Stainton Lighting
Design Services

Application of Dual Distribution Networks (DDN)

A Case Study of Durham Innovation District Project

By

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What is a Dual Distribution Network - DDN

DDN network was developed by a company called KelTech IoE – Why

During the development of Wembley Way there was a significant issue with space for power and significant data requirements in the ducted system and apparatus.

KelTech developed a system with collaboration from Schreder incorporating power and data into one System.

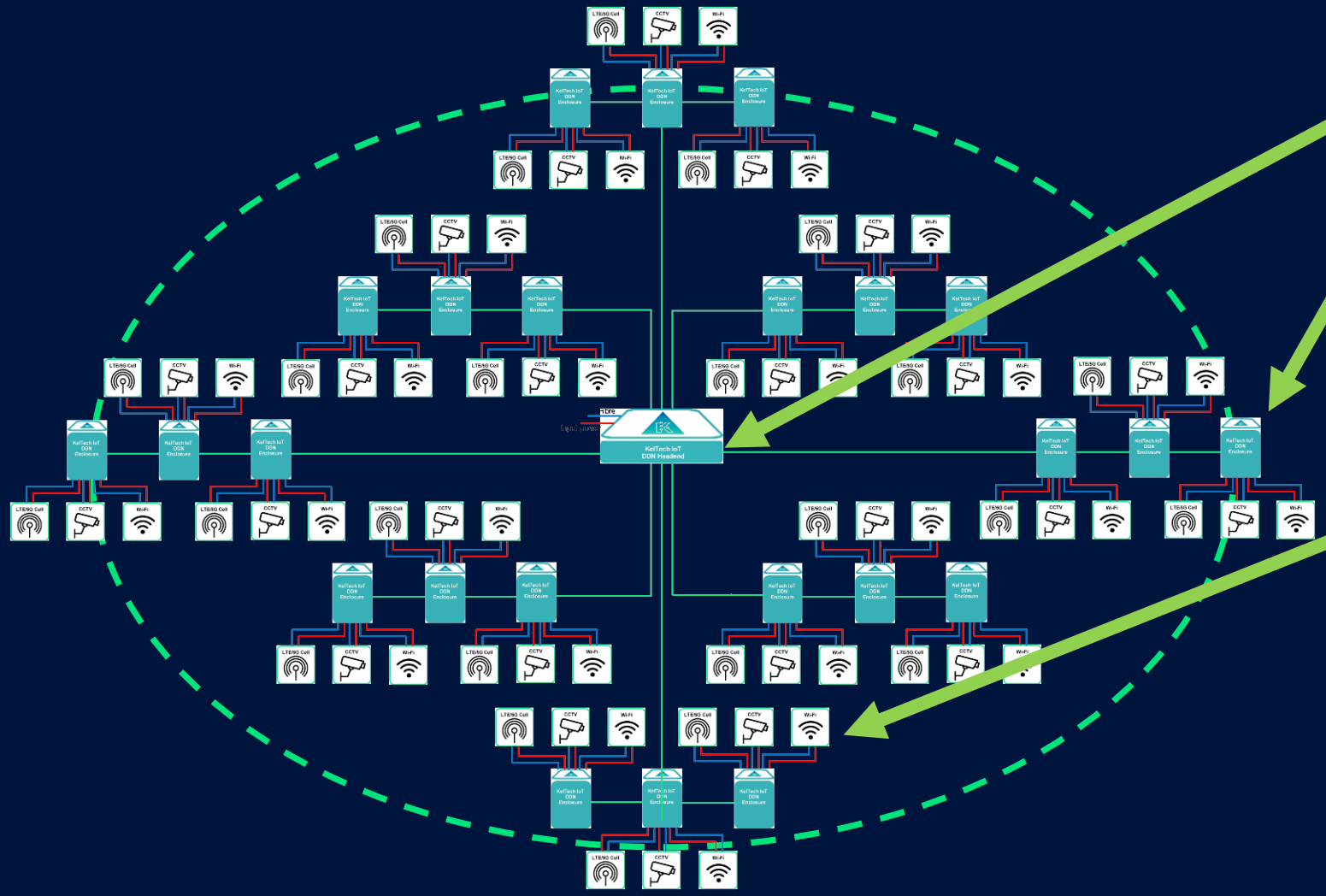
This is a comms company looking to resolve a multi disciplinary issue.

