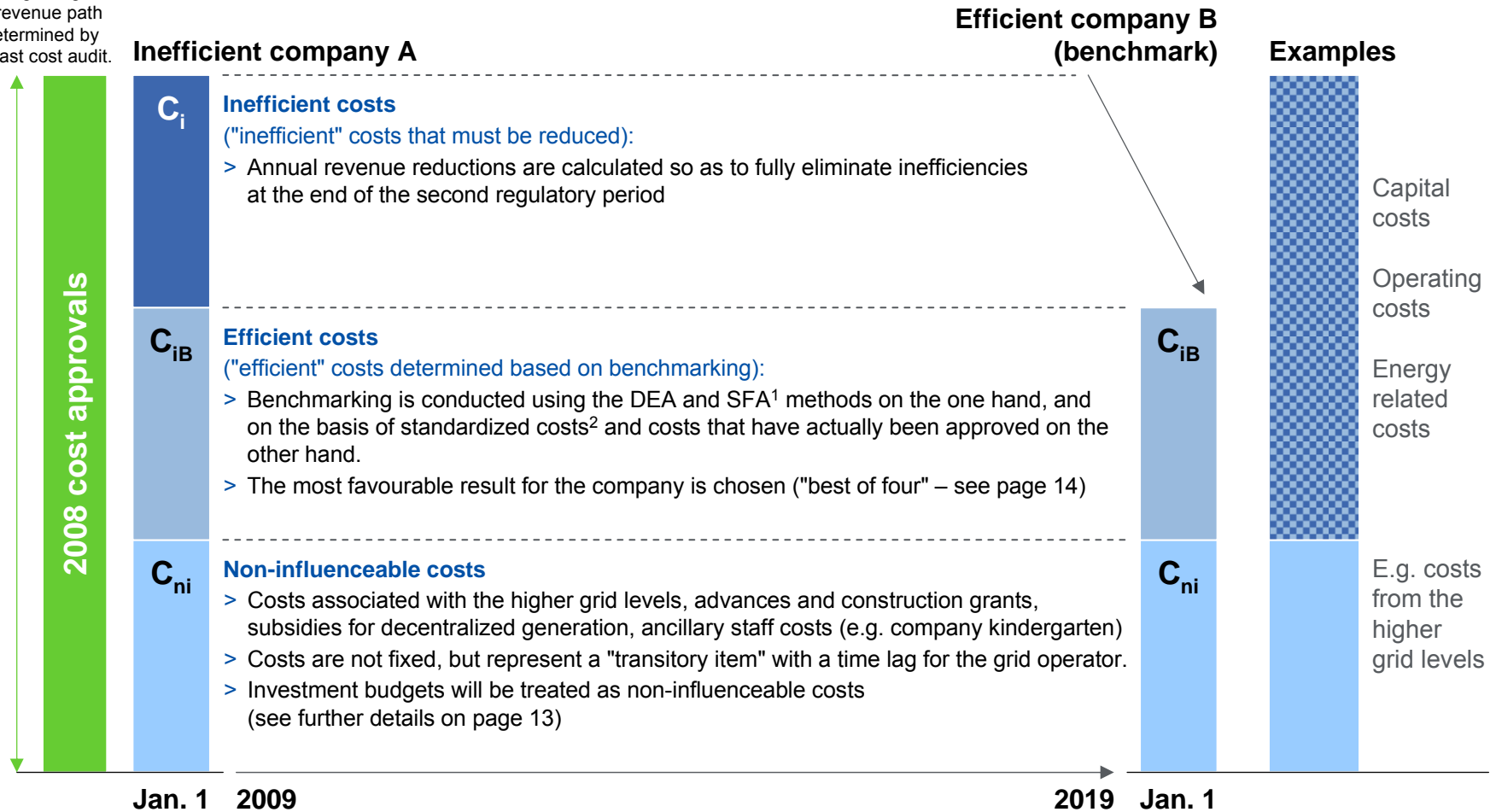
$$R_t = C_{ni,t} + [C_{iB,0} + (1 - V_t) \times C_{i,0}] \times \left(\frac{CPI_{t-2} - XF_t}{CPI_0} \right) \times EF_t + Q_t$$

