

**Gas
Transmission**

Modification 0714

CV Shrinkage Analysis

**Workgroup Meeting
5th March 2020**

nationalgrid



Flow Weighted Average CV - Recap

The Gas (Calculation of Thermal Energy) Regulations 1996 provide for consumers to be billed based on the average of the daily charging area CVs that are calculated for each billing period

The daily charging area CVs are calculated based on the Flow Weighted Average CV of all offtakes that supply a particular LDZ

The CV that consumers may be billed on is capped at 1 MJ/m³ above the lowest source CV entering that LDZ

The billing CV for each LDZ is the lower of the FWACV and any Capped CV

FWACV Calculation

$$\text{FWACV (MJ/m}^3\text{)} = \frac{(V_1 \times CV_1) + (V_2 \times CV_2) + (V_3 \times CV_3)}{(V_1 + V_2 + V_3)} \quad \frac{\text{(MJ)}}{\text{(M}^3\text{)}}$$

Where V_n = daily volume (m³) of relevant input to LDZ

CV_n = daily average CV (MJ/m³)

FWACV quoted to 1 decimal place for transportation charging and consumer billing

CV Shrinkage

CV Shrinkage = Measured LDZ energy – Billed LDZ energy

Due to rounding, some CV shrinkage is generated every day

Can be both positive or negative when CV capping has not occurred

Capping can increase CV shrinkage considerably as the billed energy will be less than the measured energy at most sites in the LDZ

CV shrinkage is one element of NTS shrinkage, which is procured by NG every day

NG forecasts NTS shrinkage costs for each year, any overspend is added to the forecast 2 years later. These forecasts are used to calculate the SO commodity charge each year.

NG are also incentivised to minimise the costs incurred from shrinkage

Mod 0714 FWACV Analysis

NG has calculated the potential impact on CV shrinkage of the Perenco entry point flowing at 46.5 MJ/m³ Wobbe Index for each of the scenarios presented at the last meeting

https://gasgov-mst-files.s3.eu-west-1.amazonaws.com/s3fs-public/ggf/book/2020-01/Mod%200714%20-%20Perenco%20NTS%20Penetration%20Analysis_0.pdf

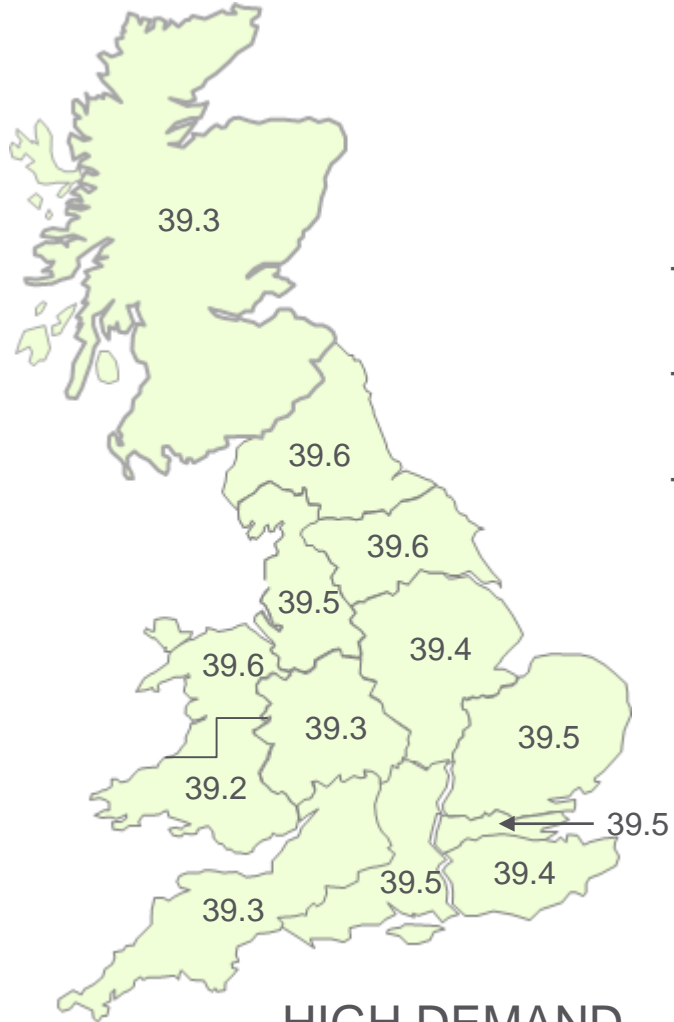
- Perenco NTS entry CV is assumed to be 36.6 MJ/m³
- CVs at other NTS entry points, supplies and demands are consistent with the Consumer Evolution FES scenario
- CVs at LDZ offtakes are then derived from the modelling
- Embedded LDZ entry point CVs (mainly from biomethane sites) are derived from a historical day where total demand for the day is a close match to the FES scenario day
- Assumes no mitigation activities between NTS and GDN control rooms

CV shrinkage in the following slides is per day

To calculate cost of CV shrinkage, average SAP from 2019 (1.2 p/kWh) has been used

