



Working document with
preliminary results

Carrying out the Cost Benefit Analysis for a change to Imbalance Settlement Periods in Europe

Slides on the cost information for the stakeholder meeting

8 March 2016

Information on cost from the questionnaire – summary

We have started with an imperfect data set...

- We have received a total of 125 responses to the questionnaire
- Data coverage is incomplete
 - No cost values for 10, mostly smaller, countries
 - Only 29 (partial) responses on ISP 30 → focus in this slide pack on ISP 15 and 5

...filling gaps by emails to respondents and scaling up based on assumptions

- Verifying information received on cost has been a major task
 - We have looked at each questionnaire individually to spot ambiguities
 - We have sent >40 emails to respondents, made >40 manual corrections
- Remaining gaps were filled by assumptions based on information provided
 - Within our sample: We have looked at comments and applied assumptions to scale up costs to represent the country as a whole
 - Outside our sample: We have applied sample averages and scale variables to close gaps for countries without observations

... which led to preliminary costs between € 3.4 bn (ISP 15) and € 13.6 bn (ISP 5)

- Preliminary results show total costs in the range of 3.4 bn for a change to ISP 15 up to € 13.6 bn for a change to ISP 5 (NPV 2019, real)
 - Large variation between ISP 15 and ISP 5 (factor 3)
 - Metering costs are by far the largest line item (c. 75-90% of Totex)
 - Five countries with largest costs bear more than 40% of total costs
- These results based on questionnaires might overestimate economic costs
 - Only incremental costs should be included (e.g. to ongoing meter replacement)
 - Only optimised costs for an ISP change should be included (e.g. not all load meters have to be read at new ISP scale, depending on corresponding benefits)

- Data coverage
- Overview of responses
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Cost data covers the largest EU countries

Total coverage

- We have received 125 responses to the questionnaire in total
 - 21 responses did not contain any cost information at all
 - Includes multiple responses by a single company (e.g. SSE from GB submitted 5 questionnaires for different business activities)

Geographic coverage

- Overall, we have a good geographic coverage
 - We have received responses from 22 countries, including the largest power markets in DE, UK, FR, IT, ES
 - We have no values for 10, mostly smaller, countries
- Countries which currently have an ISP > 15 min were most likely to reply
 - GB, FI and SE account for 75 combined (60%), partly due to separate reports by subsidiaries and business activities (retail, trading, generation,...)

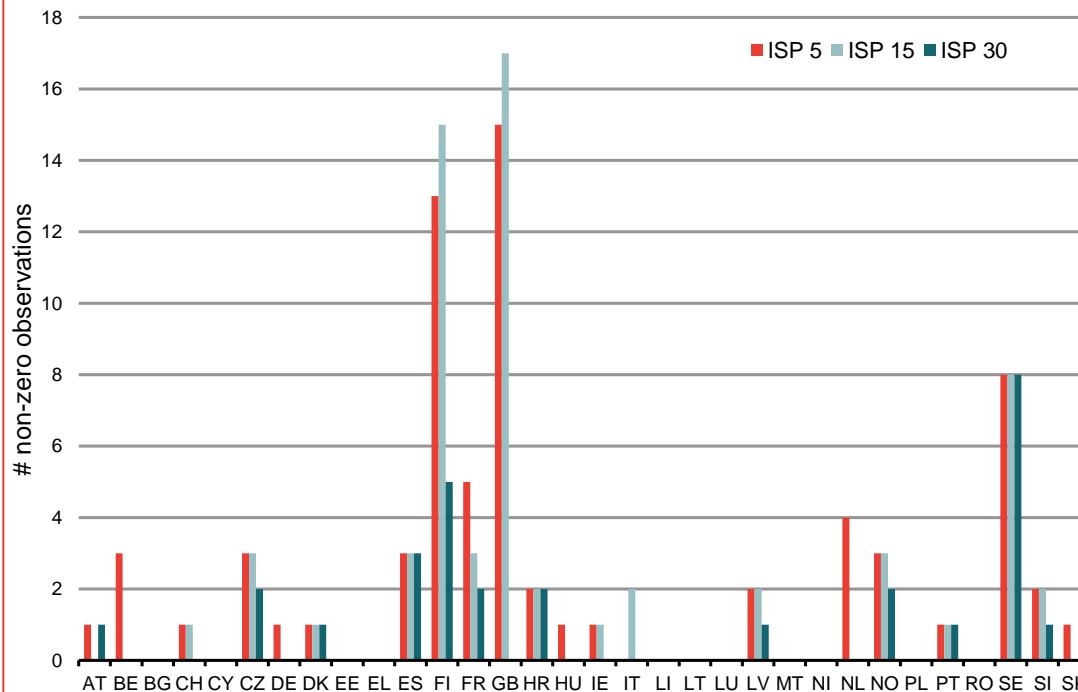
Coverage by ISP period

- Best coverage for a move to ISP 15 and ISP 5
- For ISP 30, we only have less than 29 observations
 - Low number can partly be explained since 13 countries by current ISP duration (60 or 30 mins)

... main gaps for 10 smaller countries and ISP 30

Overview of non-zero cost responses by country

Number of non-zero observations



- We have received 125 questionnaires in total
- The number of non-zero observations varies by ISP period
 - ISP 30: 29 responses
 - ISP 15: 64 responses
 - ISP 5: 71 responses
- Zero-observations can have multiple reasons
 - No response from a country
 - No response for the current ISP period (e.g. BE for ISP 15)
 - No significant cost expected
- Most non-zero responses come from countries which currently have an ISP period of 60 minutes
 - GB: up to 17 responses
 - FI: up to 15 responses
 - SE: up to 8 responses

Responses from country with ISP...	Responses on...		
	ISP 5	ISP 15	ISP 30
15	17%	2%	3%
30	30%	33%	7%
60	54%	66%	90%

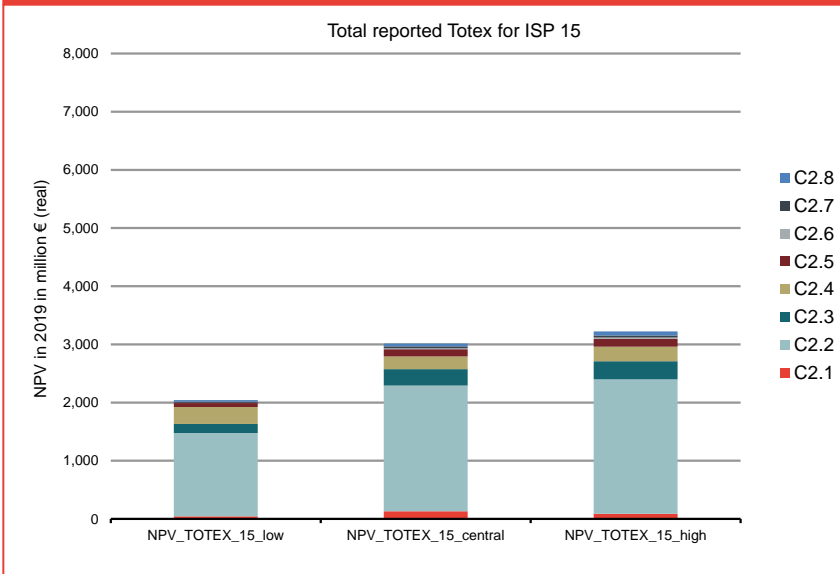
Single observation – likely to be an error

Most respondents with ISP 15 do not report a cost since they assume that they stay on 15 min

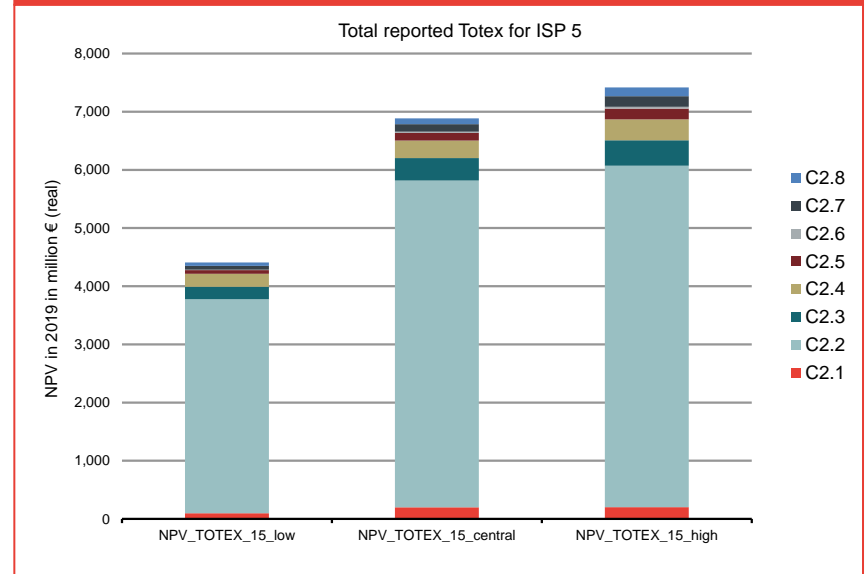
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Reported* TOTEX range from € 2 to 7 billion (NPV)...

