

Accessing the Grid in Warwickshire:

- APSE Big Energy Summit 2019 -
'Energising local government' -
Warwick, 15 March, 2019

Dr Jacky Lawrence, Corporate Energy Manager

jackylawrence@warwickshire.gov.uk

01926 47 6623

Agenda

- Warwickshire Energy Planning
- Where we are now?
- Meeting additional electricity demand
- Understanding the scale of the problem

Warwickshire Energy Planning – where are we now?

In 2015 Warwickshire County Council's Cabinet approved the establishment of a **Warwickshire Energy Plan (WEP)**

The plan has three main policy areas:

Policy Area 1: Increase use of low and zero carbon technologies

Policy Area 2: Increase public support for low and zero carbon technologies

Policy Area 3: Take people out of fuel poverty to improve their health and wellbeing

plus

4: That the Council encourage Landlords to invest in their housing stock on energy reduction schemes

5: Where a maintained school requests it, undertake a cost benefit analysis for installing solar panels on the school

6: Phasing and resourcing of policy areas for manageable delivery to focus partner support, secure external funding and fill gaps in provision.

7: Review of the Council's own energy policy in respect of buildings, other land assets and the opportunities presented by new developments.

Currently 158 MW installed renewable energy generation capacity
in Warwickshire (mostly solar)
meets almost 9% of total consumption of electricity

Warwickshire Energy Planning – advantages of local generation / drivers

Policy Area 1: Increase use of low and zero carbon technologies

Objective: Increase the amount of decentralised embedded generation

Increasing generation capacity nearer to where the demand occurs (decentralised energy) has many advantages:

- Enhanced energy security locally / nationally
- Retention of more energy spend within county boundary / the local economy
- Cost effective route to achieving carbon targets for developers
- Cost savings through reduced need for investment in high voltage transmission networks leading to more competitive and stable pricing longer term
- Driver of technical innovation
- Dramatically reduced conversion, transmission and distribution losses (therefore cost savings)
- Job creation
- Opportunity for local political leadership
- Opportunity for community owned schemes
- Electricity supply less vulnerable to sabotage or extreme weather
- Could enable the development of heat networks and smart grids
- More sustainable use of resources
- Reduced emissions of carbon dioxide

Warwickshire Energy Planning – the economy

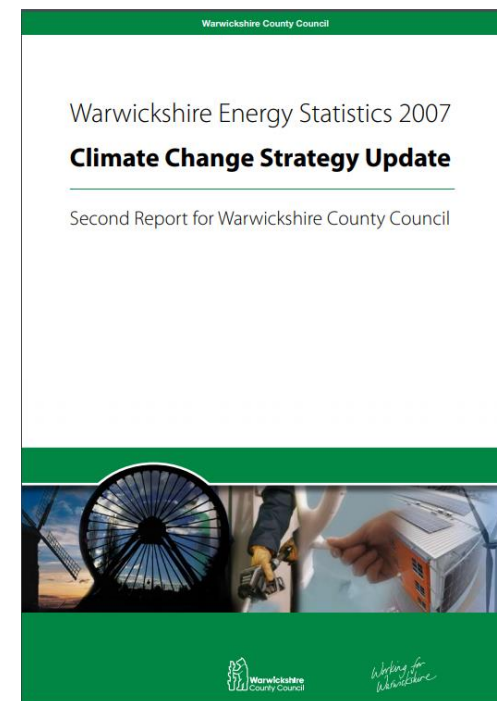
It is estimated that the Domestic + Industrial & Commercial sectors spend around **£400 - £500 million** each year on 3,000GWh* of electricity.

In 2007 the **energy intensity** of Warwickshire's economy was estimated and found to be higher than the regional and national averages
– thought to be a result of a higher than average proportion of employment in energy intensive industry.

| | |
|---------------------|-------------------------------|
| Warwickshire | 2.3 GWh/ million £ GVA |
| West Midlands | 1.9 GWh/ million £ GVA |
| United Kingdom | 1.8 GWh/ million £ GVA |