Billing CV Maps: 2019/20 Base Case

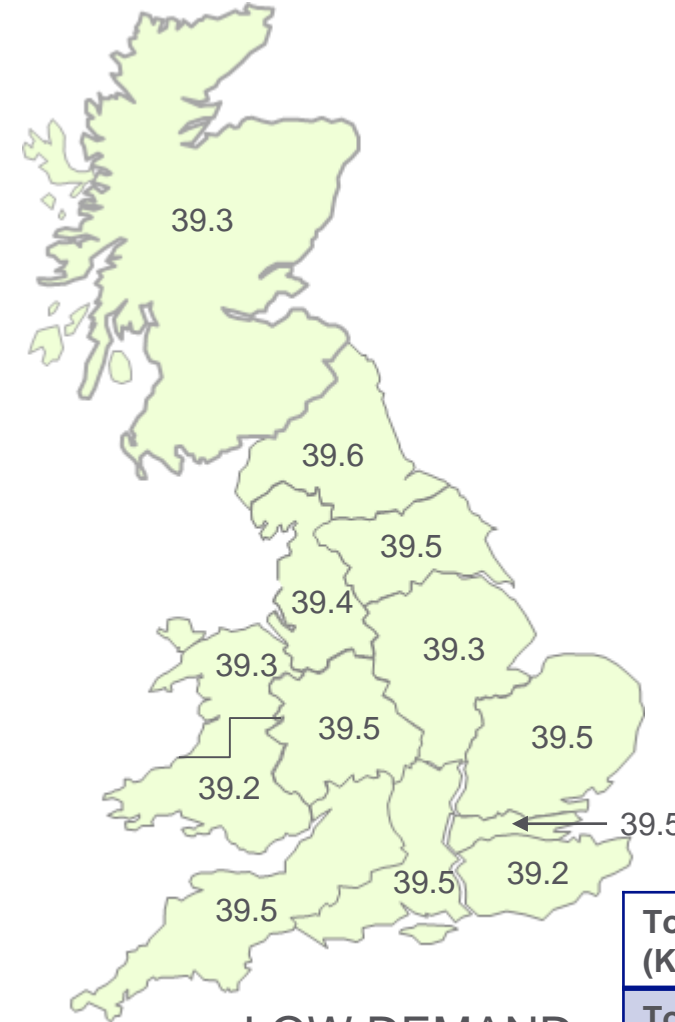
Based on 2019/20 'Consumer Evolution' FES data



HIGH DEMAND
Winter 1 in 20

- Maps show the forecast billing CVs in MJ/m³ for each LDZ
- All LDZs are forecast to be billed based on the FWACV
- No CV capping occurs, CV shrinkage only arises due to rounding between measured CVs and FWACV

Total CV shrinkage (KWH)	-185,368
Total cost	- £2,224.42



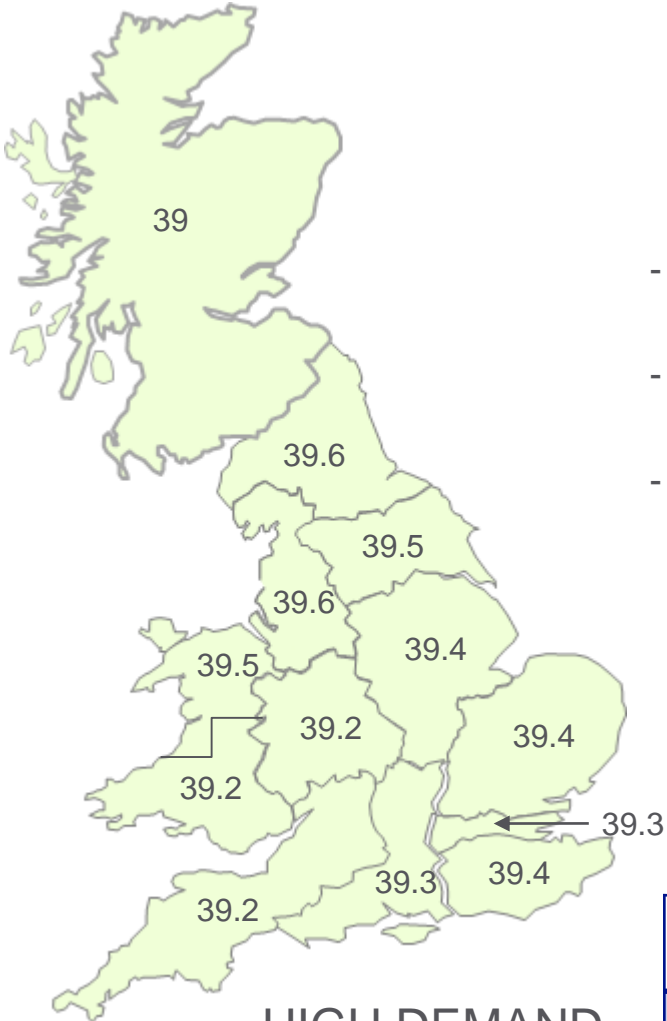
LOW DEMAND
Summer day

Total CV shrinkage (KWH)	-30,298
Total cost	-£363.57

Billing CV Maps: 2025/26 Base Case

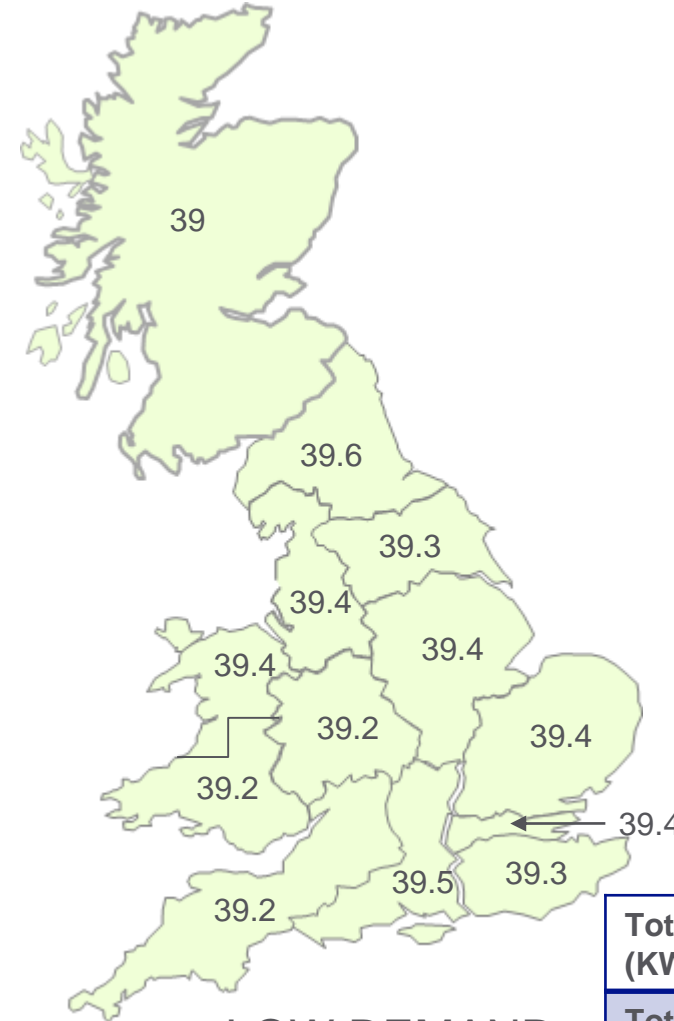
Based on 2025/26 'Consumer Evolution' FES data