What is a Dual Distribution Network - DDN

DDN network is effectively a power and fibre distribution system with three distinct elements.

- Network power distributing up to 2kW watts of DC power over 2 kilometres
- Providing a usable DC power at 48V to asset level
- Providing a dark fibre network capable of carrying significant data
  - This can be used for on column elements
  - Can be leased to standard fibre network providers

What is a Dual Distribution Network - DDN



One Central distribution point called the Head End distributes Network power to:

Gemini 520 -200W units which manage the fibre network and convert the network power to 48V DC

This then terminates into a Gemini FD33 unit.

At each point the fibre either passes through or is spliced as needed

What is this equipment like

Head End and Optical Distribution Frame





Gemini 520 -200W unit

- Fibre pass through
- Network to DC power conversion



Gemini –FD33 unit

- Fibre pass through or termination
- DC power connection



DC driver

May require specific form factor



How It All Fits Together

Head End with Network Power Output over a six core cable in three pairs

Black – Red

Green Yellow

Blue - White

Network Power from Black and Red cores converted to DC

Red and Black distribute DC

Other 4 cores pass through all equipment

Network Power Green and Yellow cores converted to DC

Spare Red and Black distribute DC for units before conversion

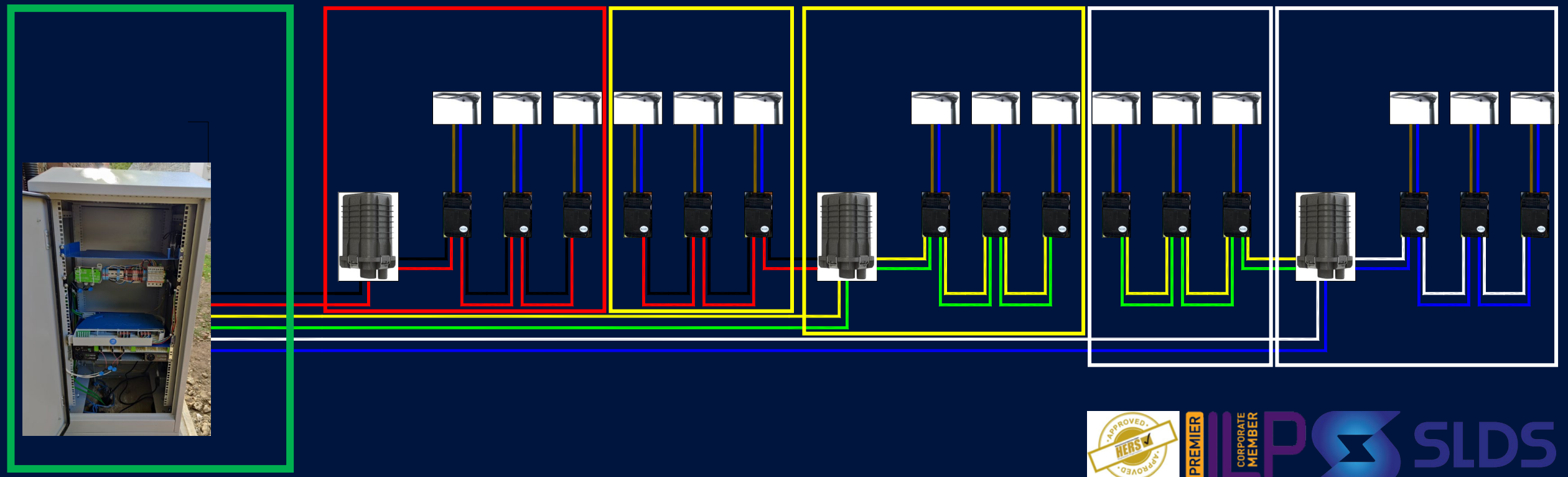
Green and Yellow are distribute DC after conversion (in addition you can tie the Black and Red in to increase overall cable size to 2mm)

Other Blue and White cores pass through all equipment

Network Power Blue and White cores converted to DC

Spare Green and Yellow distribute DC for units before conversion (in addition you can tie the Black and Red in to increase overall cable size to 2mm)

Blue and White distribute DC after conversion ((in addition you can tie the Black and Red and the Green and Yellow in to increase overall cable size to 3mm)



Design Considerations

Step 1 : Where can you put the Head End:

- You need a suitable power supply for potential attached load
- Determine number of Network Power supplies needed (each supply provided 3kw of power)
- Location to site feeder pillar
- Ideally data connection if you intend to use the dark fibre element

The headend should be located to maximise the potential usage of the system whilst also considering the above.