Change to ISP 15



Change to ISP 5

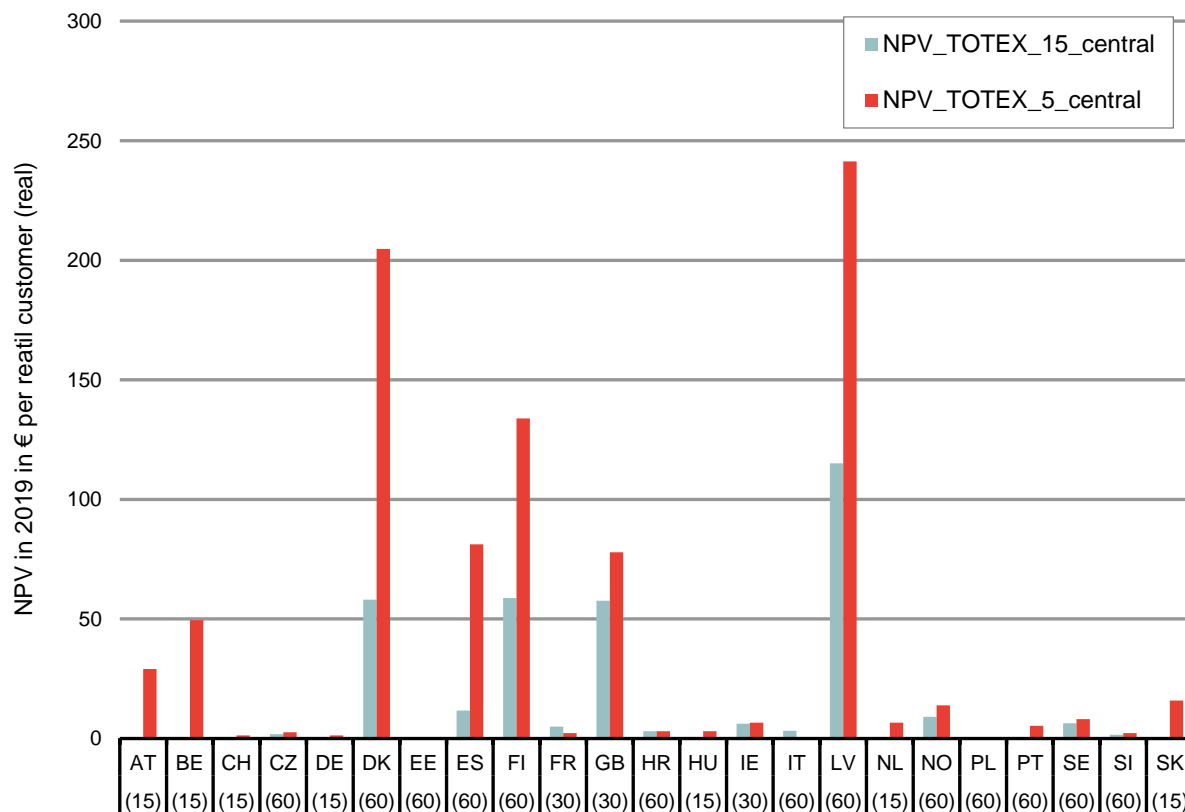


Summary

- NPVs of reported Totex vary significantly between ISP 5 and ISP 15
 - ISP 5 Totex are more than three times as high due (i) higher reported Totex by country and (ii) more countries affected by a change to ISP 5
- Metering and notification costs (2.2) are by far the largest cost item
 - Between 72% (ISP 15) and 82% (ISP 5) of total Totex reported
- Reported Totex are only a subset of total Totex due to
 - Incomplete representation of within-sample countries; and
 - Gaps for countries without an observation for some/all line items

... with a large variation between reported Totex per retail customer*

Preliminary



Gaps on number of meters affected – this did not allow to conduct a bottom-up approach based on unit costs

Large variation in costs reported by retail customer

- Difference can have several reasons
 - Low coverage of responses for a country (i.e. not fully representative)
 - Low assumed unit costs/ number of units to be adjusted (in particular for metering)
 - Scale effects, i.e. fixed cost are divided by different number of customers
- Gaps in the data prevent unambiguous identification of drivers

We have removed four outliers from our analysis

- A complete statistical outlier analysis is not feasible given the limitations of the dataset
 - Low number of observations by line item and/or country
 - Differences between countries may be driven by fundamental drivers (e.g. a higher share of meters that have to be replaced (C2.1), differences in necessity to update software (C2.4))
- We have identified the following “extreme” observations which would have a significant influence on the results of the CBA if not addressed:

Table. Overview – removal of outliers

No.	Line item	ISP 5	ISP 15	ISP 30
C2.1	Trading platforms	One observation for DE: OPEX moved to benefit side (impact liquidity)		-
C2.2	Metering and notification systems		One observation for ES: OPEX removed	-
C2.3	Scheduling and settlement			-
C2.4	Billing systems	One observation for GB removed		-
C2.5	BRP forecasting, trading and scheduling			-
C2.6	Documentation			-
C2.7	Network related costs	One observation for HR: CAPEX removed	One observation for HR: CAPEX removed	-
C2.8	Other costs			-

Source: Frontier

- Further adjustments are made with respect to metering costs (see next section)

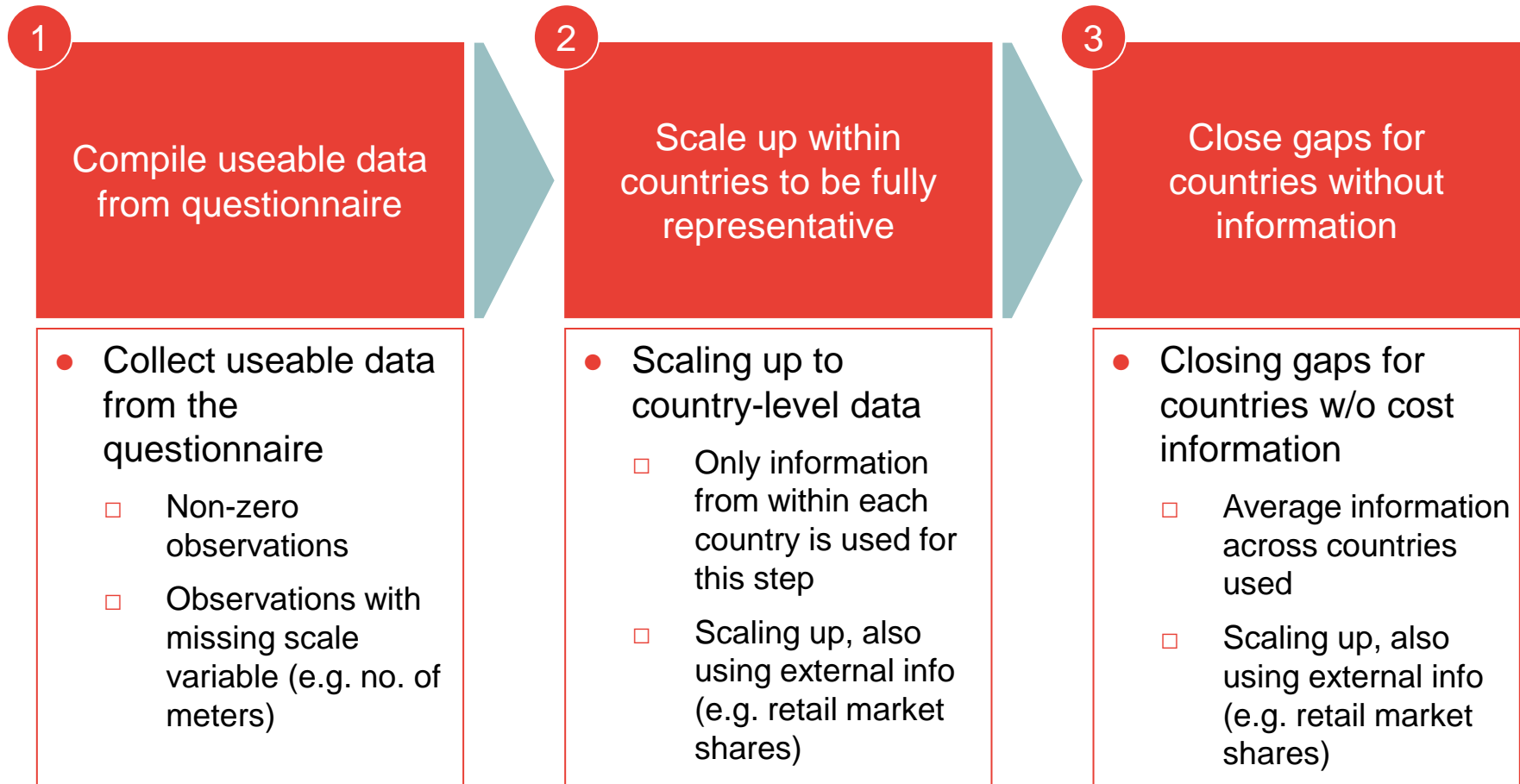
Focus in the next slides is the ISP 5 and 15 (central value) for which we have the best data quality

Results are preliminary and subject to further robustness checks and internal QA

All figures are presented as the average of responses, denoted as net present value (NPV) in 2019 (2015 real money)

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We proceed in three steps to scale up the cost information as an input to the CBA



... preliminary results for largest cost items are illustrated in the following slides

We have used the following variables to scale up reported costs

Table. Overview - scaling variables for cost items

No.	Line item	Scale variable within-sample	Closing gaps out-of-sample	Explanation and comments
		Scaling up observations by country in sample to be fully representative	Average of within-sample costs are scaled up by...	
C2.1	Trading platforms	None	100% (i.e. apply sample average)	Within sample costs treated as representative (Only condition is that ISP 5 cost \geq ISP 15 cost)
C2.2	Metering and notification systems	<u>TN</u> : None <u>DN</u> : Market share of reported costs where available (proxy: no. of large DNOs (source: Eurostat))	No. of retail customers (source: Euroelectric, 2013)	Ratio of no. of retail customers used as proxy for ISP meters
C2.3	Scheduling and settlement	No. of main retailers and generators (source: Eurostat)	No. of main retailers and generators (source: Eurostat)	Sample contains subset of main retailers and generators
C2.4	Billing systems	No. of customers with ISP readable meters (0.8.2)	No. of retail customers (source: Euroelectric, 2013)	External information used to close gaps on ISP meters, e.g. retail market shares
C2.5	BRP forecasting, trading and scheduling	No. of main retailers and generators (source: Eurostat)	No. of main retailers and generators (source: Eurostat)	Sample contains subset of main retailers and generators
C2.6	Documentation	None	100% (i.e. apply sample average)	No obvious scale variable for cost of modifying codes and agreements, relatively small cost item
C2.7	Network related costs	None	No. of TSOs	Mainly TSO-related costs, majority of which is a fixed cost for system change per TSO
C2.8	Other costs	None	None	This category captures specific items that do not systematically occur in other countries or are capture under items C2.1-C2.7

Source: Frontier

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Overview of fully scaled-up results

Starting point are reported Totex from questionnaires
...

- Starting point is an imperfect data set...
 - Only limited data coverage regarding line items and/or countries
 - Underlying value drivers (e.g. no of ISP meters) only available for a subset
- ... with large variation between reported Totex
 - Reported Totex differ significantly between countries
 - Differences can only partly be explained by country characteristics

...which are scaled up to full country level...