- R_t = Allowed revenue in the year t
 $C_{ni,t}$ = Costs that cannot be influenced, i.e. employee benefit costs and grid fees for higher voltage levels (e.g. transport grid fees), applicable for year t
 $C_{iB,0}$ = Influenceable costs of the benchmark company in the reference year
 V_t = Percentage of inefficiency that has to be reduced by the end of year t
 C_i = Costs that are caused by inefficiency of the individual company
CPI = Consumer price index
XF = General X-factor, based on 1.25% in the 1st regulatory period;
 $XF_{2009} = 0.0125 = 1.25\%$
 $XF_{2010} = 1.0125 \times 1.0125 - 1 = 0.025 = 2.52\%$
EF = Expansion factor; dependent on number of connections to grid (50%) and on the size of the service area (50%)
Q = Quality component (not yet implemented)
t = index running from 1 to 5 (basis 0 is reference year)

$$R_t = C_{ni,t} + [C_{iB,0} + (1 - V_t) \times C_{i,0}] \times \left(\frac{CPI_{t-2} - XF_t}{CPI_0} \right) \times EF_t + Q_t$$

Revenue Cap: Composition of Costs

The beginning of the revenue path is determined by the last cost audit.

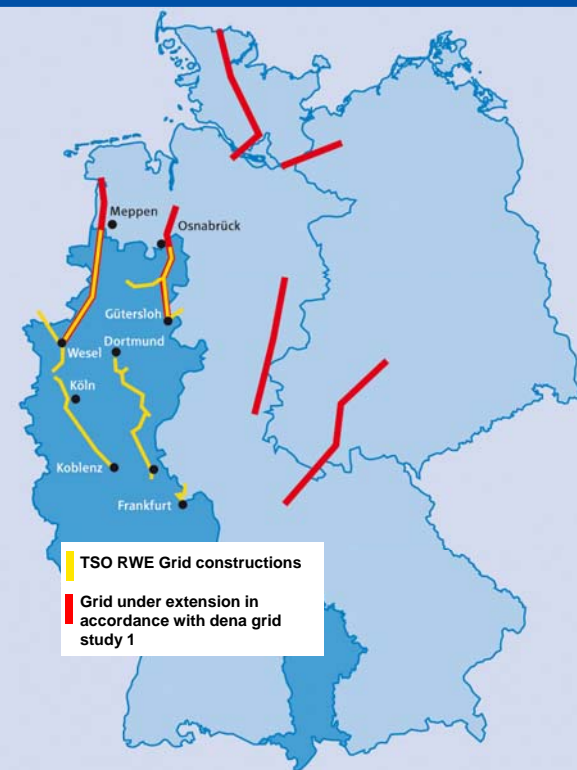


1) DEA = „Data Envelopment Analysis“, SFA = "Stochastic Frontier Analysis"
 2) The standardization eliminates differences due to the age structure of the assets

Investment Budgets are considered non-influenceable costs

- > For extensions and restructuring measures it is possible to file for investment budgets:
 - In case of approval capital costs are considered as non-influenceable costs
 - Duration of the approved budget depends on the respective project
- > Triggers for application:
 - Increasing wind generation
 - Relocation of conventional generation and nuclear phase-out
 - Increasing cross-border trades
- > The effects of the systematic 2-year delays in payback are capitalized and compensated upon completion

Necessary grid extensions according to dena study



Source: RWE TSO Electricity

Benchmarking

$$V_t = \frac{t}{10} \quad (\text{first period}) \quad \frac{t}{5} \quad (\text{second period})$$

(Relative inefficiency can be max. 40%, meaning that in each year of the first period a maximum of 4% of influenceable costs must be reduced)

Methods

- > The aim is to set efficiency limits based on combinations of inputs (e.g. total costs) and outputs (e.g. electricity distribution in kWh).
- > Grid operator inefficiencies can be determined based on their position relative to these limits.
- > In principle, the directive prescribes two methods for determining efficiency.
 - DEA (Data Envelopment Analysis)
 - SFA (Stochastic Frontier Analysis)
- > The two methods are based on different approaches (stochastic and non-stochastic) and may thus deliver different results.
- > "Best of Four": the best result from two DEA and two SFA benchmarks (one with real and one with standardized costs each)
- > Furthermore a 60% minimum of efficiency is applied