Step 2 : Group assets into CCTS and DC groups:

- This depends on the number of loads and their characteristics
- Good rule of thumb is to group within 100m, but for smaller loads such as 9W can extend this to 200m
- Grouping depends on the size of the copper available to reach the other loads

Step 3 : Locate conversion enclosures:

- Ideally place in the middle of a grouping

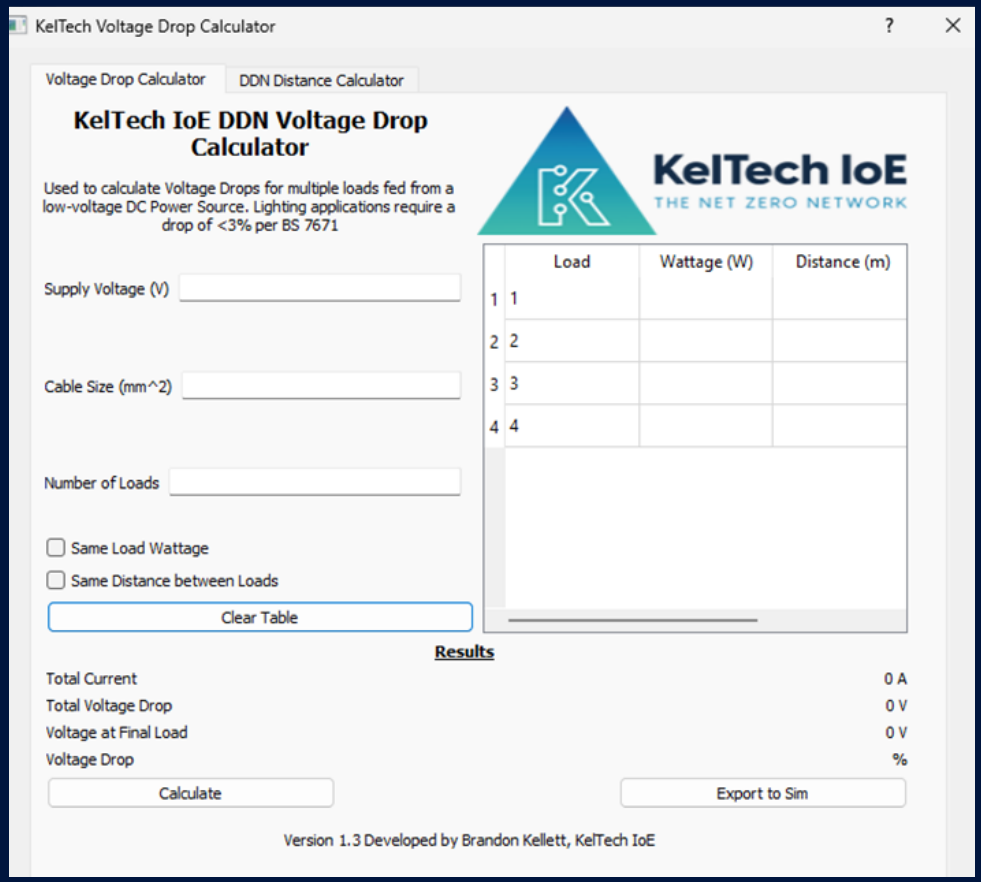
Design Considerations

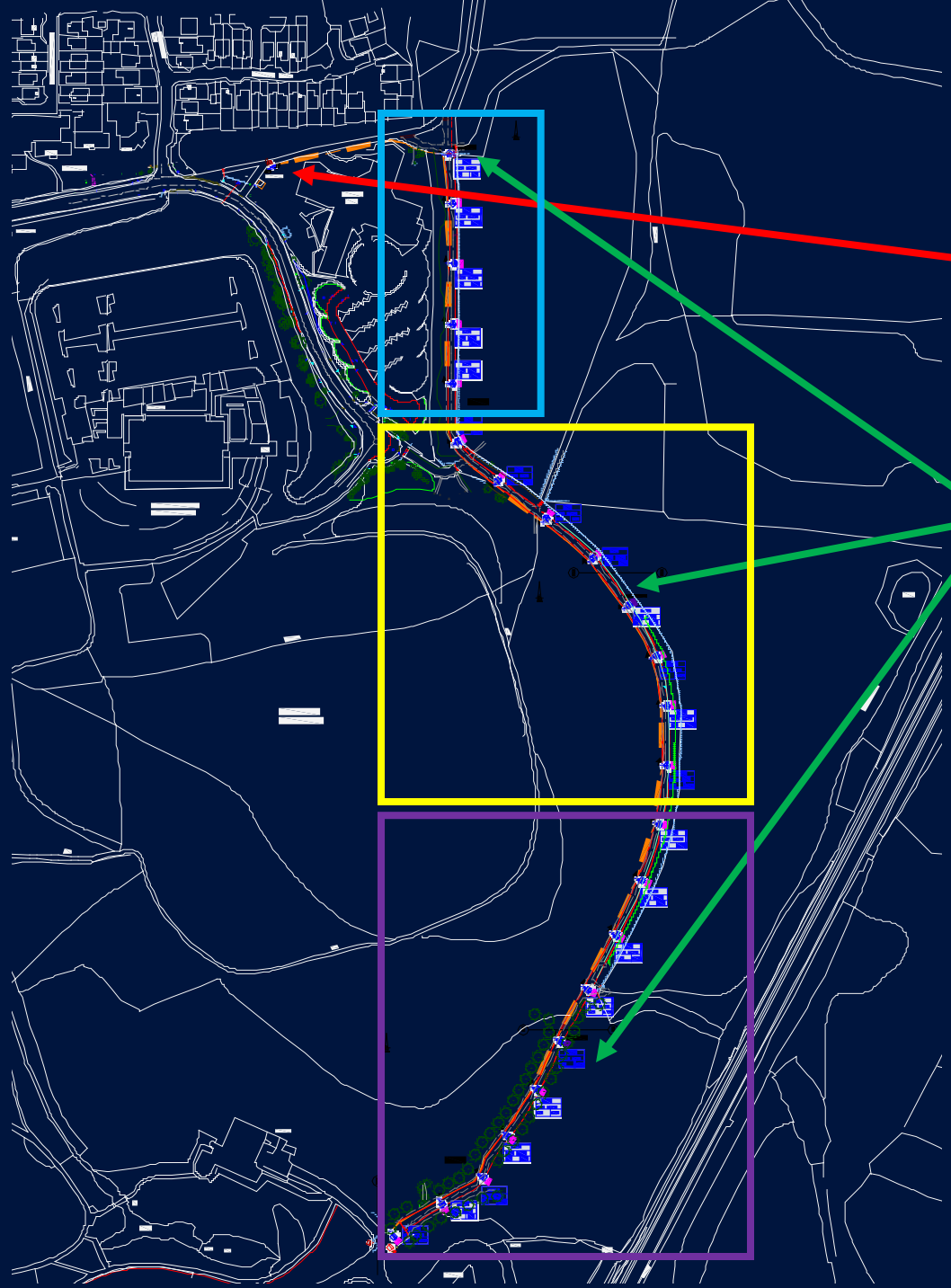
Step 4 : Undertake Volt drop calculations

To do this KelTech IoE have developed Power & Distance Checks using DDN Tools:

- The Voltage Drop calculator confirms whether an enclosure can serve a group of loads
- Restrictions here are from BS 7671:
  - Voltage Drop must be <5% (BS 7671:2018 Sec. 715 "Extra-Low Voltage Lighting Installations)
- Use the Distance Calculator to confirm whether the Enclosure can be powered by the Headend

This is an iterative process, and you may need to go back and change the design – this is normal! The more designs you do, the more familiar you will get with the limitations