- Within our sample: We have looked at comments and applied assumptions to scale up costs to represent the country as a whole
- Outside our sample: We have applied sample averages and scale variables to close gaps for countries without observations

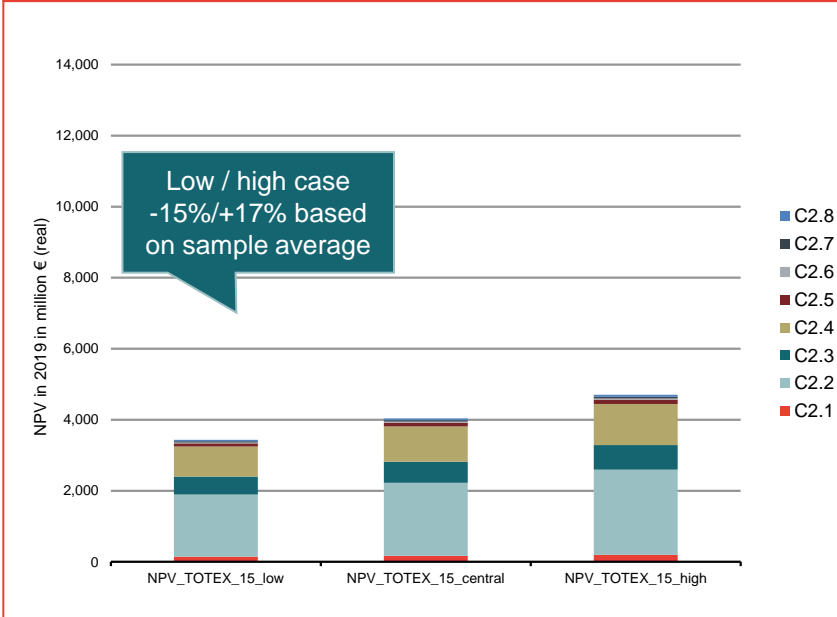
... and further adjusted to reflect economic costs (esp. for metering)

- Results represent incremental costs of a change to a new ISP period (rather than pure Totex in a new ISP regime)
- Magnitude of responses and comments in questionnaires suggest that reported Totex might overestimate economic costs
 - Only incremental costs should be included (e.g. to ongoing meter replacement)
 - Only optimised costs for an ISP change should be included (e.g. not all load meters have to be read at new ISP scale, depending on corresponding benefits)

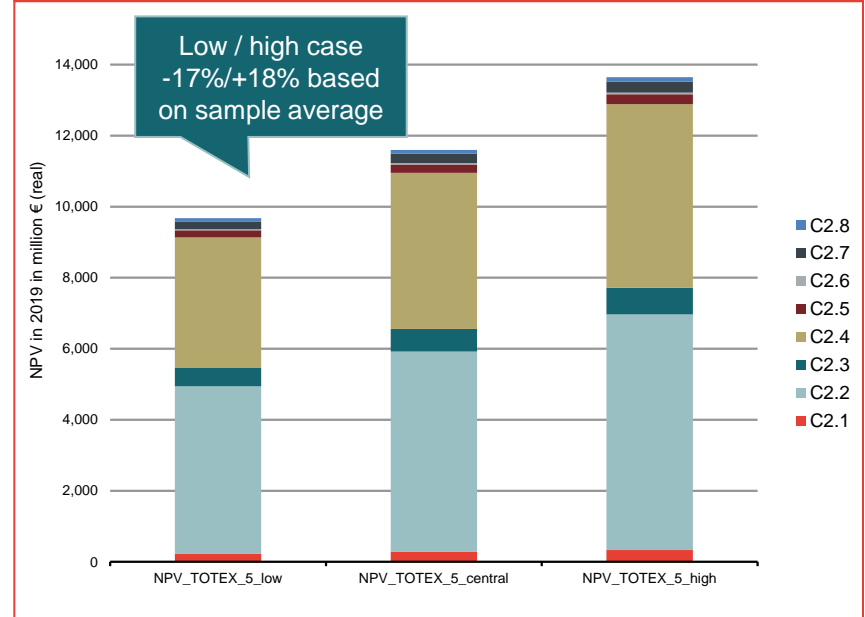
We aim at economic costs for the CBA

Overview of fully scaled-up results by line item

Change to ISP 15



Change to ISP 5



Summary

- **Reported Totex have been uplifted to reflect total costs in all countries**
 - Uplift by 34% for ISP 15 (central case)
 - Uplift by 68% for ISP 5 (central case) – higher uplift necessary due to more gaps
- **Metering costs (2.2) remain by far the largest cost item also after upscaling**
 - Metering costs (2.2) account for more than 50% of total costs
 - Lower weight than in reported Totex (>70%) due to (i) higher data coverage and (ii) adjustments

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Metering and notification system costs

Scope of this line item

- One-off cost of replacing/updating the meters (remotely or on-site)
- Incremental operating costs of managing new meters
- The cost of incremental change to processes required to provide shorter timeline data relating to contract volume notifications for each ISP
- The cost of incremental change to systems and processes to new ISP period

We distinguish between TN and DN

- We have divided the sample into
 - Costs reported by TSOs that affect meters and systems on the transmission network (TN)
 - Costs reported by other stakeholders (mainly DSOs) on cost that occur mainly with respect to meters and systems in the distribution network (DN)
- TN Costs reported by TSOs account only for c. 15-20% of total metering costs (after full upscaling)

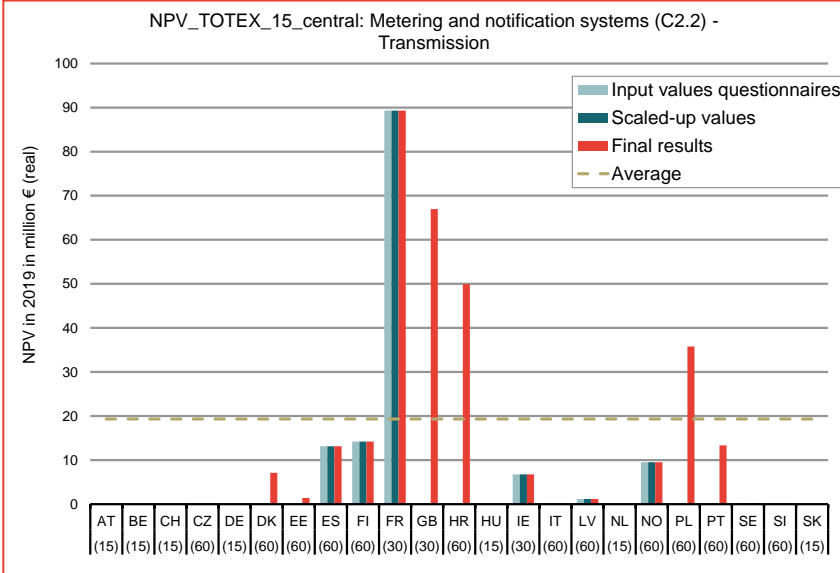
We observe a large variation for DN costs – adjustments necessary

- We observe a large variation for DN costs, only partly explained by country specifics
 - Large variation of costs per retail customer even for countries with same initial ISP and smart meter roll-out (e.g. IT ~ 1€/customer vs. DK c. 50-200 €/customer)
 - Underlying assumptions on necessary replacements varies significantly across and even within countries – ranging from <5% to 100%
- To determine the final result, we present two cases, involving different degrees of adjustment to reported Totex

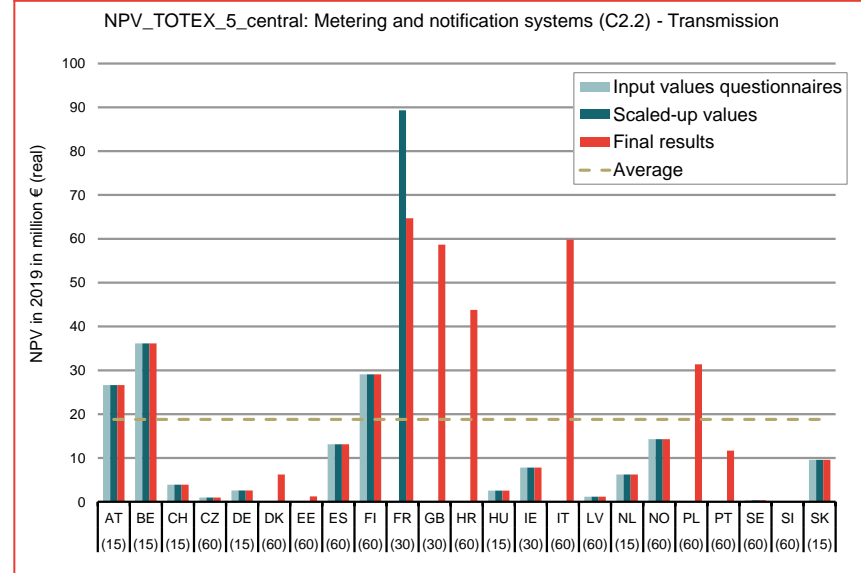
2.2 Metering and notification systems – transmission

Preliminary

Totex ISP 15 (TN)



Totex ISP 5 (TN)



1 Usable information

- Collect all observations reported by TSOs on TN

2 Scaling up

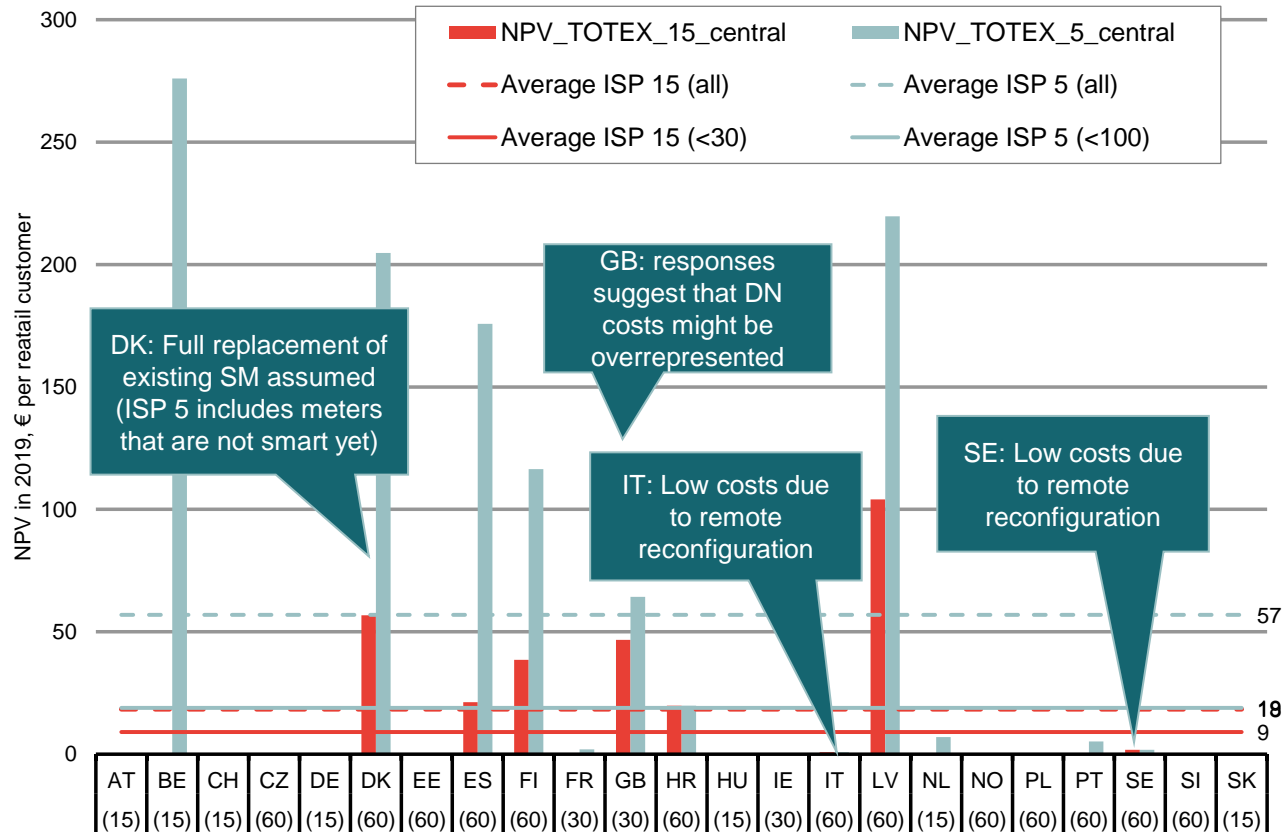
- No scaling up to country-level data since TSO replies treated as fully representative
 - Most countries with single TSO
 - DE: all 4 TSOs replied