Energy Intensity - is a measure of the energy efficiency of an economy

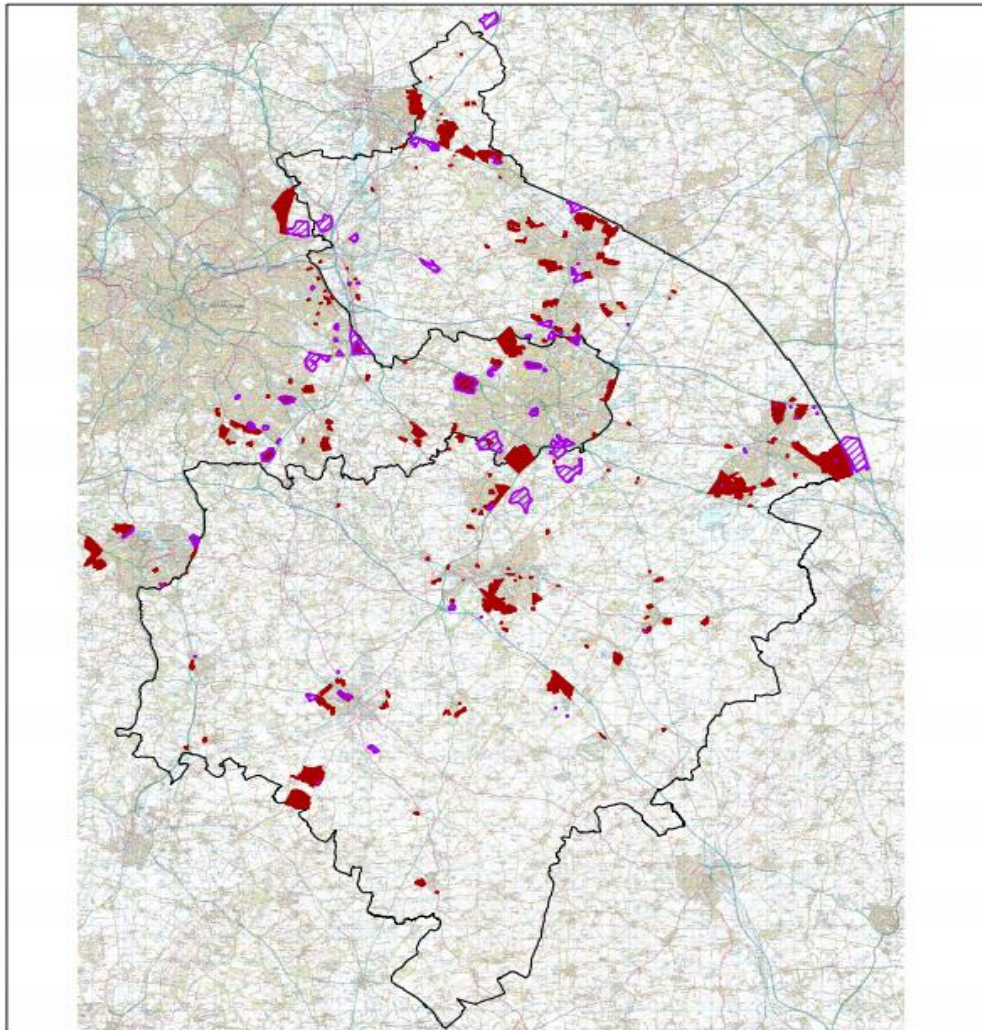
* Losses from central power station to consumption by final user estimated to be equivalent to 5,500 GWh.



2007 estimates

Warwickshire Energy Planning – additional electricity demand to 2030

County Wide Housing and Employment Sites



Areas of additional housing and employment land allocations

Legend
[Purple hatched box] Employment Allocations
[Red box] Housing Allocations

N
**Warwickshire**
County Council
Communities
13 Feb 2019

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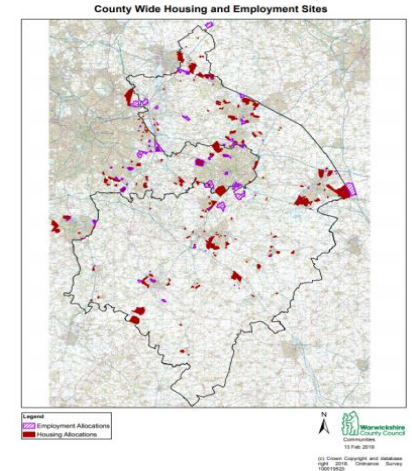
Warwickshire Energy Planning – additional electricity consumption to 2030

Estimates of the additional electricity demand from the additional housing and employment land allocations in the county are: -

