



*Serving the Midlands, South West and Wales*

# **A summary of the Ofgem RIIO-ED1 Interruption Incentive Scheme Target Setting Methodology**

# Overview of Presentation

 **High level summary of calculation of targets**

 **More detailed slides**

- CI target calculation
- Duration (CML per CI) calculation
- CML target calculation
- Final target selection

# IIS Target Setting Methodology

## Planned incidents

- Ofgem introduced the use a rolling average calculation in order to derive targets for both planned CIs and planned CMLs
- A three year average is used to derive the next target, but with a two year lag incorporated.
- For example the three average for the period 2010/11 – 2012/13 will be the target for 2015/16.
- Planned CI and CML targets flex up and down as network activity levels change through the period (e.g. increased activity leads to higher incurred CIs and CMLs, which in turn increases future targets. Vice versa for decreased activity)
- Implication of target setting methodology is that sustained outperformance benefits cannot be attained, because targets tighten as performance improvements are made.

# IIS Target Setting Methodology

## Unplanned incidents

- Ofgem set targets upfront for both unplanned CIs and CMLs
- Terminology
  - Current underlying performance – essentially average of most recent years' actual performance (four years for LV and HV, 10 years for EHV and 132kV)
  - Current benchmark performance – essentially the performance that the distribution network should be delivering taking into account network characteristics and number of customers

# IIS Target Setting Methodology

## Unplanned incidents – Overview of CI target setting

- Determine:
  - Current underlying performance for unplanned CI
  - Current benchmark performance for unplanned CI
- Unplanned CI target for year 1 is the current underlying performance
- Targets for subsequent years are derived using an annual unplanned CI improvement factor.
  - 1.5% annual improvement where current performance or targets are worse than current benchmark
  - 0.5% annual improvement where current performance or targets are better than current benchmark

# IIS Target Setting Methodology

## Unplanned incidents – Overview of CML target setting

- Determine benchmark duration (CML per CI) disaggregated by voltage level
- Multiply benchmark duration by reference CI to derive starting CML values
  - Reference CI is derived from the higher of CI targets or CI benchmark
- Apply improvement factors for subsequent CML values
  - HV - 3%
  - 132kV, EHV and LV – 1%
- Aggregate voltage specific values to a total ‘first pass’ CML target
- Alternative starting point - factors in 25% of actual CML performance where actual is currently better than first pass targets.

# More detailed slides

# CI – Benchmark

## Combination of:

- LV – Four year average of own performance
- HV – Analysis in 22 disaggregated categories of circuits based on four years of data
- EHV – Ten year average of own performance
- 132kV – Ten year average of own performance

# CI – LV Benchmark (415V)

 **The LV part of the CI benchmark is derived from an average of the preceding four years actual performance.**

$$\text{Benchmark}_{2012/13} = \text{Average} (\text{Actual}_{2009/10}, \text{Actual}_{2010/11}, \text{Actual}_{2011/12}, \text{Actual}_{2012/13})$$

 **Actual performance is used because DNOs have not been funded to improve fault rates at lower voltages.**

- It is also hard to make a significant reduction in CI at LV because only a low number of customers benefit from each improvement.
- Exceptional event data is excluded.
- A four year average is used to smooth out any residual annual variations due to different underlying weather conditions.

# CI – EHV Benchmark (33kV & 66kV) and 132kV Benchmark

 Both the EHV and 132kV benchmarks use a ten year average.

$$\text{Benchmark}_{2012/13} = \text{Average} (\text{Actual}_{2003/04}, \dots, \text{Actual}_{2012/13})$$

 Actual performance is used because DNOs have not been funded to improve fault rates at these voltages.

- Normal running arrangements at these higher voltages mostly have alternative routes that can switch supplies quickly for an n-1 event.
- The volume of incidents affecting customers (i.e. caused by multiple events) is therefore low.
- Improvement projects have high costs.

# CI – HV Benchmark (6.6kV-11kV)

## HV benchmarking is the most sophisticated and complex part of the benchmarking process

- HV CIs provide the greatest contribution to overall CI performance
- Each incident can interrupt several hundred customers
- Low cost remote control and system automation can lead to a significant reduction in customers interrupted per fault

## HV benchmarks are based upon a five stage process of

1. Categorising each HV circuit into disaggregation bands;
2. Creating DNO specific performance factors for each band;
3. Calculating industry factors based on averages;
4. Calculating a DNO benchmark for each band based upon some DNO specific factors and some industry factors; and
5. Summing up the band benchmarks to determine a cumulative HV benchmark.