3 Closing gaps

- Using average in-sample cost data to fill gaps
- Scaled by no. of retail customers (source: Eurostat)

Reported Totex per retail customer show a large variation between countries

Preliminary



Adjustment necessary since Totex may differ from costs

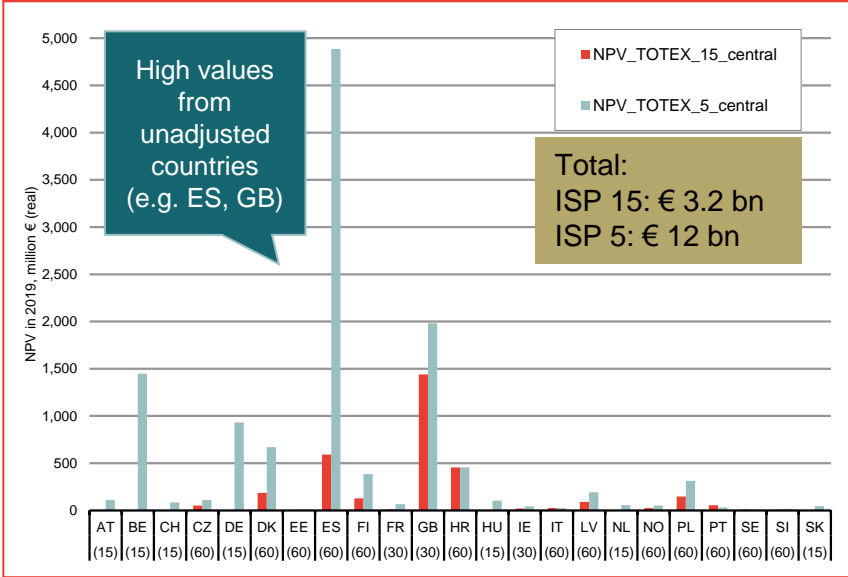
- Same countries report high incremental Totex per retail customer, mainly due to a large share of required meter replacements (up to 100%)
- We have applied an adjusted average to fill the gaps in other countries
 - ISP 15: DK, FI, GB and LV
 - ISP 5: BE, DK, ES, FI and LV

To determine final costs for DN metering costs, we distinguish two cases

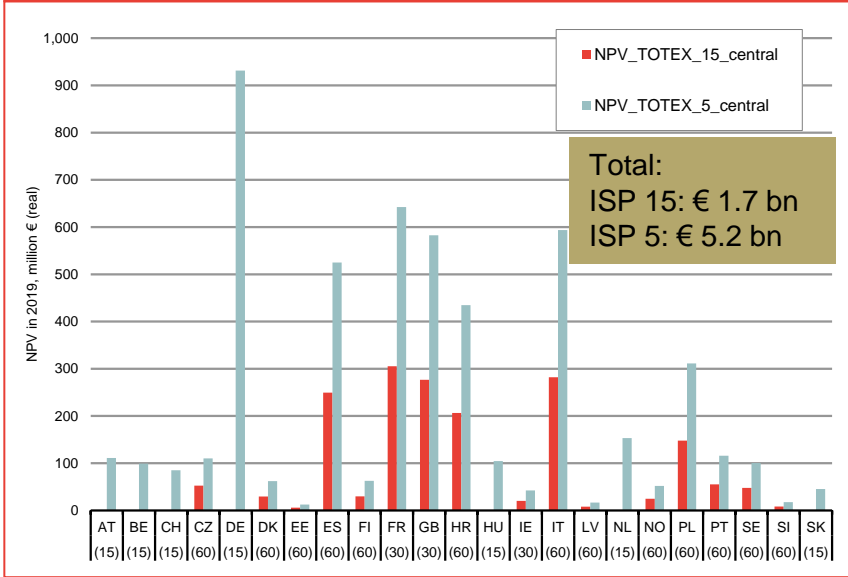
Preliminary

Notice different scales used

Case 1 – no adjustment to countries with observation



Case 2 – apply adjusted average applied to all countries



Interpretation of results

- Case 1 relies on sample information – we have only adjusted the average that is used to fill the gaps for countries without observation
- Case 2 better reflects what we believe is the true economic cost – We have also adjusted the values for in-sample countries with high Totex

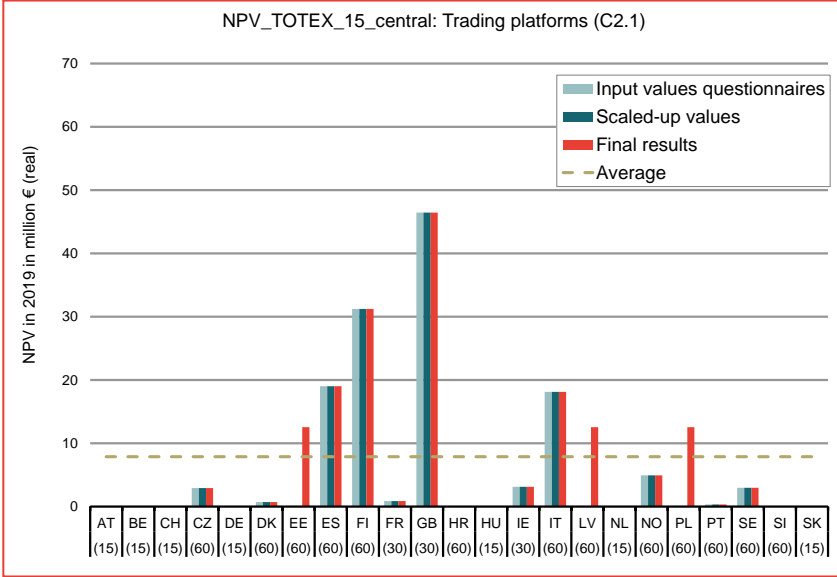
... We believe Case 2 is closer to true economic costs

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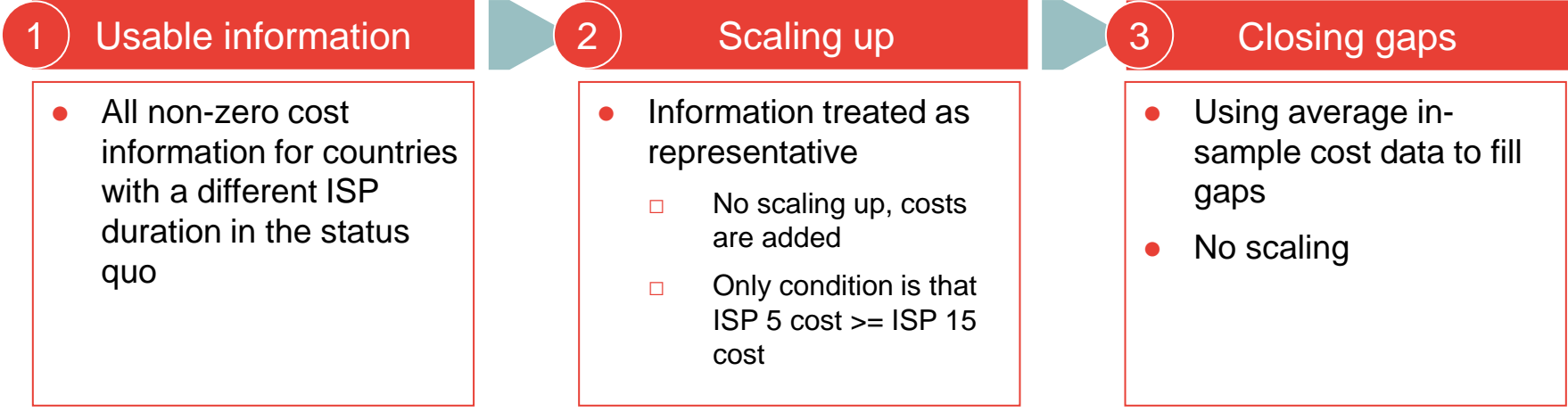
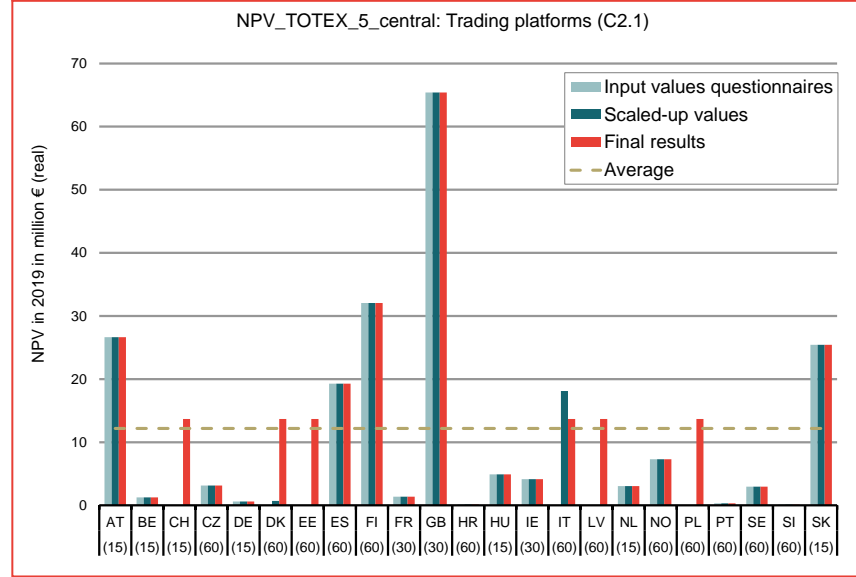
2.1 Trading platforms