- Maps show the forecast billing CVs in MJ/m³ for each LDZ
- All LDZs are forecast to be billed based on the FWACV
- No CV capping occurs, CV shrinkage only arises due to rounding between measured CVs and FWACV



HIGH DEMAND
Winter 1 in 20

Total CV shrinkage (KWH)	426,649
Total cost	£5,119.79



LOW DEMAND
Summer day

Total CV shrinkage (KWH)	32,718
Total cost	£392.61

Billing CV Maps: 2019/20 Scenario 1

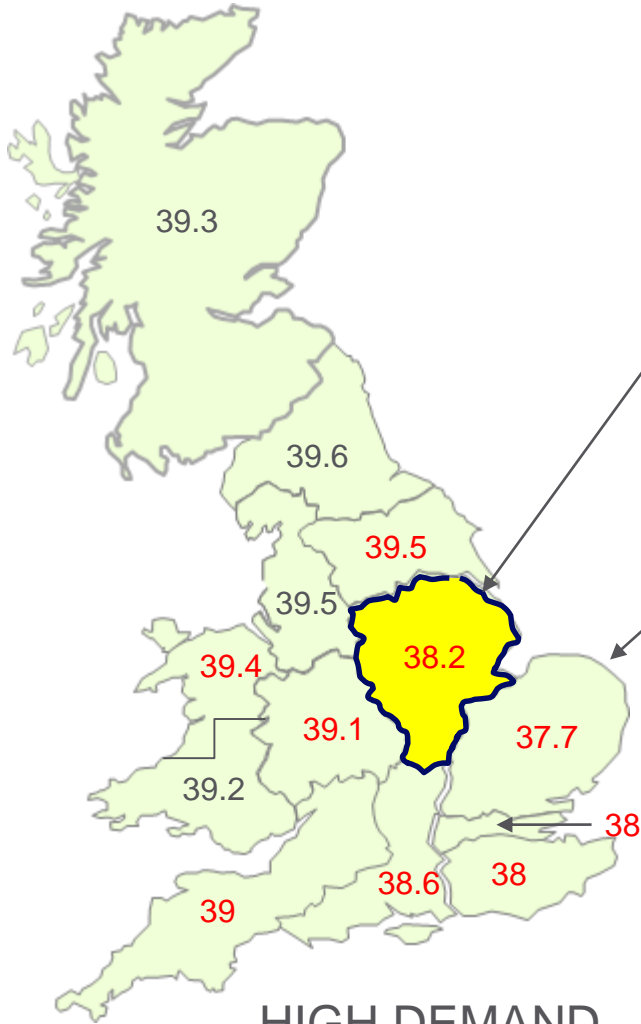
Perenco WI 46.5MJ/m³, Other Bacton Supplies WI 47.2MJ/m³