- **260,000 MWh from new housing** (based on Government energy statistic averages for Warwickshire)
- **250,000 MWh from new employment land allocations / additional FTEs** (very rough estimate based on Warwickshire electricity consumption per FTE stats)
- **520 MWh from new street lights on roads where the new housing will be built** (based on current Warwickshire street lighting data)
- **11,000 MWh from EV charge points** (based on assumptions on usage and plans in Warwickshire EV Charging Infrastructure Strategy)

Total additional electricity demand

- **523,000 MWh** which is an additional 18% on current consumption



Note - HS2 passes through Warwickshire but the 3 TWh demand will be met from additional zero carbon generation capacity elsewhere – likely to be from new offshore wind.

Warwickshire Energy Planning – challenges

Stratford-on-Avon District Local Industrial and Economic Strategy 2018-2032

| Objective (What) | Action/Priority (How) | Purpose (Why) |
|-----------------------------|---|---|
| 6. To improve energy supply | To lobby and liaise with the energy sector on behalf of businesses | To ensure that power supplies do not hinder economic growth |
| 6. To improve energy supply | To encourage the growth of low-carbon technologies and the efficient use of resources | To ensure future energy resilience |
| 6. To improve energy supply | Establishment of a political Champion for Energy | To ensure awareness of issues is maintained and encouraged in developments at an early stage rather than expensive and prohibitive retrofitting |
| 6. To improve energy supply | Investigate the possibility of setting up a company to provide an income stream from the District Heating network | To profit from use of low energy technology To show commitment to saving energy and innovative DC |

SDC has produced a Local Industrial and Economic Development Strategy ‘ The Place of Business at the Heart of England. It identifies (paragraph 3.3.6) that demand for electricity is increasing significantly.

Business leaders have raised concern about the adequacy of power supply across the sub region and the impact of lack of power is having on economic growth.

There is a particular concern locally, given the transition of the automotive sector to electric vehicles, notwithstanding the additional significant demand that electric vehicles charging points, will add to the electricity demand.

The action plan includes separate objectives to improve energy supply (page 77 of the document).

www.stratford.gov.uk/enterprise

Warwickshire Energy Planning – challenges

SDC Planning

Capacity on the grid has affected the emerging specification of EVCPs in new residential homes set out in the Council's draft Supplementary Planning Document 'Development Requirements'.

Initially, **SDC had planned to recommend a min 7Kw specification for EVCPs** so that they would be futureproofed for the larger batteries in EVs that are likely to come on line in the future.

However, **they have had to revise this specification in light of developers comments, that there is not enough capacity in the grid, and to meet the specification would require an additional substation, compromising the viability of the development.**

Electric Vehicle Charging Infrastructure
Strategy 2017-2026
Warwickshire County Council
November 2017



'Warwickshire - Leading the Charge'

Warwickshire Energy Planning – challenges

Site 1 - 4 x dual 7.4kw (64amp) charging posts

WPD Costs

| Summary of the electricity reinforcement work required None | |
|---|-----------|
| Non-contestable Assessment and Design Fees | £403.00 |
| Non-contestable Connection Works | £0.00 |
| Contestable Connection Works | £5,809.82 |
| Connection Charge excluding VAT | £6,212.82 |

Electrical and buildings works costs

£37,493.05 includes all electrical and building works from the WPD connection such as: site barriers & signage, trenching and duct work from boundary to GRP and from GRP to EV charger positions, concrete base for GRP and charger posts, GRP, disposal of all rubbish, removal of shrubs, plants & hedges.

Total = £6,212.82 + £37,493.05 =
£43,705.87 - not going ahead

Site 2 - 3 x dual 7.4kw (64amp) charging posts

WPD Costs

| Summary of the electricity reinforcement work required None | |
|---|-----------|
| Non-contestable Assessment and Design Fees | £403.00 |
| Non-contestable Connection Works | £0.00 |
| Contestable Connection Works | £2,909.54 |
| Connection Charge excluding VAT | £3,312.54 |

Electrical and buildings works costs

£24,220.53 includes all electrical and building works from the WPD connection such as: site barriers & signage, trenching and duct work from boundary to GRP and from GRP to EV charger positions, concrete base for GRP and charger posts, GRP, disposal of all rubbish, removal of shrubs, plants & hedges.