# HV Benchmark – Stage 1

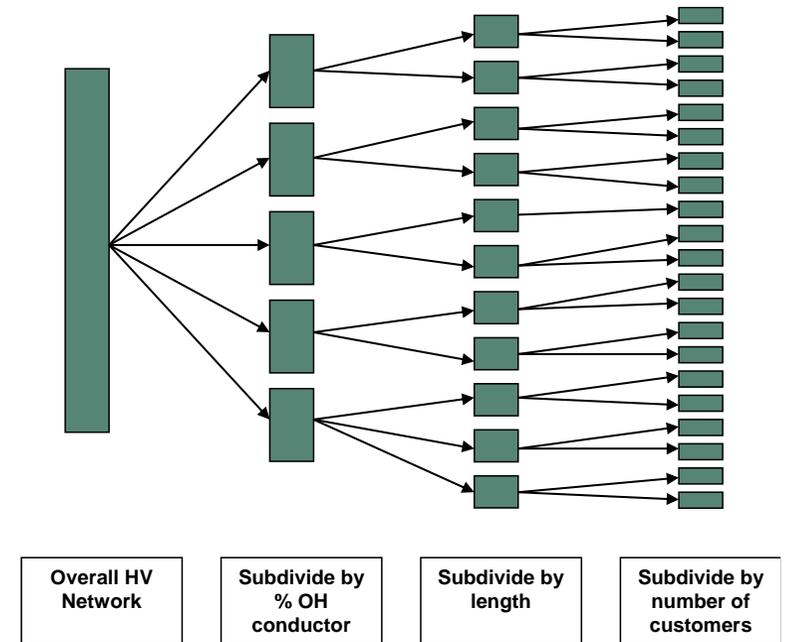
## Categorising each HV circuit into disaggregation bands

### Reasons for using disaggregated bands

- Comparison of performance for ‘like’ circuits
- Remedial actions may be different (for example actions for short underground circuits with few customers are different to those for long overhead circuits with many customers).

### Disaggregation is based on:

- Percentage of circuit length that is overhead conductor (5 categories);
- Circuit length (2/3 categories for each of the 5 %age categories)
- Number of customers on the circuit (2 categories per circuit length category)
- 22 bands altogether (next slide)



Disaggregation of Performance Data

# HV Benchmark – Stage 1

## Disaggregation bands

Band	Percentage OHL	Circuit Length	Connected Customers
UG1A	0%	0<km<4	0<y<1000
UG1B	0%	0<km<4	y>1000
UG2A	0%	km>4	0<y<2000
UG2B	0%	km>4	y>2000
MA1A	0%<x<20%	0<km<8	0<y<1000
MA1B	0%<x<20%	0<km<8	y>1000
MA2A	0%<x<20%	km>8	0<y<2500
MA2B	0%<x<20%	km>8	y>2500
MB1A	20%<x<50%	0<km<11	0<y<1000
MB1B	20%<x<50%	0<km<11	y>1000
MB2A	20%<x<50%	km>11	0<y<2200
MB2B	20%<x<50%	km>11	y>2200
MC1A	50%<x<80%	0<km<19	0<y<500
MC1B	50%<x<80%	0<km<19	y>500
MC2A	50%<x<80%	km>19	0<y<1700
MC2B	50%<x<80%	km>19	y>1700
OH1A	x>80%	0<km<40	0<y<400
OH1B	x>80%	0<km<40	y>400
OH2A	x>80%	40<km<55	0<y<700
OH2B	x>80%	40<km<55	y>700
OH3A	x>80%	km>55	0<y<700
OH3B	x>80%	km>55	y>700

### Example

- Circuit length 10km
- Overhead length 3km (30%)
- 1753 customers on circuit
- Band MB1B

# HV Benchmark – Stage 2

## Creating DNO specific performance factors

- **The DNO specific performance factors are derived from the total data for all the circuits for the DNO in each band**
  - i.e. if there are 100 circuits in MA1A then the data from all 100 circuits is used
- **The factors that are derived are:**
  - Customers in the band
  - Customers per circuit
  - Length per circuit
  - Faults per km
  - Customers interrupted per fault
  - Product of circuit length and number of circuits

# HV Benchmark – Stage 3

## Calculating industry factors based on averages

 **The industry performance factors are derived from the total data for all the circuits for all 14 DNOs in each band**

- i.e. if there are 1000 circuits in MA1A across the industry then the data from all 1000 circuits is used

 **The factors that are derived are the same :**

- Customers in the band
- Customers per circuit
- Length per circuit
- Faults per km
- Customers interrupted per fault
- Product of circuit length and number of circuits