Preliminary

Totex ISP 15



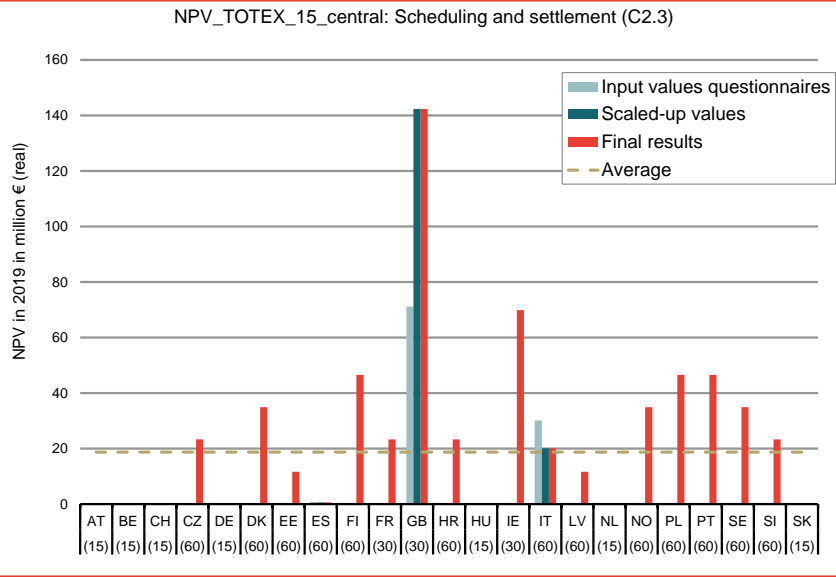
Totex ISP 5



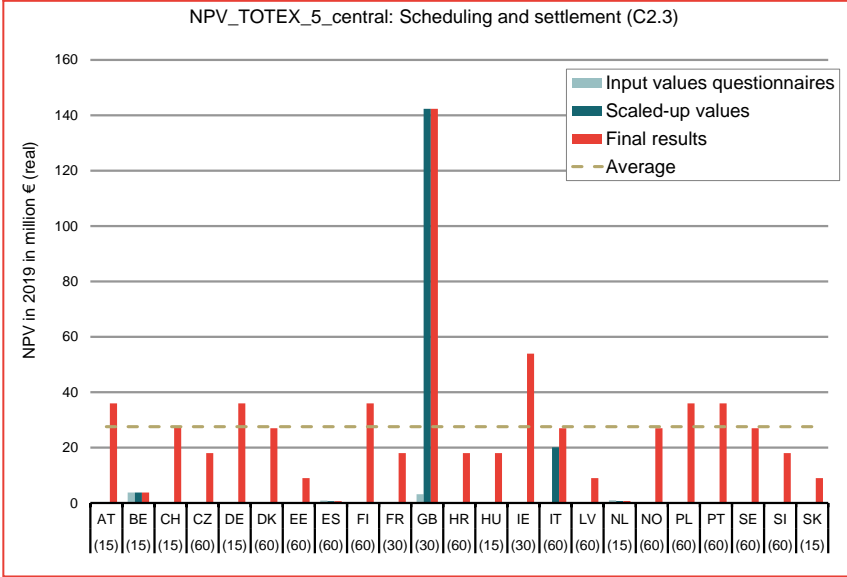
22 *) Outlier for DE (OPEX ISP 5) removed

2.3 Scheduling and settlement

Totex ISP 15



Totex ISP 5



1 Usable information

- All non-zero cost information for countries with a different ISP duration in the status quo

2 Scaling up

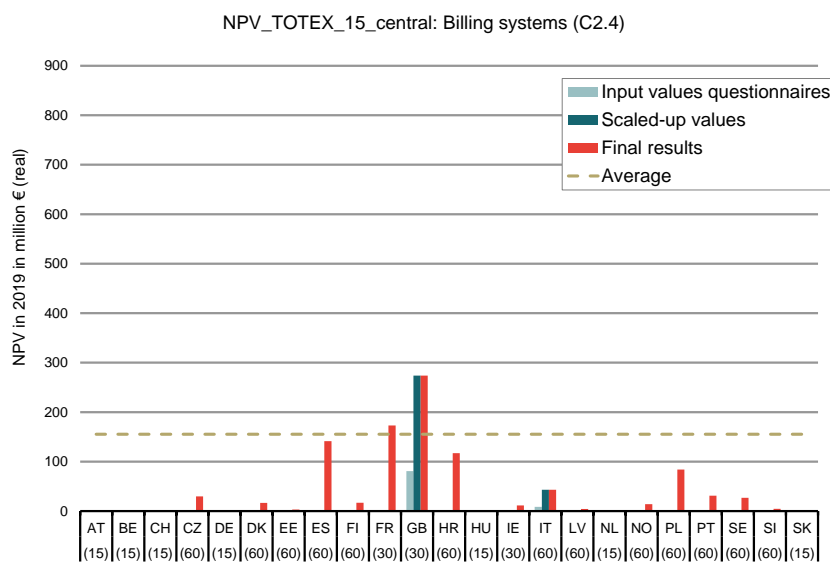
- Scaling up to country-level data by ratio of
 - No. of observations in our sample; to
 - No. of main retailers and generators (source: Eurostat)

3 Closing gaps

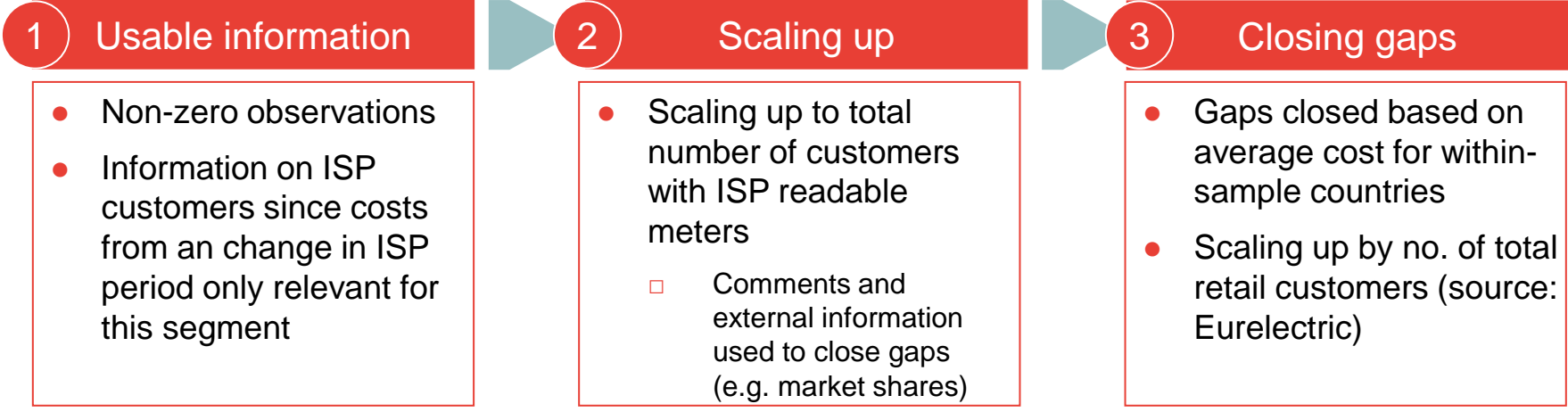
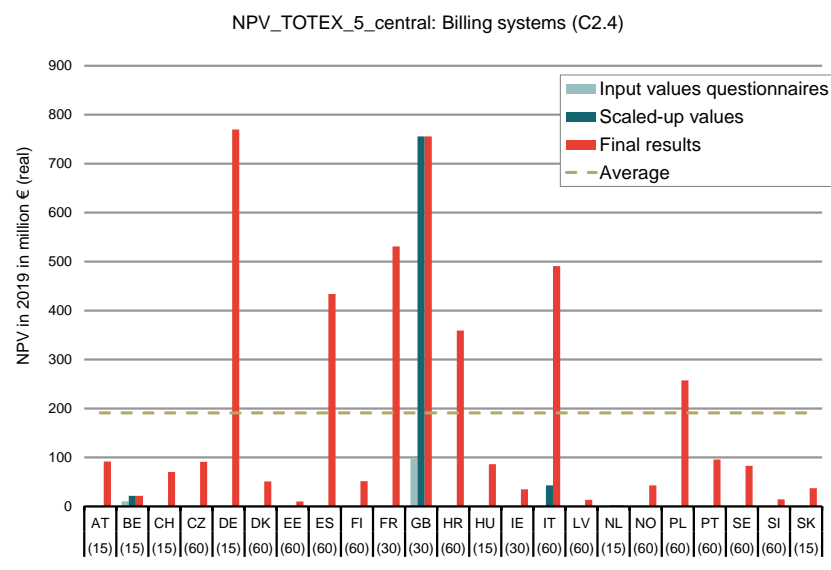
- Using average in-sample cost data to fill gaps
- Scaled by no. of main generators and retailers (source: Eurostat)

2.4 Billing systems

Totex ISP 15



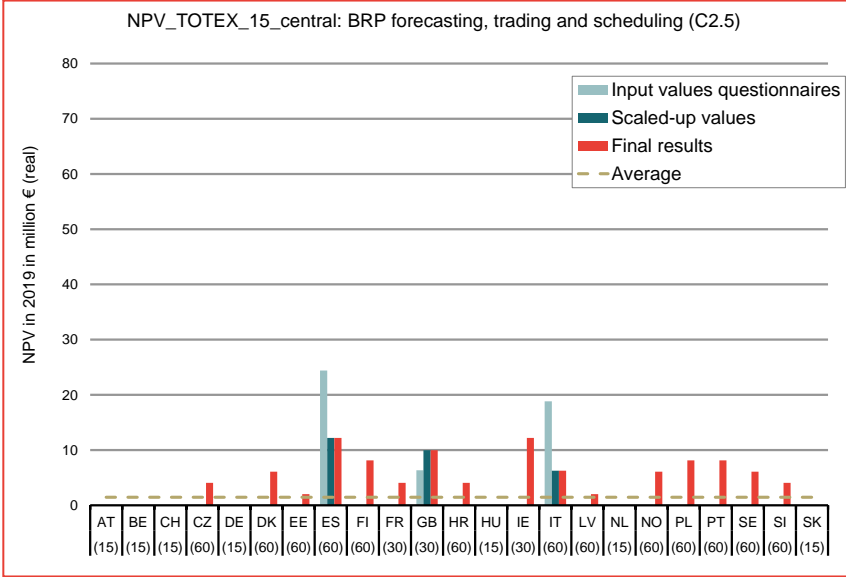
Totex ISP 5



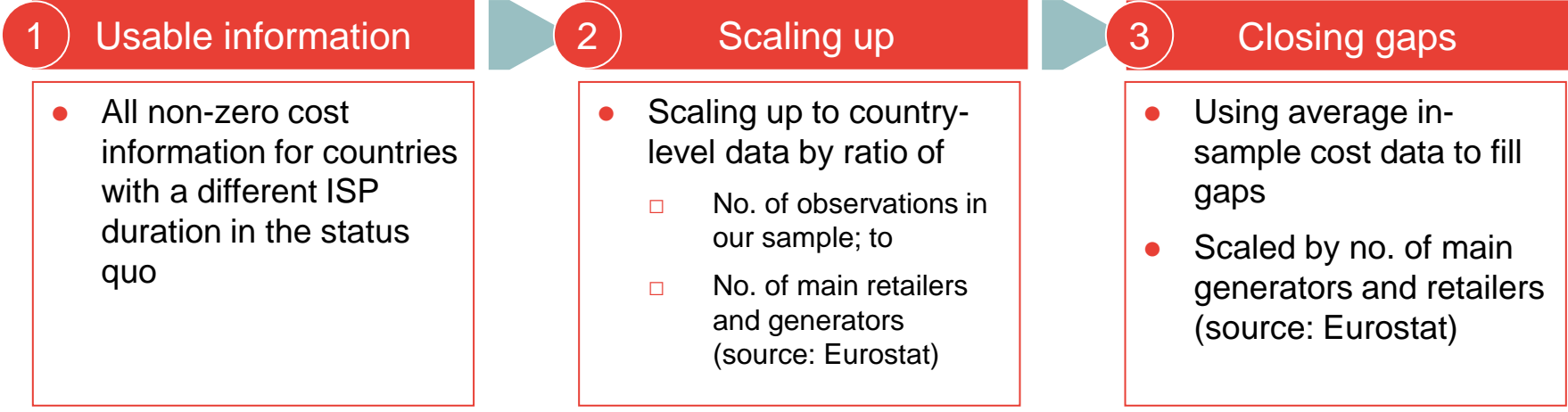
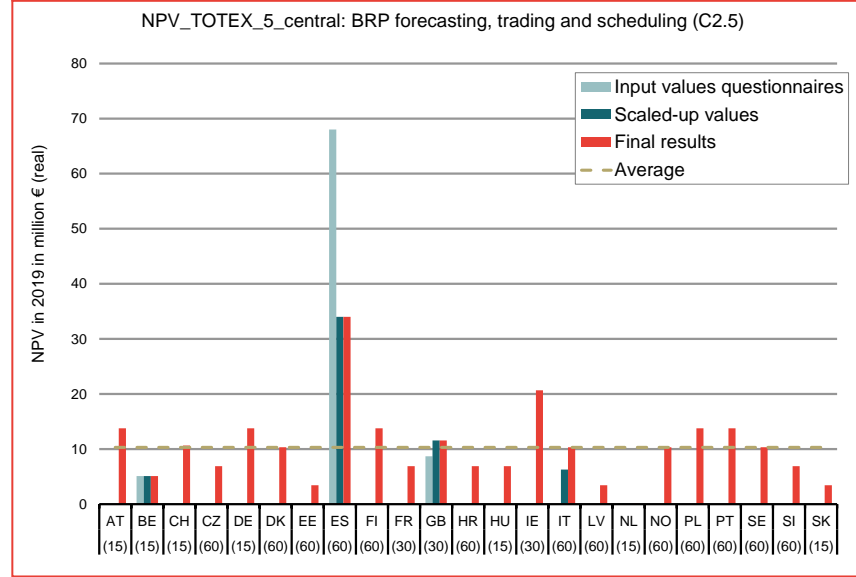
2.5 BRP forecasting, trading and scheduling