Large & Small Grid Operators

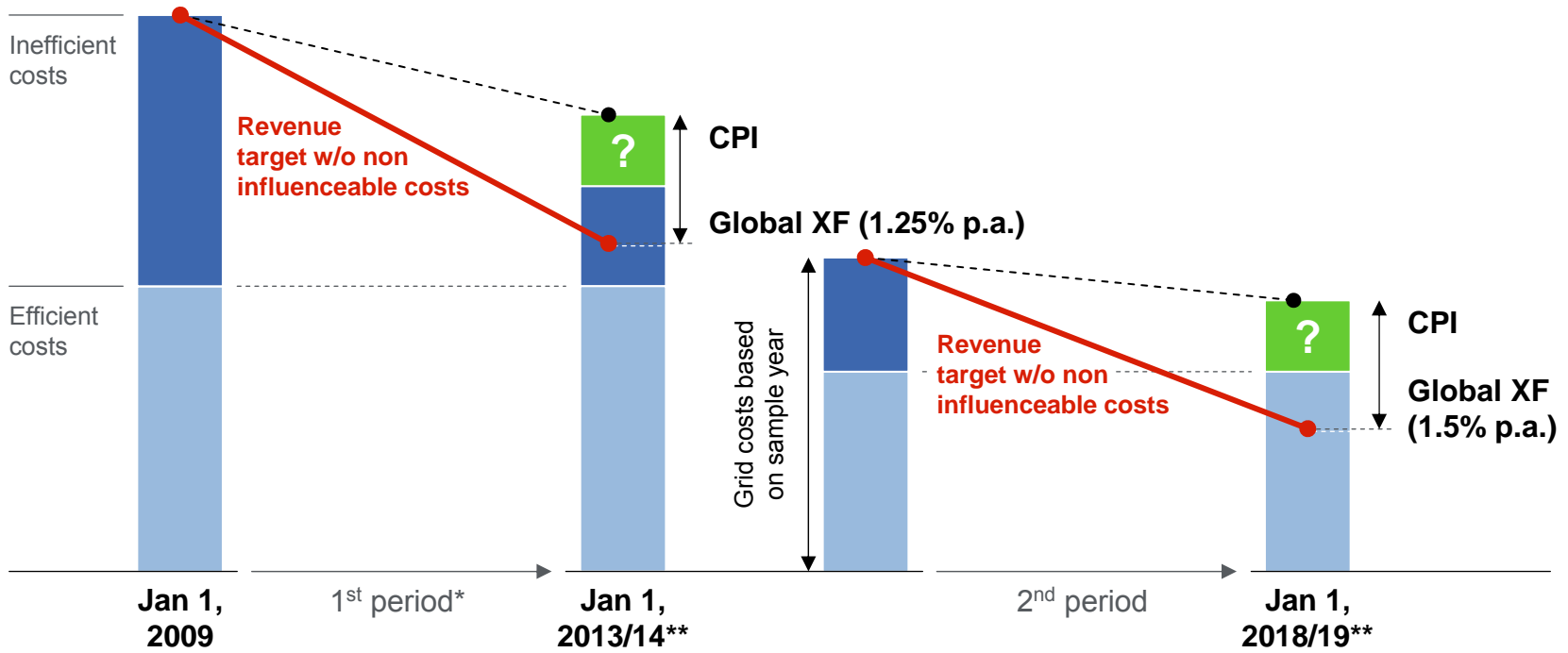
- > The DEA measures **large companies** against the most efficient company overall and **small companies** against the most efficient of their peers.
- > Grid operators with a maximum of **30,000 customers** (electricity and gas, of which **no more than 15,000 are gas customers**) can opt for the "simplified method":
 - Companies are assigned an **efficiency of 87.5%** across the board.
 - The share of total costs attributable to **non influenceable costs** is set at **45%**
 - Grid operators are then bound to their decision for **one period** (electricity: 5 years, gas: 4 years).
 - Eliminates the **extension factor, quality malus and bonus** as well as the need for approval of the **investment budget**

$$R_t = C_{ni,t} + [C_{iB,0} + (1 - V_t) \times C_{i,0}] \times \left(\frac{CPI_{t-2} \cdot XF_t}{CPI_0} \right) \times EF_t + Q_t$$