CV unchanged from base case

CV reduced from base case

CV increased from base case

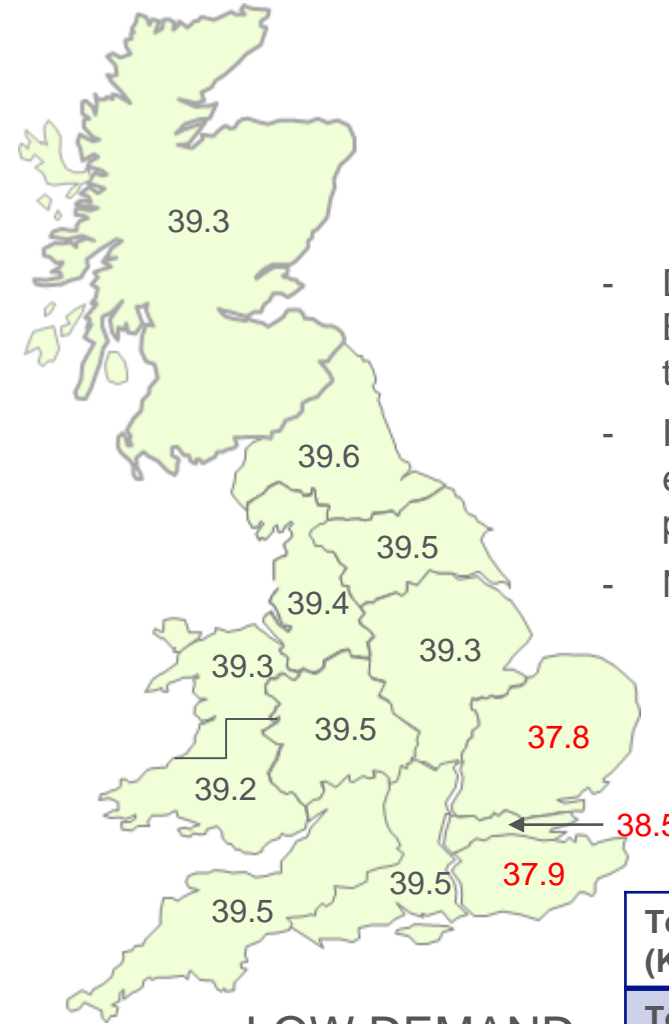
CV capping occurs



- CV decreases across most of the country, only 4 LDZs not affected
- EM LDZ - Offtakes in the east of the LDZ are affected more (e.g. Gosberton – 37.2) than offtakes to the north and west (e.g. Walesby 39.5), therefore capping occurs
- EA LDZ – All offtakes see lower CV gas therefore no capping occurs
- **These effects are due to all Bacton supplies inputting low CV gas, not just Perenco**

Total CV shrinkage (KWH)	8,372,105
Total cost	£100,465.26

(EM LDZ = £104,225)



- Due to lower flows coming from Bacton, the LDZs impacted by the low CV gas is more localised
- Interconnectors assumed to be exporting, therefore low CV gas is pushed south.
- No CV capping occurs

Total CV shrinkage (KWH)	14,236
Total cost	£170.83

Billing CV Maps: 2025/26 Scenario 1

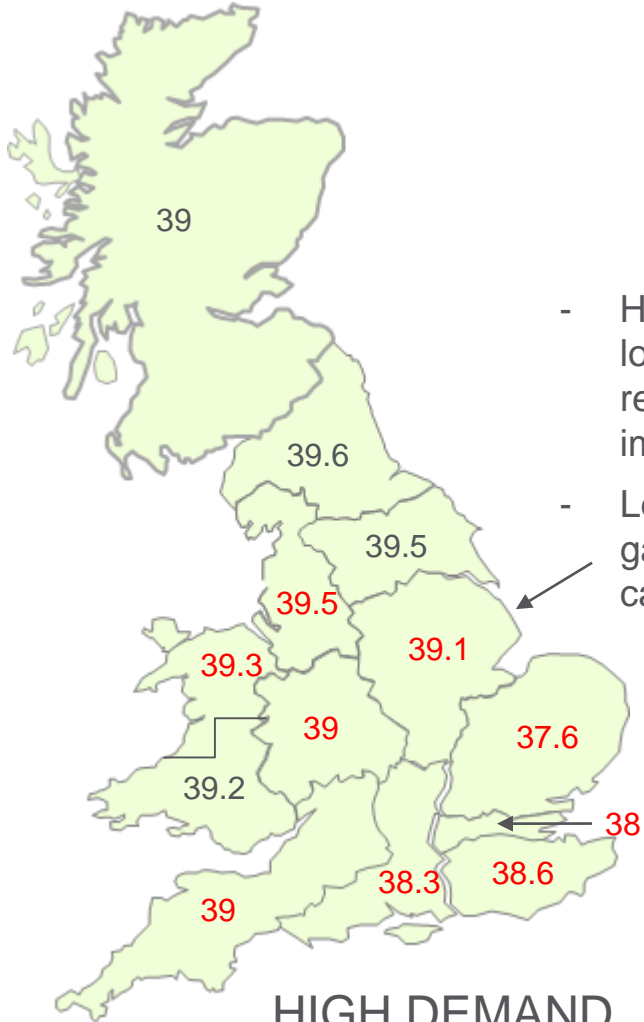
Perenco WI 46.5MJ/m³, Other Bacton Supplies WI 47.2MJ/m³

CV unchanged from base case

CV reduced from base case

CV increased from base case

CV capping occurs

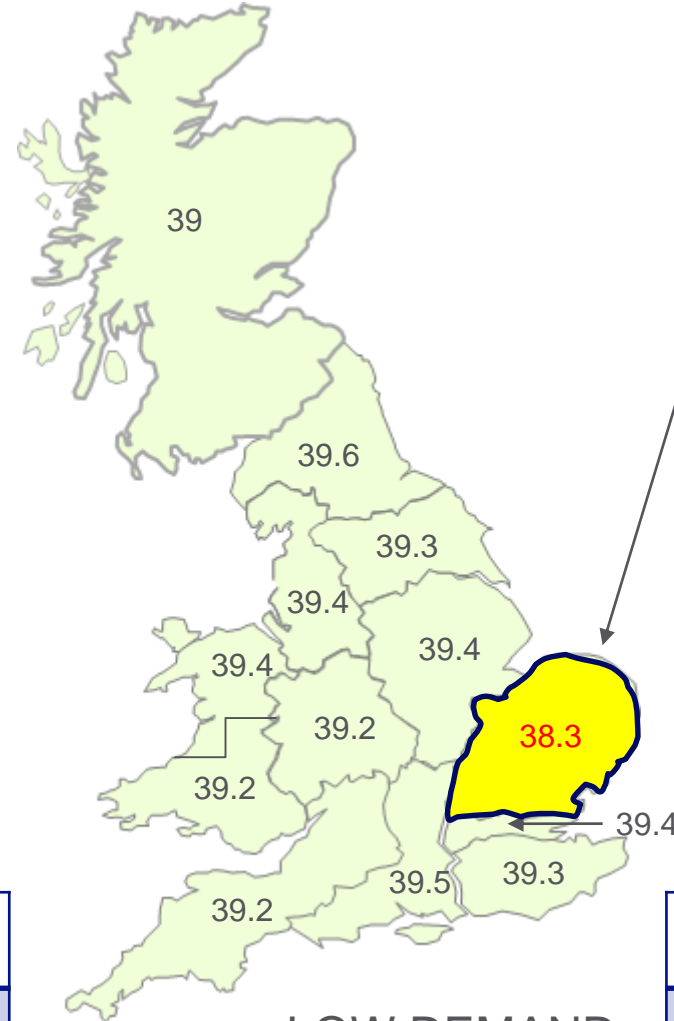


- High demand combined with lower UKCS flows by 2025/26 results in less CV shrinkage impact
- Less penetration of low CV gas into EM, therefore no capping occurs