Layout

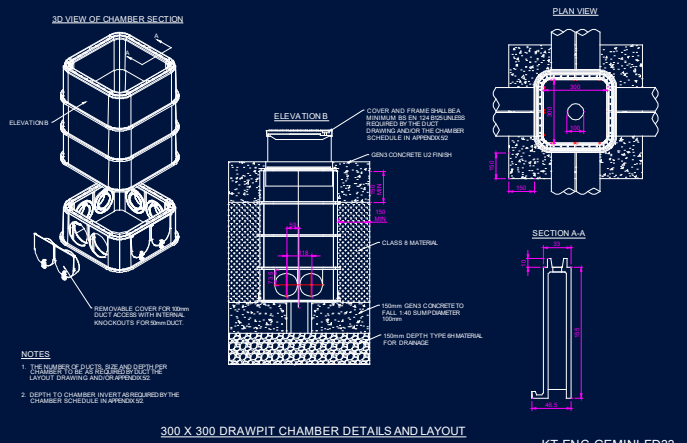
FP with Head end and power supply

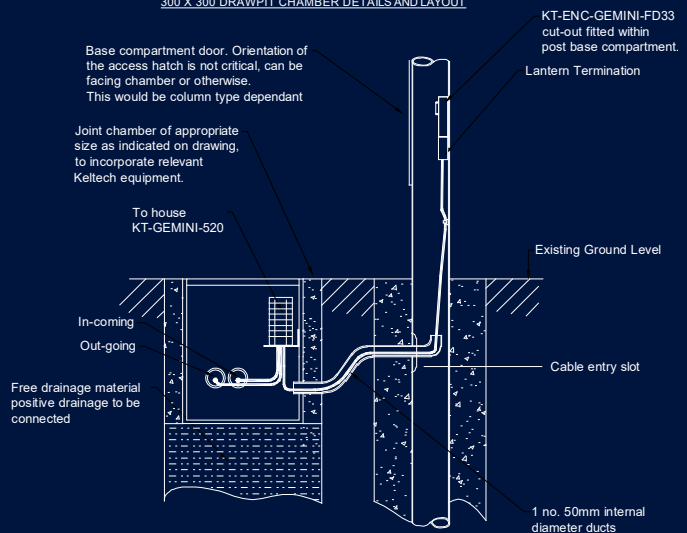
520 Units

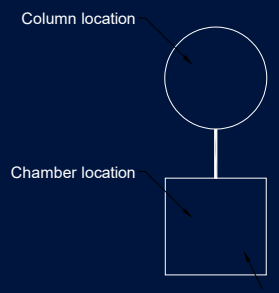
Scheme Grouping

Lantern wattages where 9 watts on this section however on the main road as part of another phase we used 23 Watts

Some details to consider: 520 unit Placement







The 520 conversion unit needs to be placed somewhere and will not fit inside the column due to size required to manage the fibre element as such at each location you need either a chamber suitable to accommodate it (450x450) it is also beneficial to have a chamber at each column to make cable management and containment easier.

This chamber should be directly opposite the cable entry





The alternative is mounting the unit inside a mini pillar

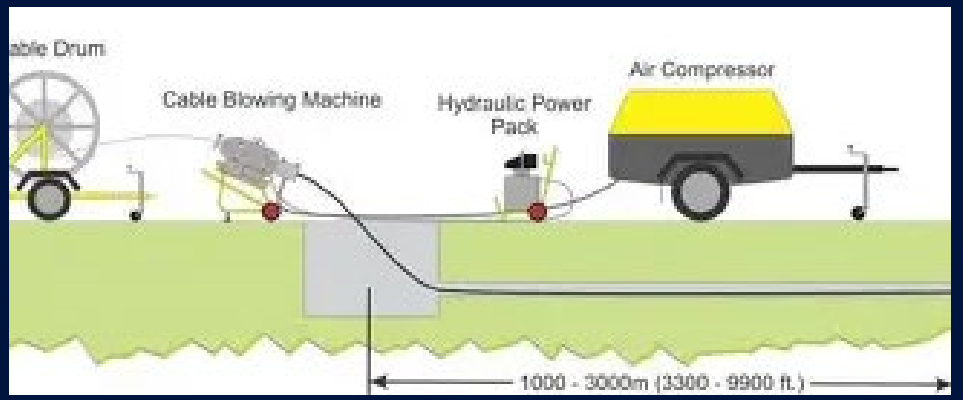


Some details to consider: 520 unit Placement



For our project we used a conventional ducting system for resilience given the innovative nature of the project.

However, significant installation costs could have been saved by using micro duct and shallow burying or even slot cutting the cable duct route and then blowing the cable through the duct using standard comms systems and installation processes.