Preliminary

Totex ISP 15

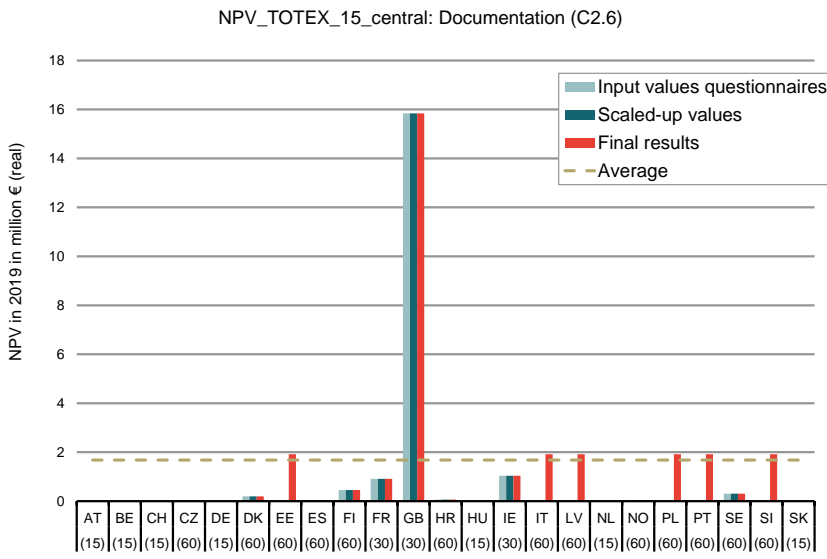


Totex ISP 5

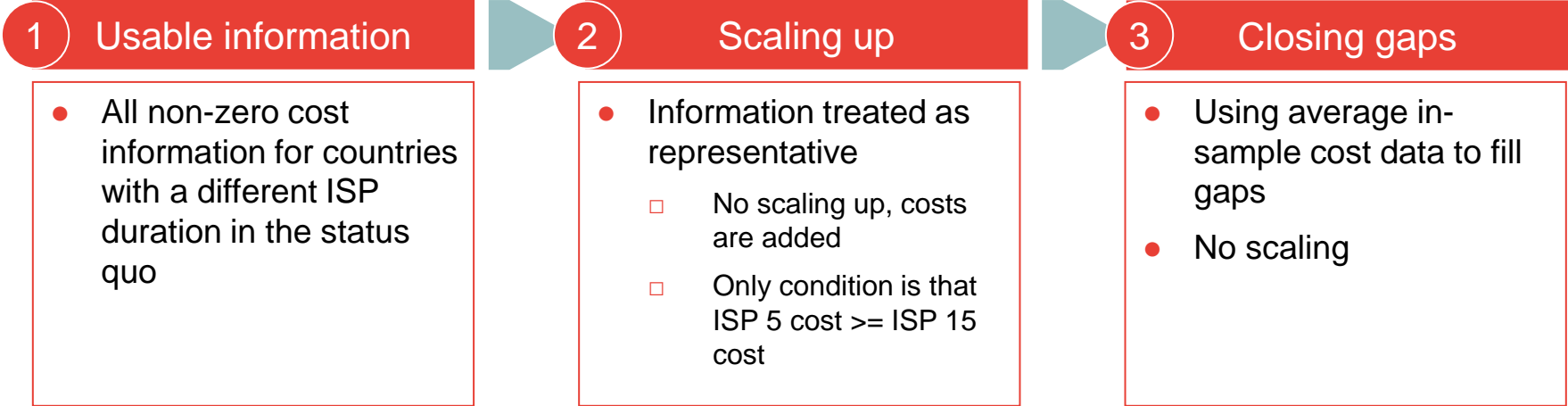
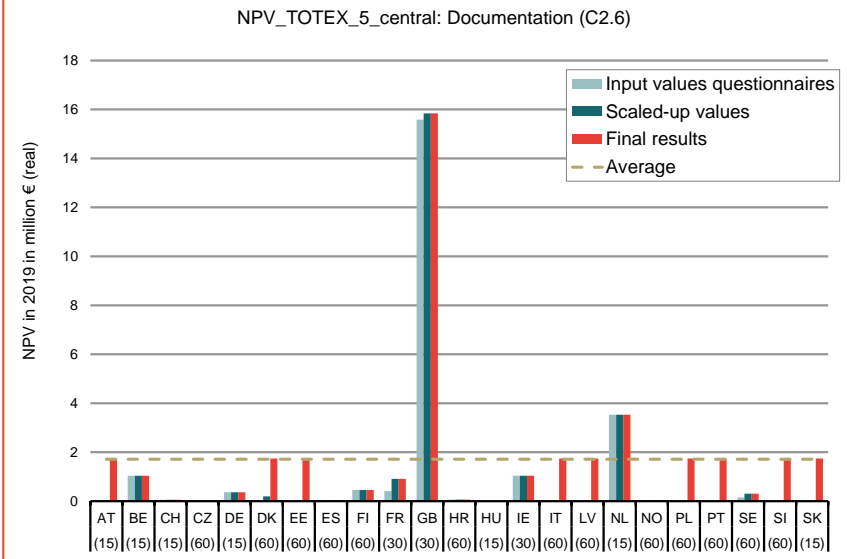


2.6 Documentation

Totex ISP 15

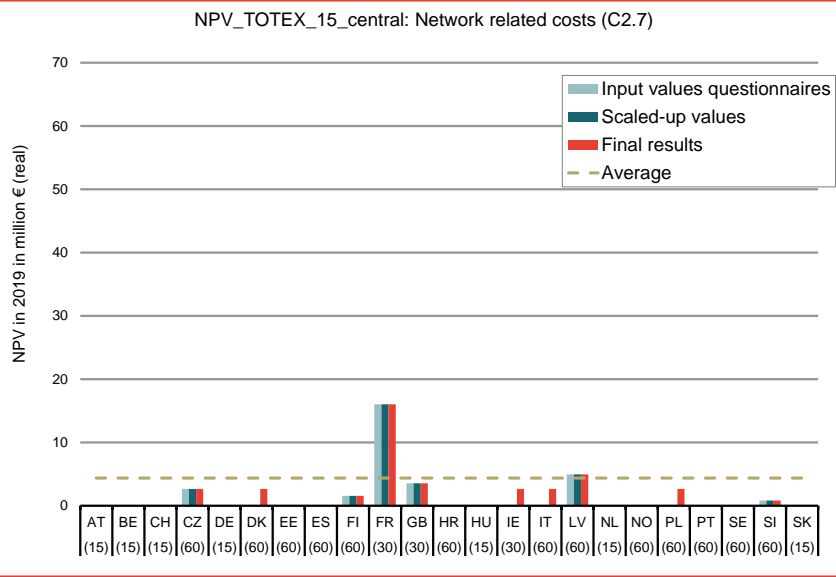


Totex ISP 5

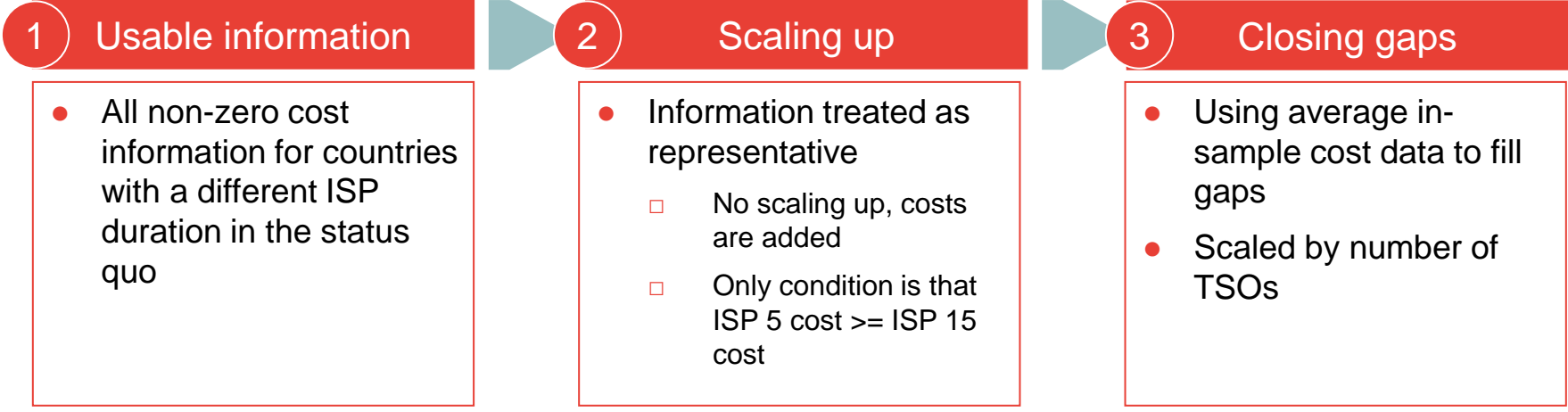
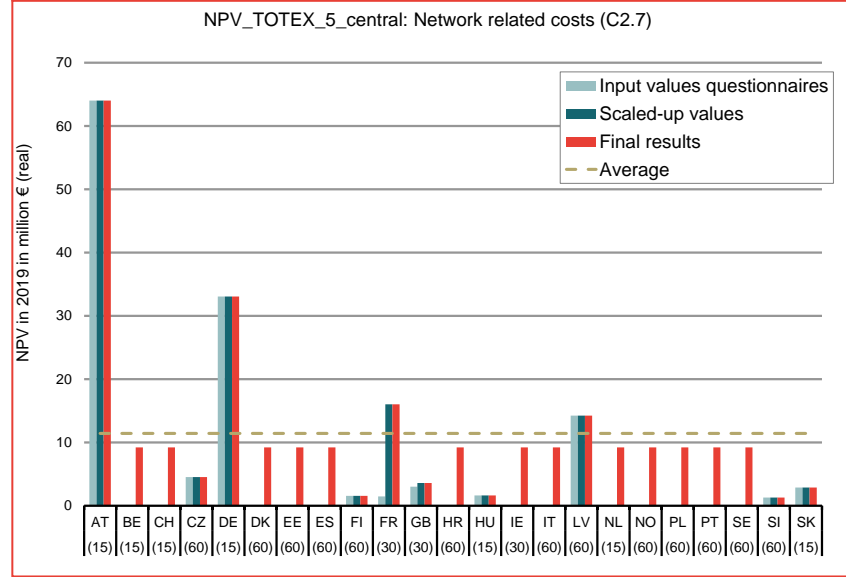