Revenue Cap: Adjustments in the Course of Time

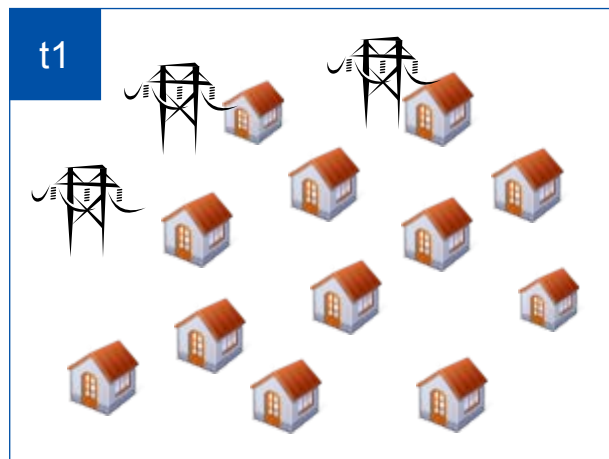
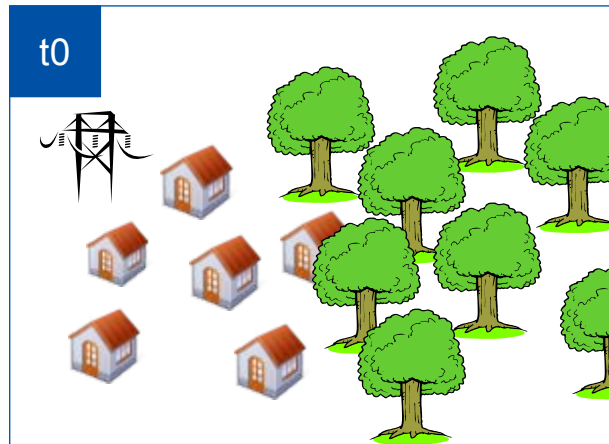
CPI_{t-2}
Adjustment by the overall consumer price index (CPI) of the last available calendar year.

XF_t
The revenue path is reduced by a global XF of **1.25% p.a.** in the first and **1.5% p.a.** in the second period for ALL grid operators.



* Electricity: 5 years, gas: 4 years
 ** Electricity 2014/2019, Gas 2013/2018

Expansion Factor for DSOs



- > Grid expansions can be factored into the revenue caps on an annual basis by way of the expansion factor.
- > The expansion factor relates to the DSO only (e.g. connection of new residential areas), while TSO extensions are mirrored in the investment budgets.
- > The expansion factor applies to the high-voltage, medium-voltage and low-voltage levels (electricity) or the pipelines as a collective, independent of pressure ratings (gas).
- > The expansion is measured by the relative growth of the area supplied (low voltage) and the relative growth of the number of connections.

Quality Regulation

Possible reliability indices for electricity grids

Parameter	Unit	Standardized Reliability Index
Interruption frequency	1/a	SAIFI
Duration of Interruption	min	CAIDI
No supply	min/a	SAIDI

SAIFI: System Average Interruption Frequency Index

CAIDI: Customer Average Interruption Duration Index

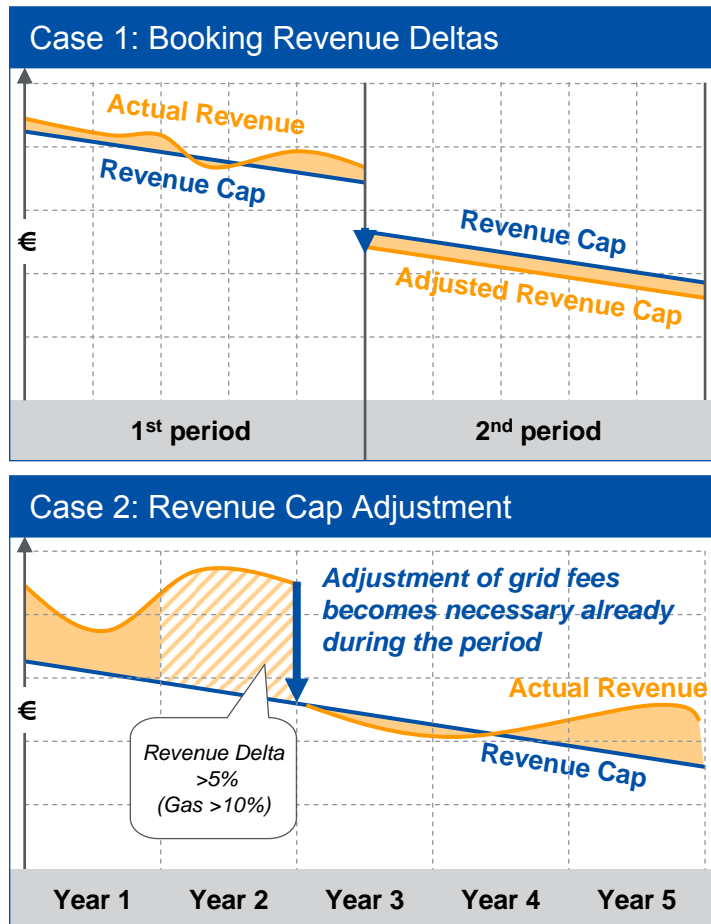
SAIDI: System Average Interruption Duration Index