Total CV shrinkage (KWH)	-393,376
Total cost	-£4,720.51

HIGH DEMAND
1 in 20 Winter

National Grid



- Capping occurs in EA LDZ
- Interconnectors assumed to be exporting, means that Perenco gas is a higher percentage of Bacton supplies.
- Gas flows are towards Bacton from the West so the impacts of the low CV gas are seen in EA LDZ.
- The low CV gas only flows through the offtakes in the East & South of the LDZ, creating a range of CVs across the LDZ

Total CV shrinkage (KWH)	1,605,514
Total cost	£19,266.17

LOW DEMAND
Summer day

(EA LDZ = £19,515)
9

Billing CV Maps: 2019/20 Scenario 2

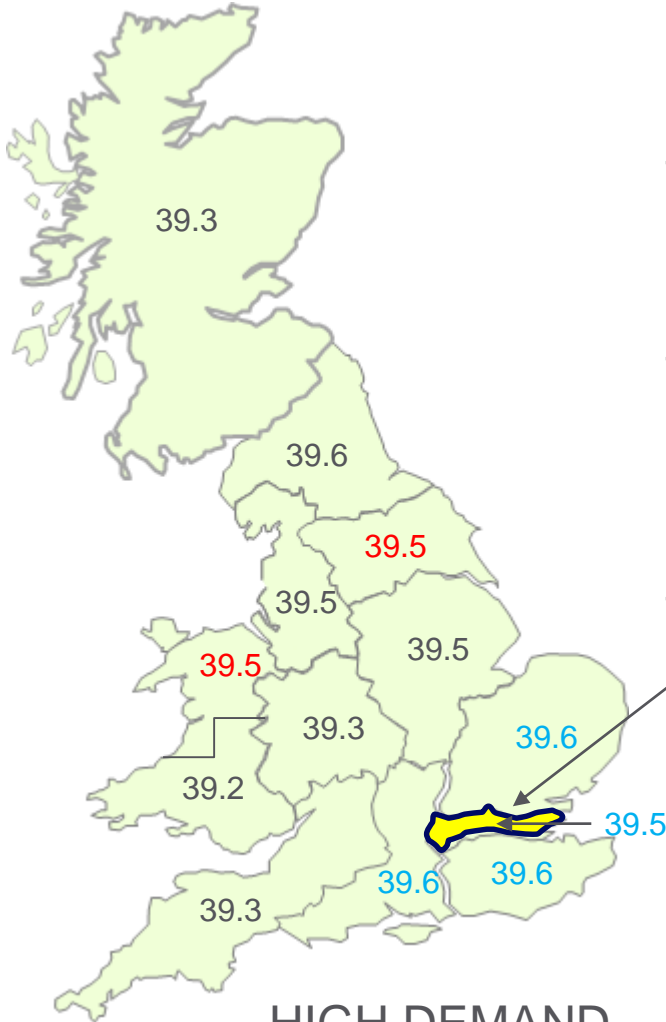
Perenco WI 46.5MJ/m³, Other Bacton Supplies WI 2019 Average

CV unchanged from base case

CV reduced from base case

CV increased from base case

CV capping occurs

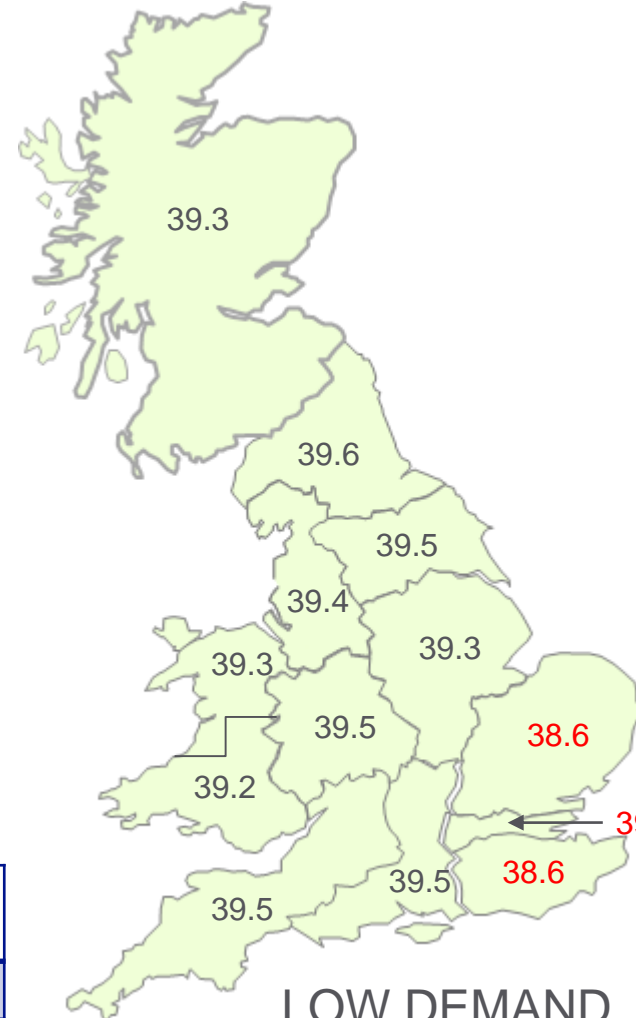


HIGH DEMAND
1 in 20 winter

- Due to the high demand the low CV Perenco gas has minimal impact on the quality of gas coming in at Bacton
- Average Bacton supply CVs are actually higher than the base data used, hence the increase in CV in the Eastern regions
- **Capping occurs in NT LDZ due to a biomethane site, not as a result of gas coming in from Perenco.**