2.7 Network related costs

Totex ISP 15



Totex ISP 5

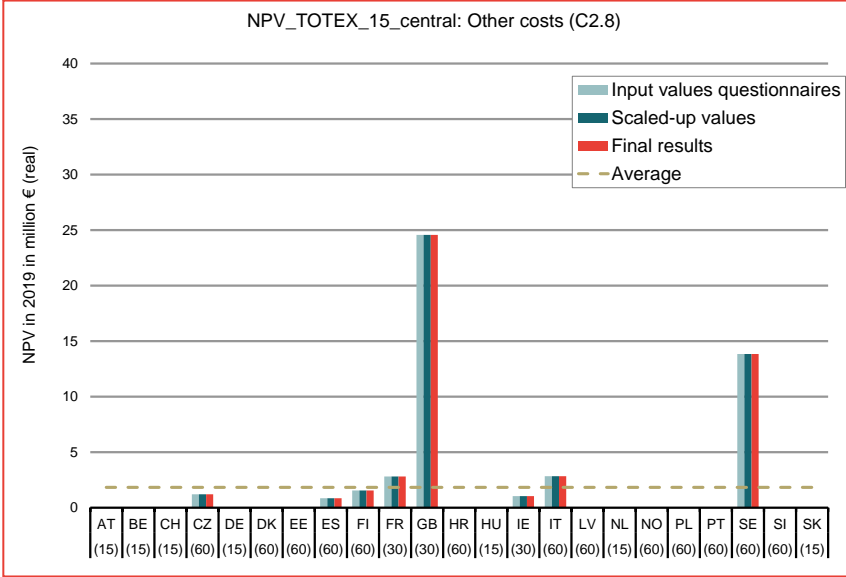


27 *) Outlier for HR (CAPEX and OPEX ISP 5 and ISP 15) removed

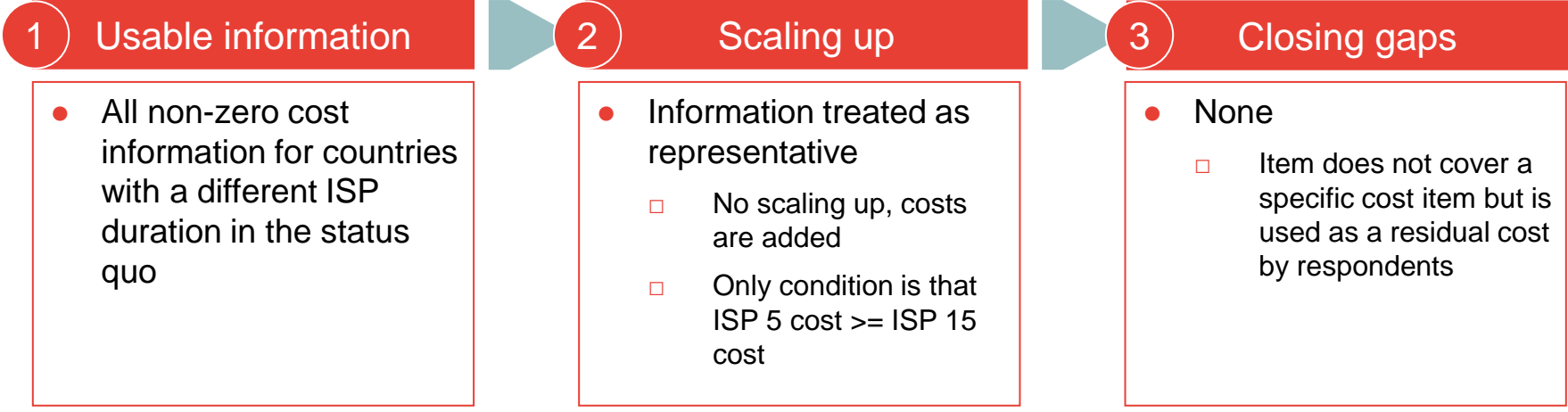
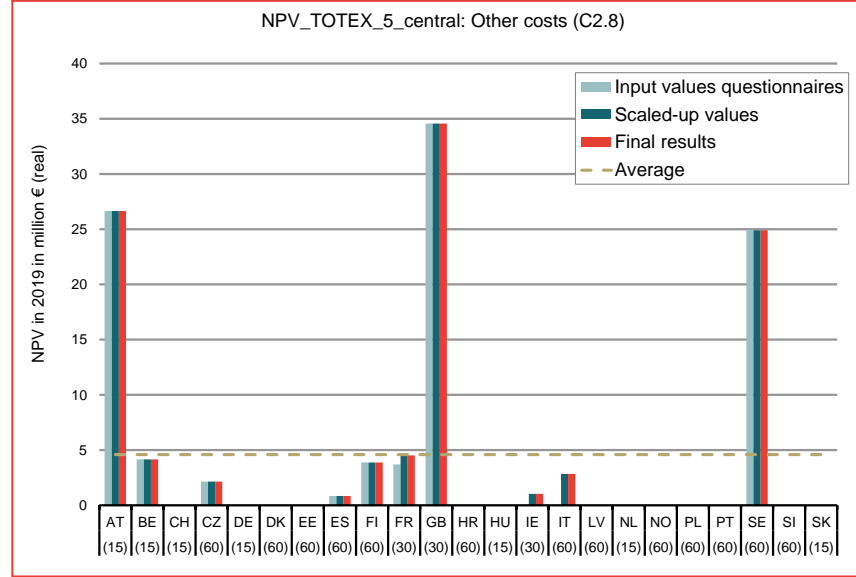
2.8 Other

Preliminary

Totex ISP 15



Totex ISP 5



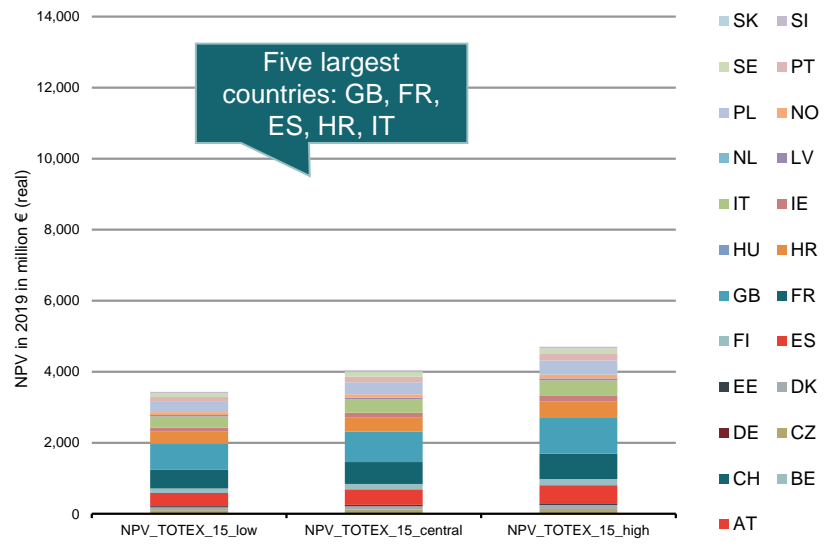
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Overview of fully scaled-up cost results by country