- > Since profit can be raised by reducing costs under incentive-based regulation, a negative effect may be felt in terms of quality or security of supply.
- > Therefore, the German Incentive Regulation Directive (ARegV) includes a quality regulation provision.
- > The plan envisions a bonus/malus system oriented to quality parameters.
- > It is possible although not certain that there will be sufficient data in the first period. However, consultation sessions on the details of quality regulation for the second period are already underway.
- > The chart shows parameters that could be used to measure quality in electricity grid operation.

Source: IEEE guide for electric power distribution reliability indices

$$R_t = C_{ni,t} + [C_{iB,0} + (1 - V_t) \times C_{i,0}] \times \left(\frac{CPI_{t-2} - XF_t}{CPI_0} \right) \times EF_t + Q_t$$

Regulatory Account – $R_{t(\text{target})} \neq R_{t(\text{actual})}$



- > Differences driven by volume fluctuations of energy transported between actual and allowed revenue are booked to a regulatory account on an annual basis. Annual compensation adjustments are pointless for reasons of price stability, therefore annual revenues above target or below target are netted.
- > The balance of the regulatory account accrues interest and is distributed over the years of the second regulatory period.
- > Case 1 depicts a scenario where the regulatory account balance is positive, i.e., the grid operator earned too much in the end in Period 1. The revenue cap for the following period is adjusted by this (interest-bearing) balance.
- > Case 2 depicts a scenario where the deviation within a period (in year 2) is too high, i.e., actual revenue differs from allowed revenue by more than 5% (electricity) and 10% (gas). Therefore, compensation must be adjusted within the period (year 3) in order to avoid exorbitant revenue deviations.

Example: Electricity Distribution Grid Company A

- > In the reference year 2006, company A received grid revenues of €150m.
- > €50m out of the €150m could not be influenced; we assume, that this number remains unchanged in the following years.
- > The remaining €100m are considered influenceable. They are contrasted with the corresponding figure of the benchmark company B, which is €90m.
- > The difference between the influenceable costs of company A (€100m) and of the benchmark company B (€90m) is classified as inefficiency (€10m) which has to be fully eliminated within ten years.
- > For calculating inflation, the regulator divides the consumer price index of two years ago (CPI_{t-2}) by the CPI of the reference year 2006 (CPI_0). We assume a constant inflation rate of 2% p.a.
 - $CPI_{2006} = 100\% = 1.0$
 - $CPI_{2007} = 102\% = 1.02$
 - $CPI_{2008} = 104\% = 1.02 \times 1.02$
- > Company A has connected new customers to its grid since 2006 and thereby increased its service area. In both respects, growth is assumed to be 0.5% p.a., leading to an expansion factor of 1.02 in 2010. The expansion factor is not applied in the first year.

Allowed Revenue of Grid Company A

$$R_t = C_{ni,t} + [C_{iB,0} + (1 - V_t) \times C_{i,0}] \times \left(\frac{CPI_{t-2}}{CPI_0} - XF_t \right) \times EF_t + Q_t$$