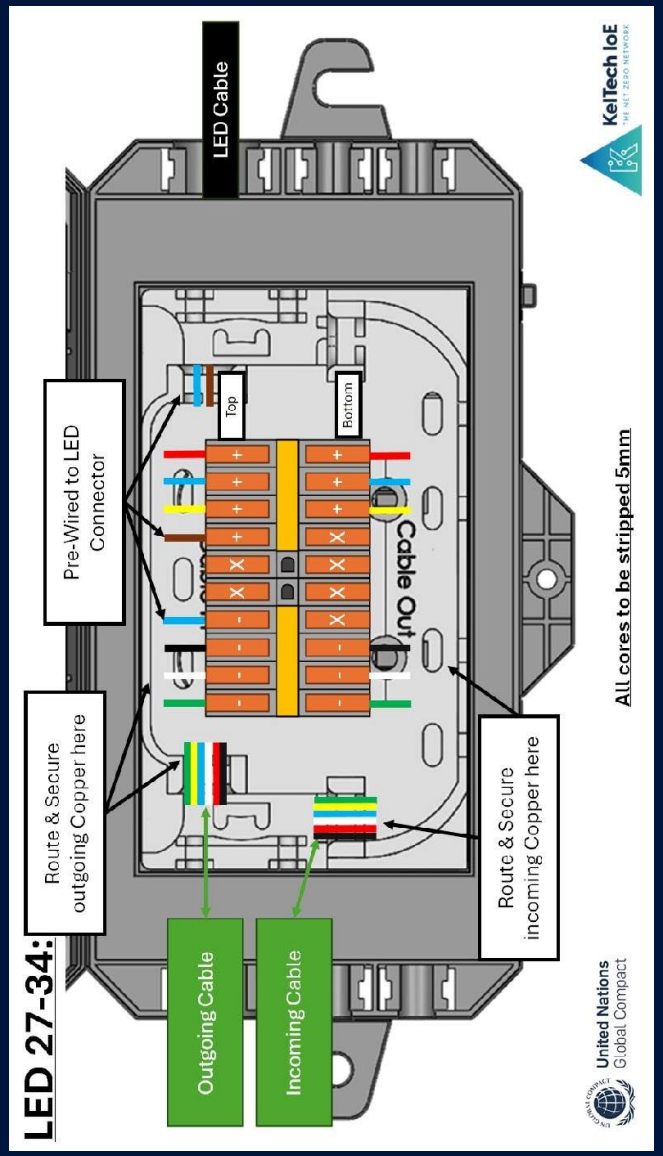


LOC System

This is a digital tag attached to each unit and also the cable. This tag will:

- Wiring diagrams for specific units such as:
  - Headend
  - Gemini 520
  - Gemini FD33 units
- Provide information relating to origin and destination of cable





What are the benefits

Speed of Deployment (x2 times faster)

- Cable network quick to install
- Install power at the same time as fibre cabling using hybrid cables

Sustainability

- Reduced carbon emissions
- Energy efficient products designed to reduce energy loss and no power conversion losses

Cost Effective Deployment

- Simplified design - no complex electrical designs or surveys
- Centralised power management - avoids multiple power cabinets & distributed UPS

Better Implementation

- Safe to touch power
- Reduced form factor with underground installation

Future Enabled

- Modular expansion capability to reach more end points

Lower Opex Costs (10%-15% Opex saving)

- More efficient electricity transmission
- No electrical testing requirements
- Centralised monitoring means more accurate & faster time to fault resolution

What could the fibre be used for

What you would expect:

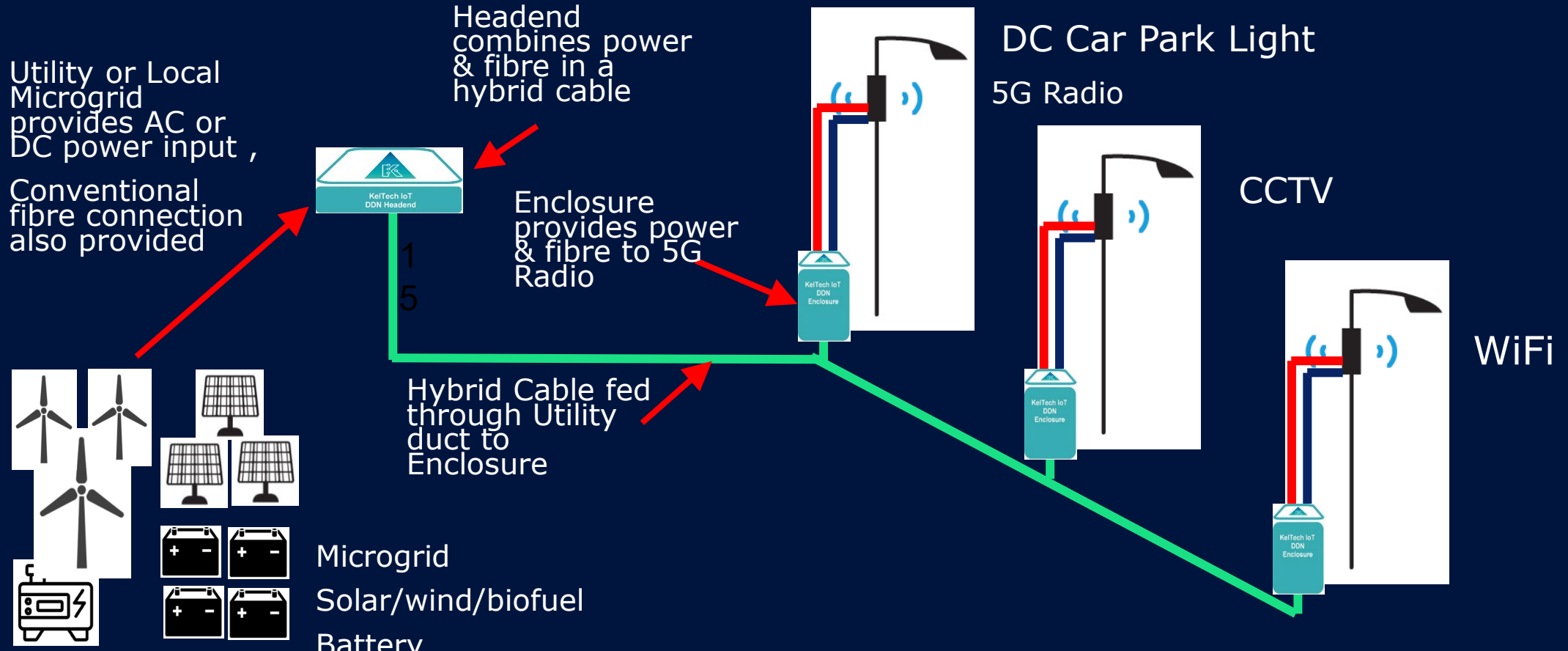
- CCTV
- Access Control
- Digital Signage
- A.V / P.A Systems
- 5G Enablement
- Noise detection
- Traffic / Pedestrian counters
- Environmental counters
- Small cells

What else:

- Leasing the network to broadband providers
  - (A single cable could supply, 768 properties with super fast broadband)
- Creating external WiFi Mesh networks
- Pretty much any connected device

As an extra the DC network could power most of the equipment mentioned above

Potential to use with off grid generation



Imagine

A housing estate or public area with

- A solar and/or wind farm providing fully off grid and SELV power and a high-speed network connection powering the following:
  - Fully adaptive street lighting system
  - CCTV with ANPR
  - PA System
  - Public WiFi Network or 5G
  - Home or business broadband
  - Dynamic advertising displays
  - Pedestrian and traffic counters
  - Safety alert stations
  - Street furniture with phone charging
  - Parking meters



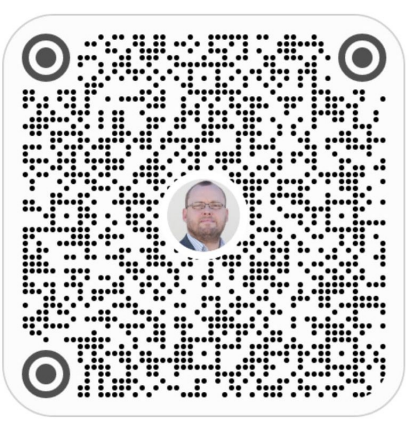




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Thank you
I am happy to answer any questions I can

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