Preliminary

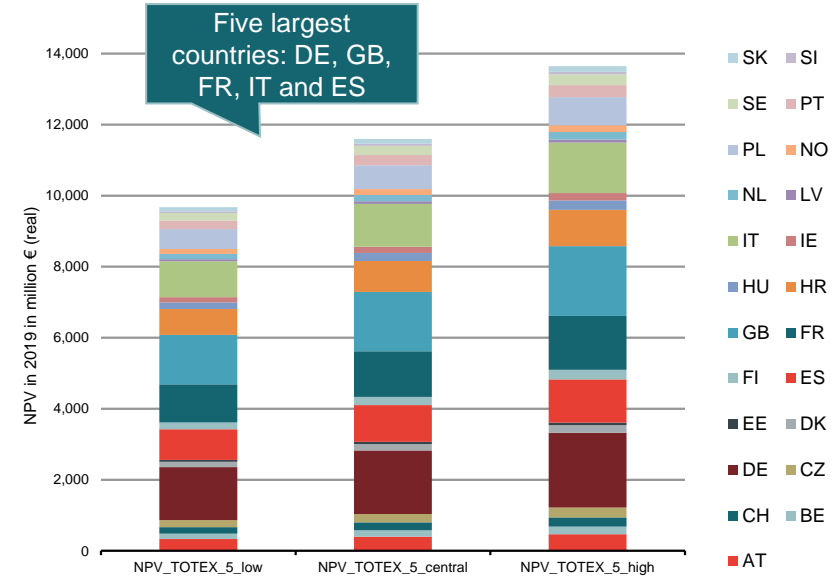
Change to ISP 15

Low / high case
-15%/+17% based
on sample average



Change to ISP 5

Low / high case
-17%/+18% based
on sample average

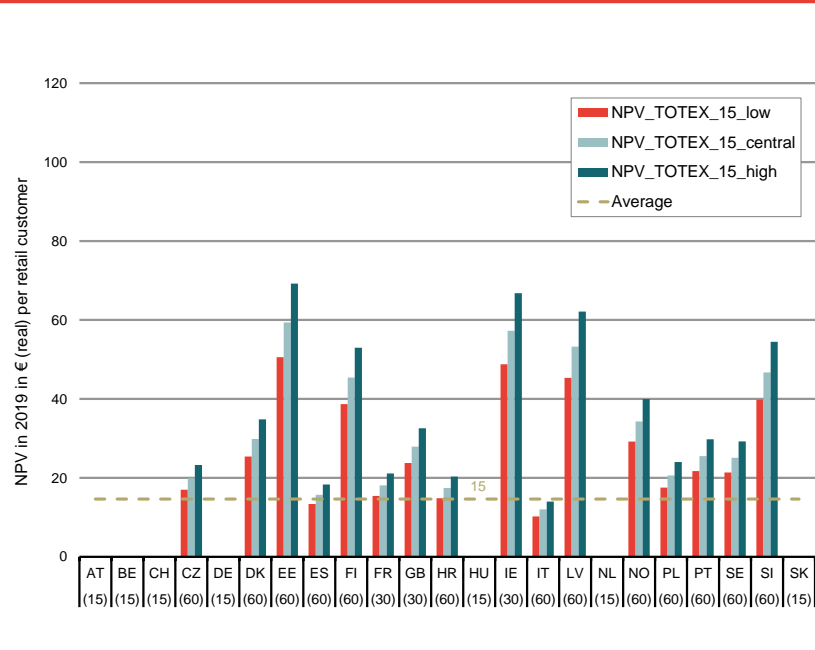


Summary

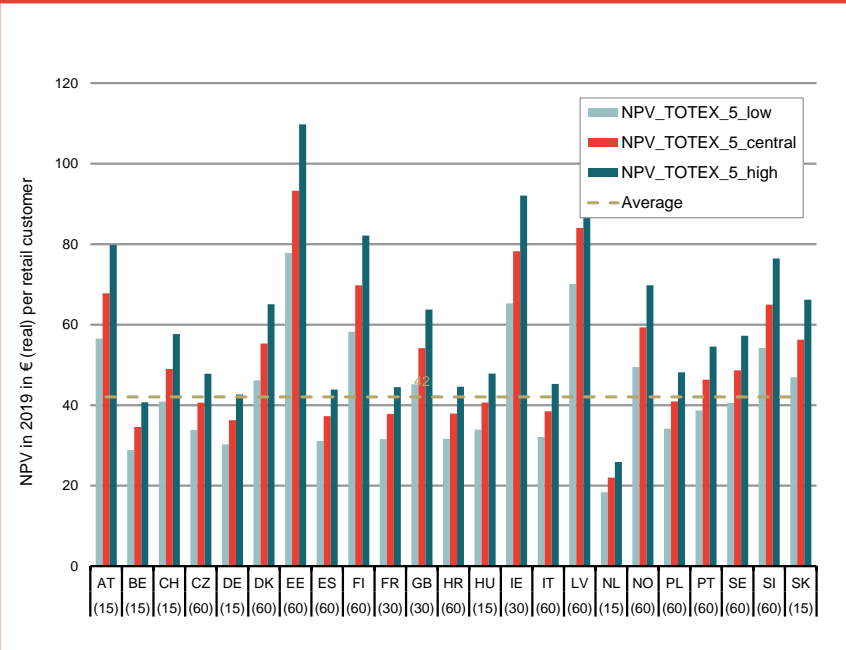
- Majority of cost borne by a few large countries
 - Five countries with largest costs bear more than 40% of costs for both ISP periods
 - GB ranked top for change to ISP 15 and second for change to ISP 5
 - Germany ranked top (driven by market size) for change to ISP 5

Fully scaled-up costs per retail customer range from 12 to 49 € (NPV 2019), depending on ISP case

Change to ISP 15



Change to ISP 5



Summary

- Large variation of costs per retail customer
 - Countries with low data coverage are closer at average since with-in sample average is used to fill the gaps
 - Larger countries (e.g. DE, FR, IT, ES) are slightly below average due to scale effects, i.e. fixed cost are divided by different number of customers
- Variation is significantly lower than for reported Totex due to adjustments

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Overview of responses by business activity

Country	Aggregator	Broker	Data provider	DSO	End consumer (metered)	Generator (metered)	Imbalance settlement agency (non-TSO)	Market operator	Meter provider	Metering service provider	National Regulatory Authority (NRA)	Power exchange	Retail supplier	Trader	TSO	Other/ undefined	Total
AT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
BE	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	2	4
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	4
DE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	4
DK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
EE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
EL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ES	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	3
FI	0	0	0	12	1	2	2	0	0	0	0	0	3	0	1	3	24
FR	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	5
GB	1	0	0	1	0	4	1	0	0	0	0	0	8	1	1	7	24
HR	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	4
HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
IE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
IT	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
LI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LV	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	2	0	0	0	0	0	0	0	0	2	0	1	0	5
NO	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	3
PL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
PT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	10	0	2	0	0	0	0	0	0	5	0	1	9	27
SI	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	3
SK	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2
UK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	0	1	29	1	13	4	2	0	0	1	0	20	4	18	31	125

Remarks: Some stakeholders have submitted several questionnaires for individual business activities. This overview also includes 21 questionnaires without any information on costs.

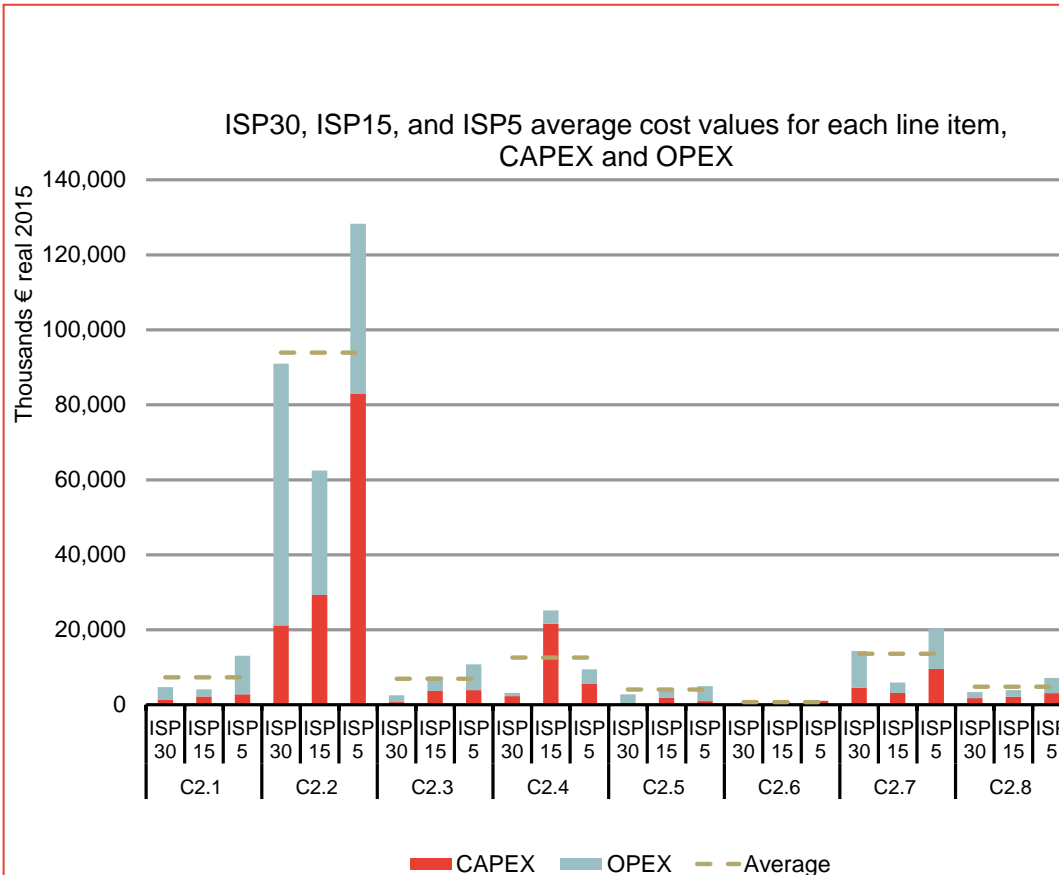
Overview of responses by line item

No.	Line item	No of non-zero observations	Type of respondents	Remarks/ noticeable values (*)
C2.1	Trading platforms	54	TSOs, retailers, others	ES: OPEX ISP 15 of 6€m IT: OPEX ISP 15 of 11€m DE: OPEX ISP 5 of 180 €m (include reduction liquidity and higher RES costs)
C2.2	Metering and notification systems	69	DSOs, TSOs, metering companies, others	DK: CAPEX ISP 5 of 670 €m ES: CAPEX >2€bn, OPEX >1€bn
C2.3	Scheduling and settlement	62	Various types	IT: OPEX ISP 15 c. 18 €m
C2.4	Billing systems	50	Various types	GB: CAPEX ISP 15 770 €m
C2.5	BRP forecasting, trading and scheduling	41	Mainly traders and retailer (31 are BRPs/ISA)	ES: OPEX of 67€m for ISP 5 IT: CAPEX of 7 €m (relative high, but moderate in absolute terms)
C2.6	Documentation	31	Various types	GB: CAPEX of 12 €m (relative high, but moderate in absolute terms)
C2.7	Network related costs	16	TSOs (12 of 16)	HR: CAPEX of 20€m for ISP 15
C2.8	Other costs	28	Various types	None (covers costs for managing/updating that did not fit in any other category)

Source: Frontier

Overview of average reported expenditures by line item

Average non-zero reported OPEX and CAPEX (NPV 2019) across all countries



- Summary of average cost reported by line item
 - Costs are expressed as present value (PV) in 2019, expressed in real (2015) terms
 - Average across all non-zero responses, e.g. does not include zero cost for ISP 15 for countries which already have this ISP period
 - Some costs are not comparable in levels due to scale effects (e.g. meter costs) which is not reflected in averaging here
- Metering costs (2.2) are by far the highest cost item
- ISP 5 costs are typically significantly higher than ISP 15
 - This is not fully reflected due to different sample across ISP periods

Main assumptions

- **Discount rate:** We will use 4% which is the value from the ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects, Final version approved by the EC, from February 2015 (p32).
- **Inflation:** Default are real values
 - We ask respondents to report their inflation assumption if they entered nominal values
 - If no inflation assumption is given but numbers are marked as “nominal”, we use a standard assumption of 2% p.a. (in line with the majority of responses)
- **Base year for real values and year of discounting:**
 - Base year for real money is 2015 (current value when questionnaires were sent out)
 - All costs and benefits are discounted to the year 2019
- **Exchange rates:** We use the 2015 average exchange rate as published by the ECB and keep this value constant over time.
- **Interpolation:** We are using 2020 and 2030 as snapshot years and interpolating linearly between them.
- **Time horizon:** The time horizon for the CBA is 10 years therefore we are assuming zero ongoing costs and benefits from 2031 onwards.
- **Depreciation:** We are using an annuity methodology so that the NPV of 100€ spent today is 100€.

Change log

- **Inflation:** We use 2% p.a. to convert nominal to real values if no inflation assumption is provided.
 - Some respondents marked their answers as “nominal” but did not provide an inflation assumption – and vice versa
 - We have sent emails to a number of respondents to confirm whether numbers are real/nominal
- **Exchange rates:** We replace respondents information on exchange rate with our default value to prevent differences only caused by difference in exchange rate expectations
- **Lower/Central/Upper values:**
 - When respondents provide a central value for a given item and ISP period, but no lower or upper value, we set these equal to the central value
 - When respondents provide a lower and an upper value but no central value, we set the central value equal to the simple average of the lower and upper values
 - When respondents provide only a lower (resp. upper) value, we set the central and upper (resp. central and lower) values equal to the lower (resp. upper) value



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