Total CV shrinkage (KWH)	2,469,089
Total cost	£29,629.06

(NT LDZ = £14,195)



LOW DEMAND
Summer day

- Low demand means less mixing of Perenco gas with higher CV gas at Bacton, therefore a drop in CV for 3 LDZs
- Interconnectors exporting therefore low CV gas is pushed south
- No CV capping occurs

Total CV shrinkage (KWH)	-136,263
Total cost	-£1,635.15

Billing CV Maps: 2025/26 Scenario 2

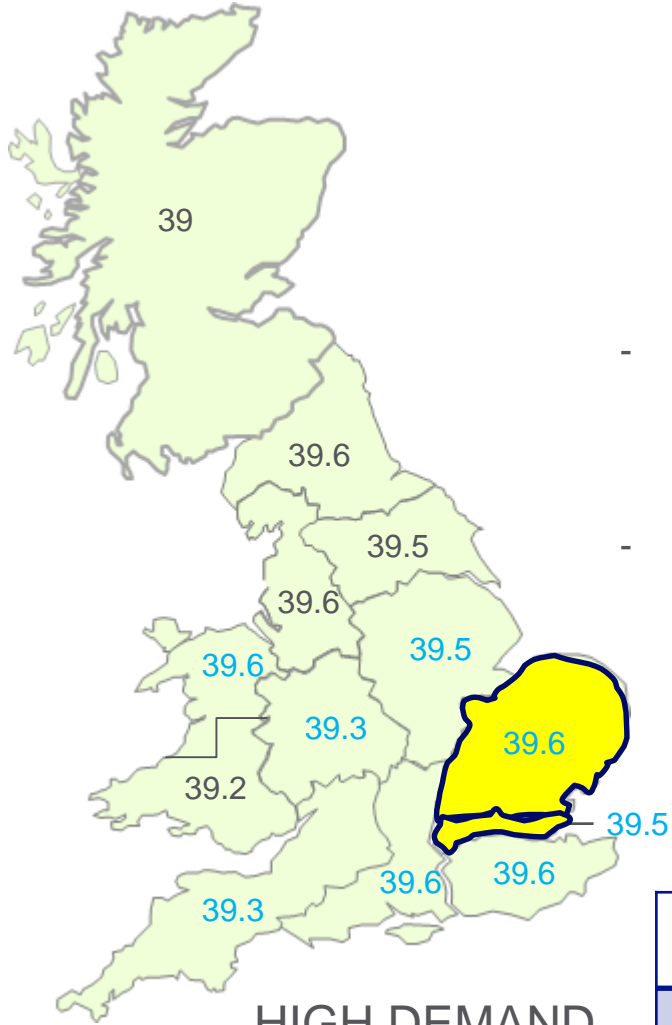
Perenco WI 46.5MJ/m³, Other Bacton Supplies WI 2019 Average

CV unchanged from base case

CV reduced from base case

CV increased from base case

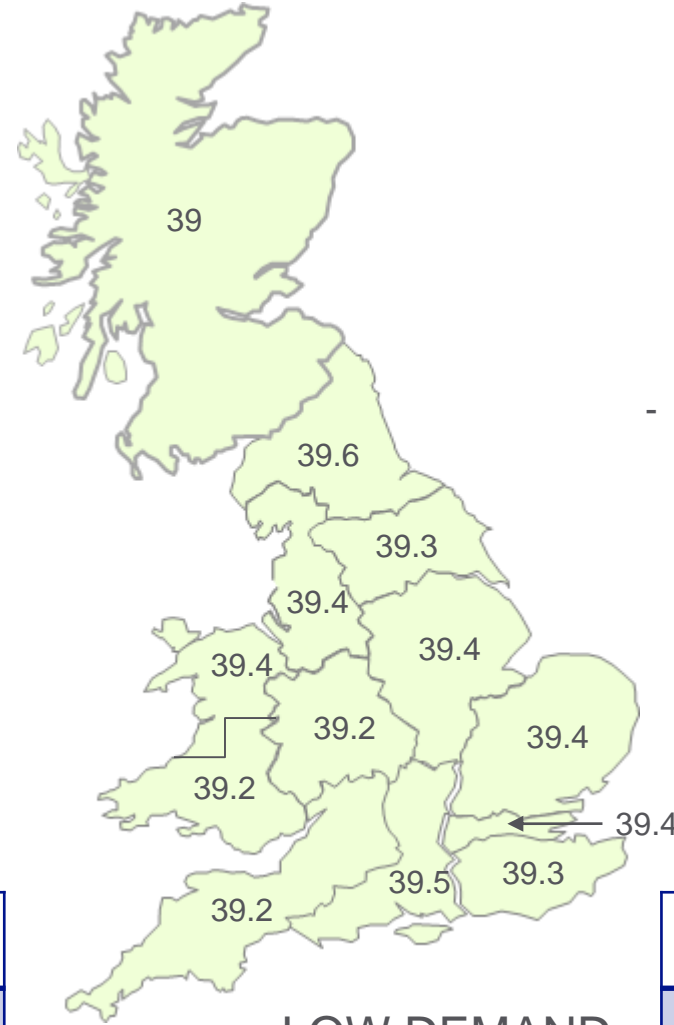
CV capping occurs



- Similarly to 2019/20, low CV gas from Perenco comingles with higher CV gas from other Bacton supplies
- **EA and NT LDZs see capping but, again, due to biomethane sites, not Perenco flows**