in 2009

R_{2009}

$$= 50 + [90 + (1 - 0,1) \times 10] \\ \times (1.02 - 0.0125) \times 1 + 0$$

$$= 50 + [90 + 9] \times 1.0075$$

$$= 50 + 99 \times 1.0075$$

$$= 50 + 99.74$$

$$= \mathbf{149.74}$$

in 2010

R_{2010}

$$= 50 + [90 + (1 - 0,2) \times 10] \\ \times (1.04 - 0.025) \times 1.020 + 0$$

$$= 50 + [90 + 8] \times 1.015 \times 1.020$$

$$= 50 + 98 \times 1.0357$$

$$= 50 + 101.48$$

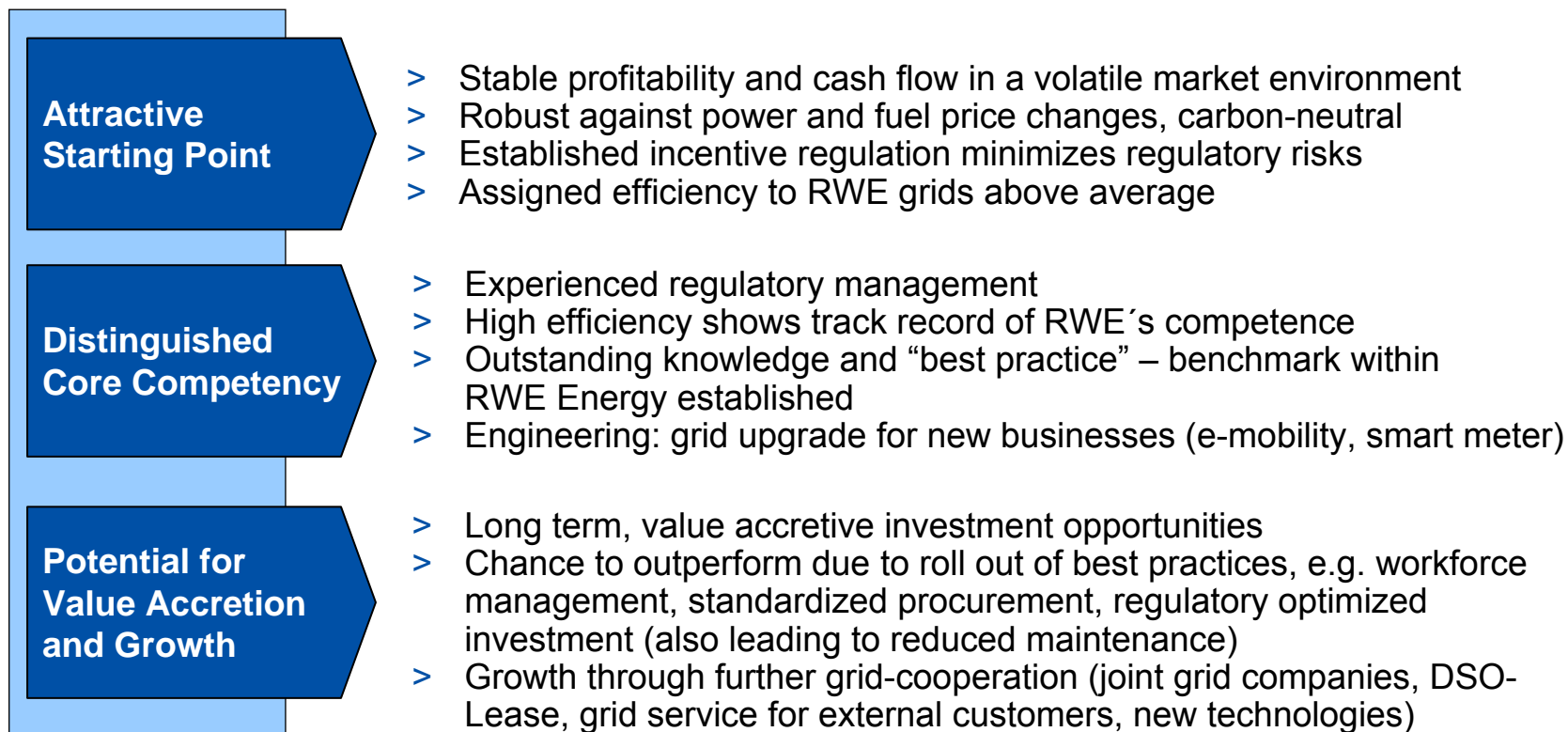
$$= \mathbf{151.48}$$

Further Development of the Revenue Cap

Period 1

Year	Non-influencable costs	Reduction of influence-able costs	Inflation	General X	Expansion-Factor	Revenue Cap
2009	50	99	1.02	0.013	1	149.74
2010	50	98	1.04	0.025	1.020	151.48
2011	50	97	1.06	0.038	1.025	151.74
2012	50	96	1.08	0.051	1.030	151.99
2013	50	95	1.10	0.064	1.035	152.26

Summary: For RWE the grid business is profitable and strategically attractive



▶ Incentive Regulation leads to planning reliability and outperformance potential

RWE Grid Assets in Germany

		Lines		Transformer Stations	Connections	Meters
Electricity		EHV and HV ≥ 110 kV	MV and LV < 110 kV			
		34,700 km	302,850 km	89,915	3,850,000	7,950,000
	Share in German grid	32%	20%			
Gas		TSO Gas	DSO Gas			
		4,000 km	30,700 km	8,500	645,000	845,000
	Share in German grid	7%	11%			

EHV = Extremely high voltage
 HV = High voltage
 MV = Medium voltage

LV = Low voltage
 TSO = Transmission System Operator
 DSO = Distribution System Operator