Total = £3,312.54 + £24,220.53 =
£27,533.07 - not going ahead

Warwickshire Energy Planning – challenges

10 sites investigated for **grid connected battery storage**

- Import / export range 1 – 5 MW
- Cost of connection for import range £46,800 to £1 million per MW
- Cost of connection for export range £62,000 to £1 million per MW

1 site possible for **Ground Mounted Solar and grid connected battery storage**

- Max import = 2 MW
- Max export from solar PV = 5 MW
- Cost of connection £425,000

6 sites investigated for **Ground Mounted Solar**

- Export range 0.25 – 4 MW
- Cost of connection for export range £10,600 to £197,000 per MW
- Average cost of connection £124,000 per MW



Warwickshire Energy Planning – impact of grid constraints on business

One company tried to increase power to their current site as they needed to increase capacity and improve quality of the products they manufactured.

There were two stages to the upgrade:

1. Increase their capacity to **4300 kVA** – affordable – but not enough power.
2. Increase their capacity to **5200 kVA**. The right amount of power – however, this option would have required major works costing substantially more than option one and it would have taken approximately 18 months to complete.

A formal request was made to WPD in March 2018 and they were supposed to receive a finalised quote August 2018. This then slipped to mid September.



Warwickshire Energy Planning – electrification of transport

It was estimated that the road transport fuel consumed the equivalent of 9,005 GWh of energy p.a. (including rail transport) *

Road transport travelled a total of 8,674 million kilometres



Zapmap – 55 charge points, 84 connection sockets, 24 different locations

No. of licensed cars by propulsion type
December 2006

| | |
|-----------------|---------|
| Petrol | 214,033 |
| Diesel | 68,831 |
| Electric | 2 |
| Steam | 1 |
| Gas | 8 |
| Petrol/Gas | 375 |
| Gas/Bi-fuel | 148 |
| Hybrid electric | 143 |
| Total | 283,541 |

* 2005 estimates

Warwickshire Energy Planning – meeting electricity demand

Research* was undertaken to see what delivery of the following county targets could entail:

- 10% of electricity consumption to be met from renewable energy sources
- 10% of heat delivered to be generated from renewable sources
- 90 MW of electricity to be generated using CHP

| Option - examples | Cost per t CO2 | Total Investment | Long-term local jobs | Number of typical installations | Installed capacity MW with this many installations | potential cost of connecting this many MW @ £124k / MW |
|--|----------------|------------------|----------------------|---------------------------------|--|--|
| Industrial scale 1.5 MW wind turbines >6.5 m/s * | £33 | £83 million | 8 | 83 | 125 | £ 15,438,000 |
| Community 600kW wind turbines >6.5 m/s | £36 | £93 million | 9 | 208 | 125 | £ 15,475,200 |
| Farm 6 kW wind turbines > 5 m/S | £142 | £347 million | 52 | 24,800 | 149 | £ 18,451,200 |
| 2MW community-scale biomass station** | £152 | £108 million | 97 | 22 | 44 | £ 5,456,000 |
| 10kWp 78 Sqm solar PV installations | £672 | £1,723 million | 173 | 36,815 | 368 | £ 45,650,600 |

*2006 estimates

The Warwickshire wind resource assessment* identified land areas suitable, with sufficient wind speed and no planning constraints for up to 178 * 1.5MW wind turbines or 445 * 600kW wind turbines

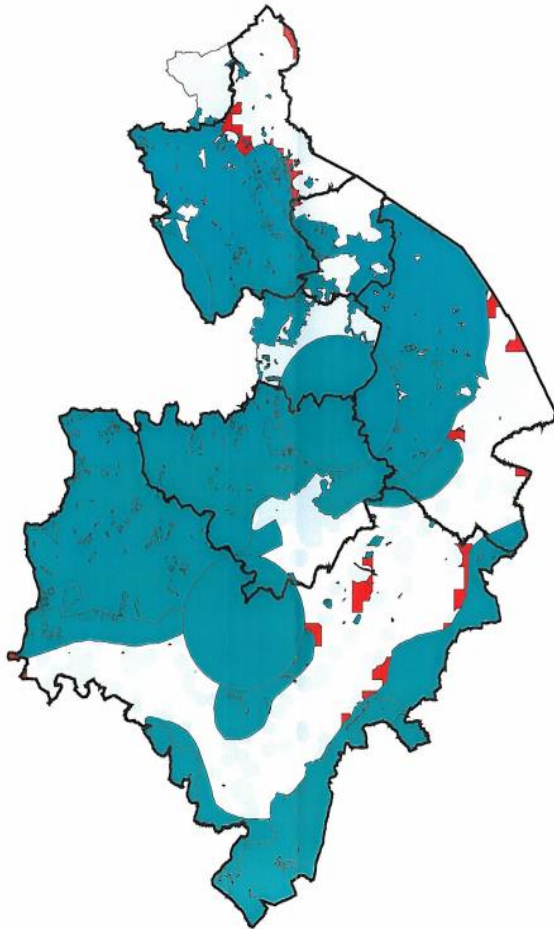
Warwickshire Energy Planning – meeting electricity demand