Total CV shrinkage (KWH)	3,010,464
Total cost	£36,125.57

(EA LDZ = £15,444)
(NT LDZ = £15,326)



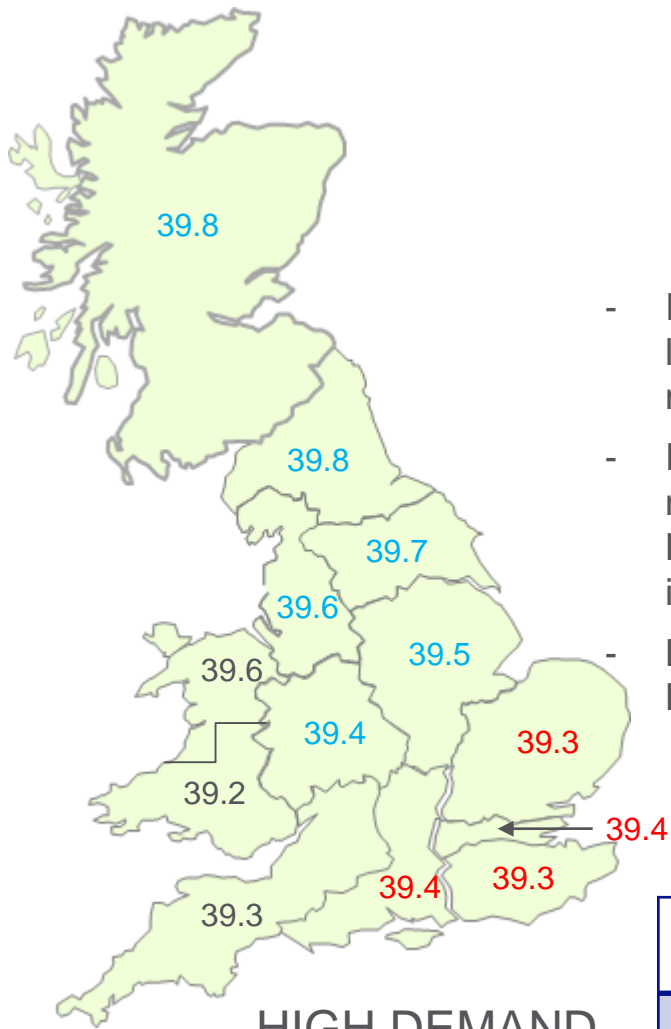
- No CV impact due to lower UKCS supplies into Bacton and interconnectors assumed to be exporting

Total CV shrinkage (KWH)	25,054
Total cost	£300.65

LOW DEMAND
Summer day

Billing CV Maps: 2019/20 Scenario 3

Max Cygnus flow at 46.5 MJ/m³ WI, all other Bacton UKCS flows at zero, interconnectors as per FES forecast (flow and WI).

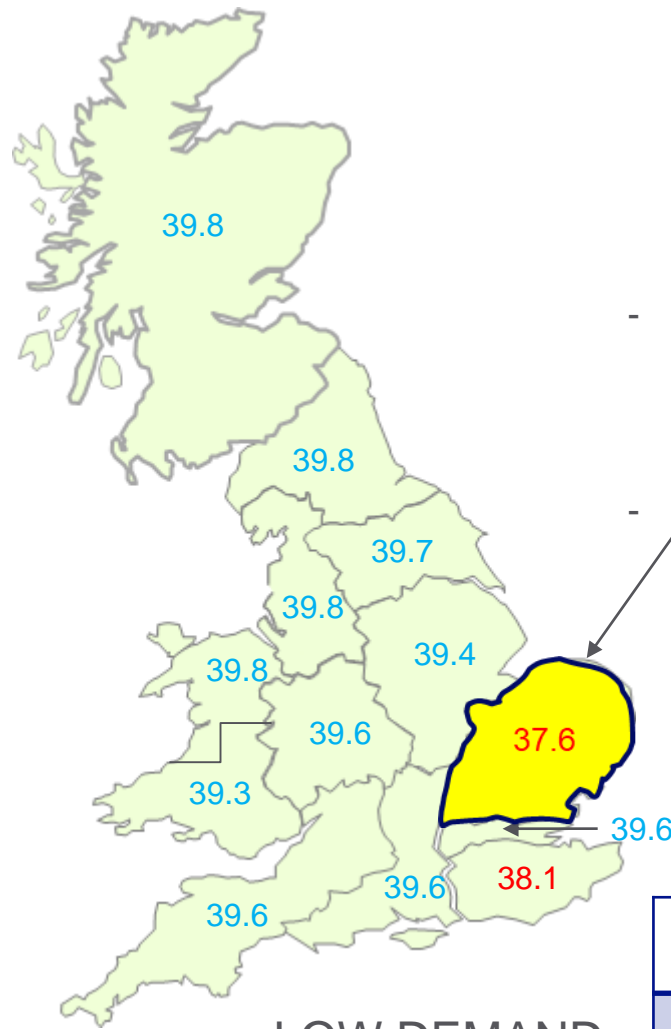


- Interconnectors importing so low CV of gas from Perenco mixes and has minimal impact
- Rebalancing of the network to make up the shortfall from Bacton supplies results in CV increases for some LDZs
- Billing CV decreases for 4 LDZs but no capping occurs

Total CV shrinkage (KWH)	-1,485,661
Total cost	-£17,827.93

HIGH DEMAND
1 in 20 winter

National Grid



- Interconnectors assumed to be exporting at low demand, therefore CVs in EA and SE are affected
- Capping caused in EA LDZ, assuming Cygnus gas is offtaken at Bacton DN offtake unblended