# HV Benchmark – Stage 4

## Calculating a DNO benchmark for each band

- 
**A complex formula is used to recombine some DNO specific factors with some industry average factors**

$$CIbm = Cust(ind) * \frac{1}{cust(ind)} * \frac{length(ind)}{cct(ind)} * \left( \left( DNOprop * \frac{Faults(dno)}{Length(dno)} \right) + \left( Indprop * \frac{Faults(ind)}{Length(ind)} \right) \right) * \frac{cust\ int\ s(ind)}{Faults(ind)} * \frac{DNOSumCctLength * ccts}{IndSumCctLength * ccts}$$

- The fault rate factor (in brackets) is based on a proportion which depends on the percentage of overhead line.
- Bands with more underground cable contain a lower proportion of industry fault rate as it is more difficult and costly to have an impact. The following proportions are used.

Band	DNO proportion	Industry Proportion
UG	80%	20%
MA	60%	40%
MB	40%	60%
MC	20%	80%
OH	0%	100%

# HV Benchmark – Stage 5

## Cumulative HV benchmark

 A cumulative benchmark is calculated by summing the 22 benchmarks calculated in each HV disaggregated band

- $HV_{bm} =$   
 $UG1A_{bm} + UG1B_{bm} + UG2A_{bm} + UG2B_{bm} +$   
 $MA1A_{bm} + MA1B_{bm} + MA2A_{bm} + MA2B_{bm} +$   
 $MB1A_{bm} + MB1B_{bm} + MB2A_{bm} + MB2B_{bm} +$   
 $MC1A_{bm} + MC1B_{bm} + MC2A_{bm} + MC2B_{bm} +$   
 $OH1A_{bm} + OH1B_{bm} + OH2A_{bm} + OH2B_{bm} + OH3A_{bm} + OH3B_{bm}$

# HV Benchmark – Summary

- **Ofgem use four years of data within the HV disaggregated benchmarking process**
  - 2012/13 benchmarks use data from 2009/10, 2010/11, 2011/12, 2012/13
- **The factors that are calculated use four years of data to reduce volatility of results (especially in bands with few circuits)**
- **Data for exceptional events is excluded**

# CI target evolution

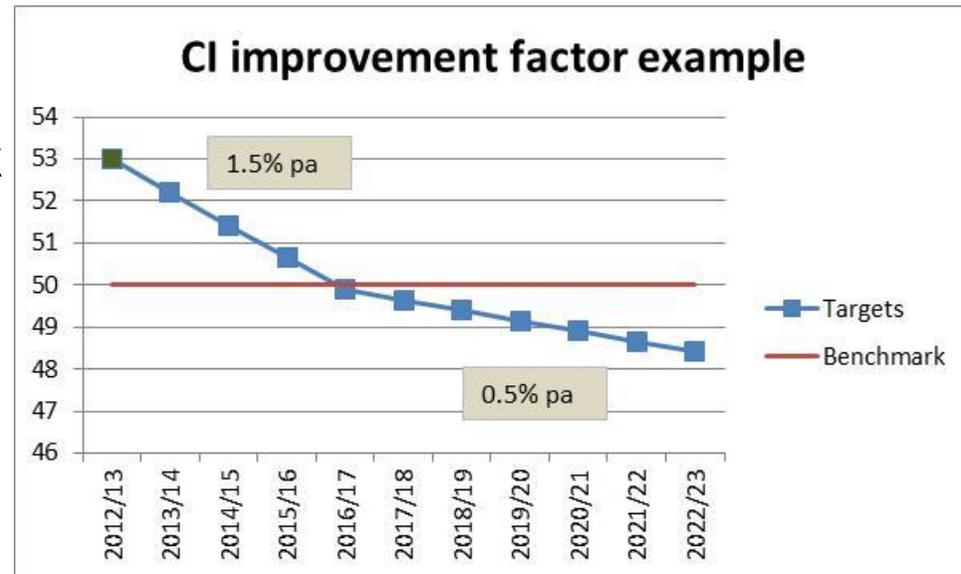
## Actual total CI performance is used as a baseline

- 4 year average LV and HV,
- 10 year average EHV and 132kV
- 4 year average of weighted impact of Grid faults, DG faults and faults on other DNO networks

## Targets for subsequent years derived by the application of an improvement factor to total CI

### 1.5% improvement factor until values are better than benchmark

### 0.5% improvement factor once values are lower than benchmark



# Duration (CML/CI) Benchmark

## **Combination of:**

 LV – Derived from four years of data

 HV – Analysis in 22 disaggregated categories of circuits based on four years of data

 EHV – Derived from ten years of data

 132kV – Derived from ten years of data

# Duration – LV Benchmarks

 The principle formula compares actual duration against industry duration.