For example




If 20% of the total additional 2030 **523,000 MWh** electricity demand was met from renewables this could be the equivalent of around 50 MW installed capacity, which could be provided by

17 * 3 MW wind turbines



0 5 10 Kilometres

Legend

-  Deliverable Resource
Windspeed > 6.5 m/s
-  Planning Constraints
Urban Areas
-  Local Authority Boundaries

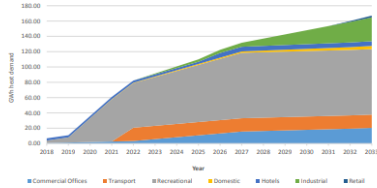
Deliverable Wind Resource
in Warwickshire

2005 estimates

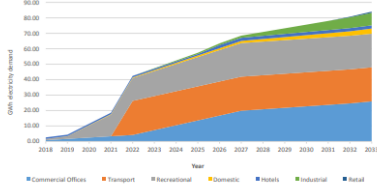
Warwickshire Energy Planning – LEPs taking action

Energy Innovation Zones in West Midlands: UK Central

Forecast heat demand



Forecast electricity demand



- Based on the available development roll-out data, Arup has estimated heat and electricity demand (GWh) and capacity (MW)
- Heat demand is forecast to grow from 7GWh to 180GWh over the period 2020 to 2035
- Electricity demand is forecast to grow from 3GWh to 80GWh over the period 2020 to 2035

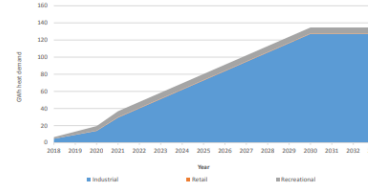
The WMCA recognises that grid constraints are an issue nearly everywhere and are planning to implement Energy Innovation Zones and are working with LEPs to develop a Regional Energy Strategy

Energy Innovation Zones in West Midlands

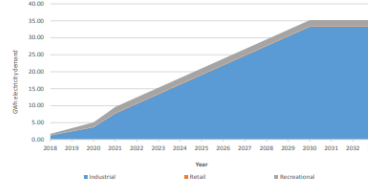
| Opportunities | Benefits |
|--|---|
| <ul style="list-style-type: none"> • The West Midlands is in a prime position to deliver low carbon infrastructure • EIZs are seen as an opportunity to deliver new energy infrastructure, corresponding to local priorities | <ul style="list-style-type: none"> • Faster delivery of energy infrastructure • Low carbon infrastructure delivered ahead of need |
| <ul style="list-style-type: none"> • This could be achieved through devolved powers to WMCA • Aim of the EIZ will be to encourage competition and infrastructure supply | <ul style="list-style-type: none"> • Lower system and avoided infrastructure costs • Local economic priorities are taken into account |
| <ul style="list-style-type: none"> • A key aim of the EIZ will be to foster new low carbon technologies and deliver infrastructure ahead of need • If successful EIZ development could be rolled-out across the nation | <ul style="list-style-type: none"> • Positive jobs and GVA impact |

EIZ in West Midlands: South Coventry

Forecast heat demand



Forecast electricity demand



- Based on the available development roll-out data, Arup has estimated heat and electricity demand (GWh) and capacity (MW)
- Heat demand is forecast to grow from 3GWh to 27GWh over the period 2020 to 2035
- Electricity demand is forecast to grow from 1GWh to 20GWh over the period 2020 to 2035

Warwickshire Energy Planning – conclusion

Insufficient affordable capacity in the grid / distribution network may mean that Warwickshire:

- Might not be able to meet its Energy Plan targets
- Might not be able to meet its renewable energy targets
- Might not be able to meet its aim of income generation from energy projects
- Might not be able to meet its share of carbon reduction targets
- Might not be able to meet electric vehicle targets
- Might not be able to meet local Industrial & Economic Strategy objectives

And that in the County

- Delivery of new planned housing and employment land developments may not be viable
- Business improvements / expansion ambitions may not be unachievable
- Future costs of improving the grid and resulting rising energy prices may make delivery of public services too expensive

Warwickshire Energy Planning – questions

- Does your Council take meeting climate change / sustainability / energy targets seriously? What makes the biggest difference to getting support?
- Have you estimated current and future electricity demands from new developments?
- Have you set renewable energy, carbon, EV or economic targets?
- What business indicators do you use?
- What grid issues have you come across? Have they ever stopped you from delivering a viable project?
- Do you know what reinforcement works are required on 11 kV, 33kV, 132kV networks?
- Have you been provided with a wide range of budget quotations for grid connections? Does this impact on your ability to plan?
- Have you come across businesses that can't expand/ re-locate because of grid constraints?
- Do you have regular meetings with your DNO to discuss any issues you come across?
- How are you working to improve the energy system? Have you got your own generating capacity / ESCO / energy supply company / energy centres / district heating / CHP schemes / private wire / sleeving arrangements in place etc.
- Have you thought about paying for grid reinforcements so that your economic targets can be achieved?

End slide

Intentionally blank

Following slides – just in case they are
needed to answer a question

| Really rough estimate of electricity consumed per employee MWh | |
|--|-------|
| North Warwickshire | 12.15 |
| Nuneaton and Bedworth | 6.63 |
| Rugby | 11.21 |
| Stratford-on-Avon | 6.22 |
| Warwick | 7.39 |

| Estimated cost of electricity consumed | |
|--|---------|
| 3000 GWh | |
| 3000000 MWh | |
| 3000000000 kWh | |
| 14.5 p/kWh | |
| 0.145 £/kWh | |
| £ 435,000,000 | total £ |

| average electricity consumption per domestic consumer (kWh) | average of all years 2005 - 2017 |
|---|----------------------------------|
| North Warwickshire | 4,635 |
| Nuneaton and Bedworth | 4,045 |
| Rugby | 4,403 |
| Stratford-on-Avon | 5,322 |
| Warwick | 4,413 |

| Additional employment land allocations | offices | manufacturing | warehouses |
|--|-------------------|-------------------|-------------------|
| | Total B1 hectares | Total B2 hectares | Total B8 hectares |
| North Warwickshire | 2.32 | 4.53 | 61.25 |
| Nuneaton and Bedworth | 19.02 | 7.56 | 7.01 |
| Rugby | 2.88 | 25.29 | 38.91 |
| Stratford-on-Avon | 37.04 | 31.34 | 13.25 |
| Warwick | 2.72 | 0 | 0 |

| Import | Export | Cost excluding VAT contestable + non-contestable | Import cost per MW | Export cost per MW |
|--------|--------|--|---|--------------------|
| MW | MW | | Grid connected - in Front of the meter Battery Storage | |
| 4 | 3 | £ 187,222 | £ 46,806 | £ 62,408 |
| 4 | 3 | £ 258,282 | £ 64,571 | £ 86,094 |
| 1 | 1 | £ 1,071,183 | £ 1,071,184 | £ 1,071,184 |

Assumptions / base data

| | | | | | | |
|--|-----------|------------|------------|------------|-------------|---------------|
| Charge speed kW | 7.4 | 50 | 175 | 7.4 | 7.4 | 7.4 |
| Number of chargers | 55 | 55 | 55 | 1000 | 10000 | 100000 |
| Parking spaces per charger | 2 | 2 | 2 | 2 | 2 | 2 |
| number of parking spaces | 110 | 110 | 110 | 2000 | 20000 | 200000 |
| usage hours a day (betewen 07:00 and 23:00) | 16 | 16 | 16 | 16 | 16 | 16 |
| utilisation (half the chargers are in use during the 16 hours) | 50% | 50% | 50% | 50% | 50% | 50% |
| average charge speed (EV charges at 70% of the maximum that a charger can provide) | 70% | 70% | 70% | 70% | 70% | 70% |
| capacity per day kWh | 4,558 | 30,800 | 107,800 | 82,880 | 828,800 | 8,288,000 |
| days per year used | 365 | 366 | 365 | 365 | 366 | 365 |
| kWh capacity per year | 1,663,816 | 11,272,800 | 39,347,000 | 30,251,200 | 303,340,800 | 3,025,120,000 |
| MWh per year | 1,664 | 11,273 | 39,347 | 30,251 | 303,341 | 3,025,120 |
| GWh per year | 2 | 11 | 39 | 30 | 303 | 3,025 |