Total CV shrinkage (KWH)	1,485,941
Total cost	£17,831.29

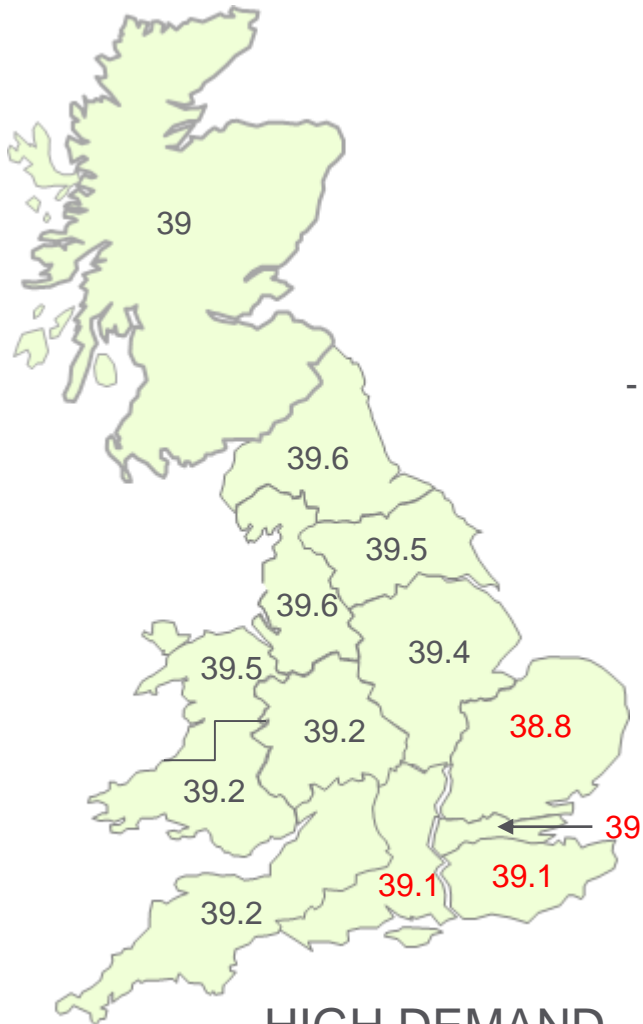
LOW DEMAND
Summer day

(EA LDZ = £19,815)
12

CV unchanged from base case
CV reduced from base case
CV increased from base case
CV capping occurs

Billing CV Maps: 2025/26 Scenario 3

Max Cygnus flow at 46.5 MJ/m³ WI, all other Bacton UKCS flows at zero, interconnectors as per FES forecasts (flow and WI).

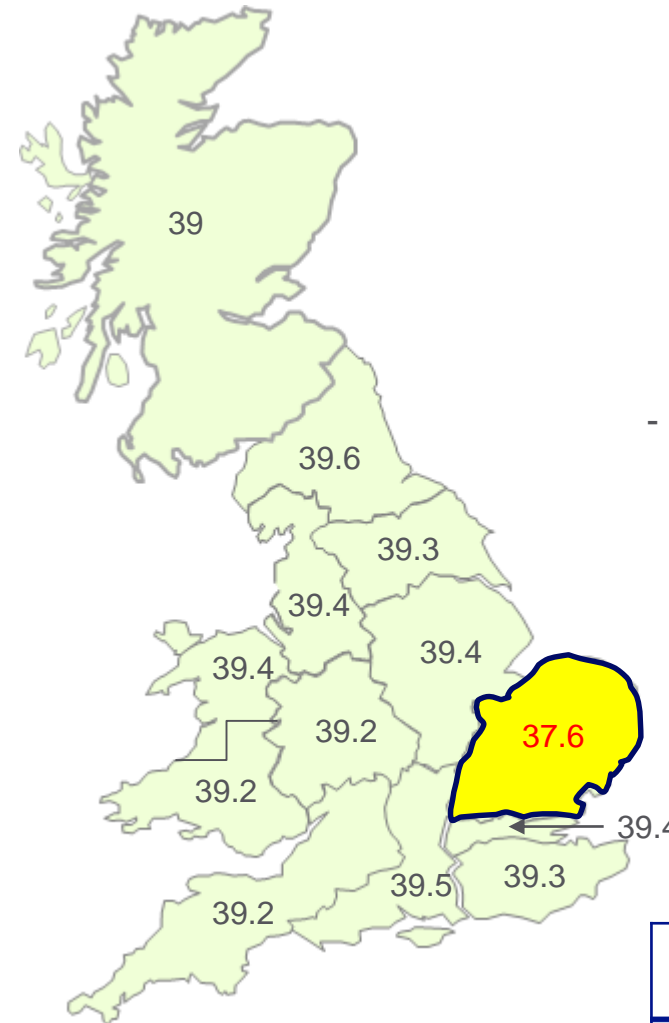


- Similar impacts to 2019/20 scenario however billing CVs are lower in affected areas as less input from interconnectors to mix with

Total CV shrinkage (KWH)	-167,997
Total cost	-£2,015.97

HIGH DEMAND
1 in 20 winter

National Grid



- Impact is more localised to EA LDZ compared to 2019/20 as Cygnus flows are predicted to reduce

Total CV shrinkage (KWH)	2,554,739
Total cost	£30,656.87

LOW DEMAND
Summer day

(EA LDZ = £30,490)

Conclusions

Scenarios 1 and 3 result in CV capping affected by the low CV gas coming in from Perenco but are unlikely to occur in reality

Scenario 2 does not result in CV capping that is due to the low CV of gas coming in from Perenco

- Scenario 2 is more realistic, though still takes a worst case view of Perenco CV

Biomethane data assumptions can have a large impact on capping as shown in Scenario 2

- In reality, CV capping due to biomethane sites should not occur as they are currently required to enrich to a higher CV