- If DNOs duration is **lower** than industry duration, benchmark is the **industry** duration
- If DNOs duration is **higher** than industry duration the benchmark is set at the **DNOs duration less 25% of the difference**

## EXAMPLE 1 (DNO Lower)

DNO duration = 194 minutes  
Industry duration = 199 minutes

DNO duration is lower  
Benchmark duration is 199 minutes

## EXAMPLE 2 (DNO Higher)

DNO duration = 207 minutes  
Industry duration = 199 minutes

DNO duration is higher  
Benchmark duration is  $207 - 25\% \text{ of } (207-199)$   
= 205 minutes

- Actual duration is the sum of **four** years of DNO customer minutes lost divided by sum of **four** years of DNO customers interrupted
- Industry duration is the sum of **four** years of industry customer minutes lost divided by sum of **four** years of industry customers interrupted

# Duration – EHV and 132kV Benchmarks

 The principle formula compares actual duration against industry duration.

- If DNOs duration is **lower** than industry duration, benchmark is the **DNOs own** duration
- If DNOs duration is **higher** than industry duration the benchmark is set at the **industry duration**

## EXAMPLE 1 (DNO Lower)

DNO duration = 25 minutes  
Industry duration = 33 minutes

DNO duration is lower  
Benchmark duration is 25 minutes

## EXAMPLE 2 (DNO Higher)

DNO duration = 56 minutes  
Industry duration = 33 minutes

DNO duration is higher  
Benchmark duration is 33 minutes

- Actual duration is the sum of **ten** years of DNO customer minutes lost divided by sum of **ten** years of DNO customers interrupted
- Industry duration is the average of the DNO values

# Duration – HV Benchmark (6.6kV-11kV)

## As per CI benchmarks, the disaggregated analysis is used

- The calculation is virtually the same
- Within each band, the CI formula (stage 4) is multiplied by an extra term of CML/CI which is derived from an **upper quartile** industry value (i.e. based upon the best quartile duration)
- Excels QUARTILE function is used to return the first quartile.
- This generates a benchmark CML value in each band
- The overall CML benchmark (for all 22 bands) is divided by the overall CI benchmark to derive the duration benchmark to be used in the calculation of CML targets.

Values	Quartile
35.6	
37.2	
55.6	
56.5	57.3
60.0	
62.1	
62.2	
65.0	
66.0	
66.5	
68.6	
72.1	
72.8	
97.7	

# CML target derivation (1/2)

- This consists of four separate calculations (LV, HV, EHV, 132kV)
- The starting CML values at each voltage for 2013/14 are derived from the product of a reference value of CI and the benchmark values of duration.
- The reference values of CI are:
  - LV uses DNO's own four year average actual CI
  - EHV uses DNO's own ten year average actual CI
  - 132kV uses DNO's own ten year average actual CI
  - HV uses higher of 2012/13 average actual performance or 2012/13 benchmark less the sum of LV, EHV and 132kV CI values
- The CML values for subsequent years at each voltage level are derived by applying an annual improvement factor
  - 1% for LV
  - 3% for HV
  - 1% for EHV
  - 1% for 132kV

# CML target derivation (2/2)

- **The ‘first pass’ CML targets are the sum of the individual voltage values.**
- **An alternative startpoint is derived from 75% of the first pass target and 25% of current average performance**
  - This is to factor in a proportion of companies’ current performance if it is better than the first pass targets
  - It sets tougher targets until the first pass targets ‘catch up’
- **The CML targets for 2013/14 are derived from the lower of the first pass targets or alternative startpoint**
- **The CML targets for subsequent years are the lower of the previous years target or the first pass targets**
  - This is to ensure that targets do not rise

# Ofgem Target derivation summary

## CI targets

- are derived from underlying actual performance in 2012/13
- with 1.5% improvement factors until targets are better than benchmark
- after which a 0.5% improvement factors applies.

## CML targets

- for 2013/14 are derived for each voltage level from the product of reference CI values in 2012/13 and benchmark duration values in 2012/13.
- subsequent targets at each voltage are derived by applying improvement factors (3% for HV 1% for others).
- an alternative startpoint incorporating 25% of actual performance is derived
- the lower of the first pass targets or startpoint is used

## These generate Ofgem calculated targets

# Final Stage – Select lowest of...

- The final stage is where Ofgem compare the calculated targets against those proposed by DNOs.
- The final targets are based upon which are the lowest.