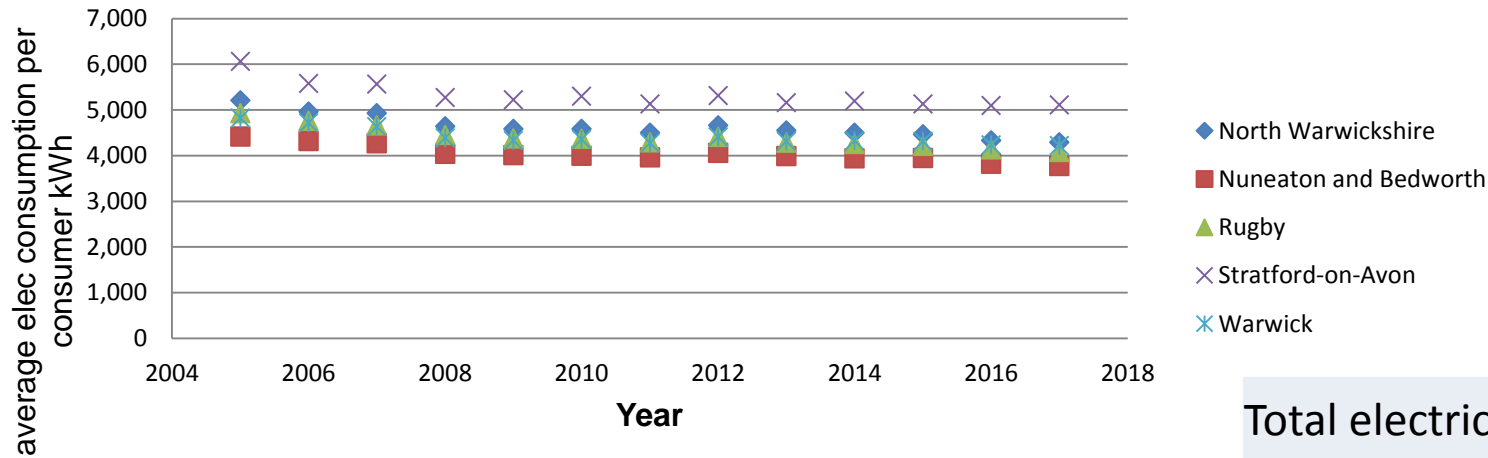
EV Charge Points

| Summary | Number of dwellings | Estimate of additional MWh electricity consumed due to the increase in number of dwellings | Additional FTE's from employment land allocations | Estimate of additional MWh electricity consumed due to the increase in FTEs / employment land allocations | Estimate of additional MWh consumed due to increased number of street lights | Estimate of additional MWh consumed due to 55 (50 kW) EV charge points (110 car parking spaces) |
|-----------------------|---------------------|--|---|---|--|---|
| North Warwickshire | 6,150 | 28,505 | 8,000 | 97,220 | 58 | |
| Nuneaton and Bedworth | 7,900 | 31,954 | 2,600 | 17,231 | 74 | |
| Rugby | 11,400 | 50,198 | 4,000 | 44,849 | 107 | |
| Stratford-on-Avon | 17,600 | 93,662 | 4,900 | 30,461 | 166 | |
| Warwick | 12,860 | 56,752 | 8,100 | 59,898 | 121 | |
| Totals | 55,910 | | 27,600 | | | |
| Totals | | 261,070 MWh | | 249,658 MWh | 527 MWh | 11,273 MWh |

| | | |
|--|--|--|
| total additional MWh from new dwellings, I&C FTEs, streetlights and EV charge points = | Total MWh electricity consumed in Warwickshire each year average = | so the % additional electricity consumption will be an extra |
| 522,528 | 3,049,922 | 17% |

Warwickshire Energy Planning – understanding the scale of the problem existing electricity demand

Domestic consumers



Total electricity consumption in Warwickshire is around 3 million MWh per year or 3,000 GWh

Commercial and Industrial consumers

