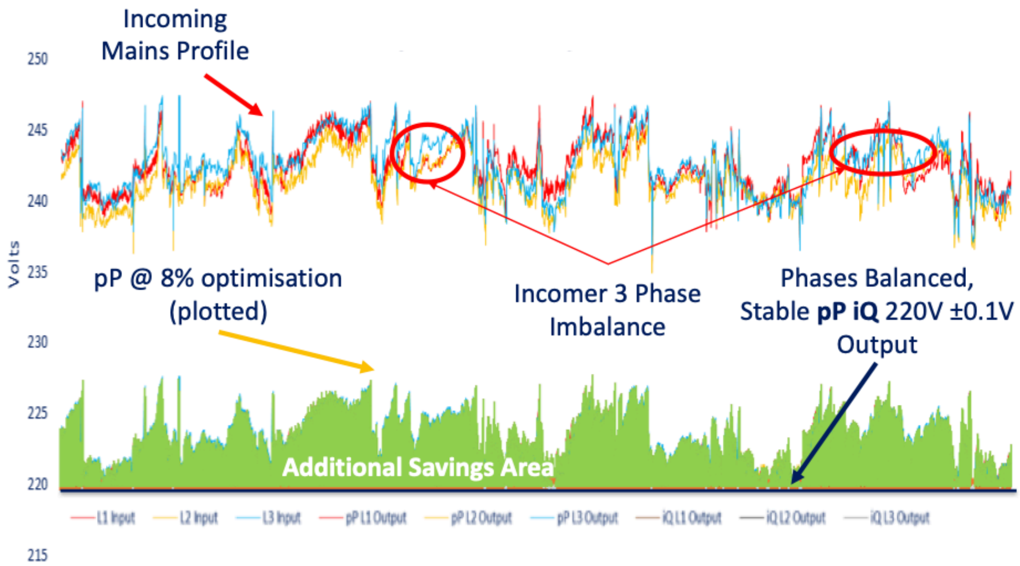
Voltage as a Service
Path to deployment

Technology

In the time since the first PowerPerfector machines were manufactured 20 years ago, iESCO UK has developed a high resolution electronic dynamic controller (known as the IQ controller). This technology provides a broader range voltage boost and reduction capability, with fine voltage control and independent phase voltage balancing.

The IQ's voltage control results in a precise 0.1V resolution flat line output, with each phase adjusted independently, performing phase balancing. The IQ will provide voltage boost if there is a voltage sag, as well as the normal voltage reduction function. This capability from iESCO leads the global VO industry. We have selected this technology as it will be suitable for group operations across the world, especially in regions that experience extended voltage sag.



The technology inside basic Power Perfector core

The technology inside Power Perfector IQ controller

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Asset protection

The VO solution has additional benefits for the site, including:

- surge protection
- harmonic reduction (the TX core will reduce triplen harmonics by approximately 50%)
- reducing the temperature of operating equipment (the energy saved is energy no longer dissipated as heat in the load equipment)
- extending life of equipment (for every 10^{O}C reduction in operating temperature the life of insulation and electrical equipment in general is doubled. Note the converse principle applies)
- voltage boost during voltage sag events. Relevant in those facilities attached to weaker grids.

Consequently, the reduction in electrical plant O&M costs may be as high as 25%, which will vary from site to site. Across a facility fleet, these O&M savings benefits will be substantial and ongoing.

Verification

Proving the energy usage savings and the CO2 footprint reduction delivered by the VO installation is important, and though it will be formally conducted post commissioning, our approach is to transparently prepare for verification at the outset.

We will utilise the EVO IPMVP methodology, which is the international gold standard.

Table 2 Basis verification steps

Step	What	When	How
Step 1	Establish a model of baseline energy usage	Before VO commissioning	Model energy usage as a function of facility inputs
Step 2	Gather data	At commissioning	For many sites, Period ON: Period OFF verification may be performed at commissioning
Step 3	Determine energy savings due to VO	After VO commissioning	Forecast energy usage at the site without VO and calculate the difference with actual energy usage

The overall approach ensures the efficient conduct of the post commissioning verification, and will provide maximum confidence throughout the process.

Step 1 can be commenced now, and we will set out an information request with the data we seek.

The verification approach will provide both a method and a model that will be of value for any organisation, as it provides a robust and widely accepted basis for monetising the energy cost savings, as well as for the CO2 footprint reduction at the facilities.

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Next steps

We now propose to firm up our preliminary analysis, and finalise all parameters including the groundwork for savings verification.

The next steps are set out in the following, and should take 1-2 months of elapsed time, subject to the availability of site data.

1. Our field engineers perform a site load survey (1-2 hours) in order to assess load types for voltage sensitivity analysis. Where facility fleets are uniform or have a number of different configurations, sampling of those “standard” types will be performed, which greatly accelerates a fleet deployment program.
2. Voltage logging data file (2-5 minutes interval, over a 7 – 14 day period, or alternatively using site SCADA-BMS data if available).
3. Installation inspection in order that we prepare a fully costed supply and installation quotation. Where facility fleets are uniform or have a number of different configurations, sampling of those “standard” types will be performed, which greatly accelerates a fleet deployment program.
4. Request for site energy usage data as a basis for modelling the baseline energy usage. Where facility fleets are uniform or have a number of different configurations, sampling of those “standard” types will be performed, which greatly accelerates a fleet deployment program.
5. Site load modelling, and baseline analysis, as a basis for future savings verification using EVO IPMVP analysis.
6. Finalised commercial proposal, addressing each site within the facility fleet.

Method of deployment

The Power Perfector deployment may be achieved in several ways, including:

Outright Purchase

The traditional capital expenditure activity, whereby the end-customer purchases the equipment and installation. The project is capitalised and is recognised on the company balance sheet as an asset. Traditional methods of funding, for example financial or operating leases, may also give rise to contingent liabilities on the balance sheet.

Managed Service

The Voltage as a Service (VAAS) managed service requires no capital expenditure. The project equipment and installation is owned by the service provider, and the transaction is off balance sheet. In exchange for the service, a performance based service fee is charged, relating to the overall energy savings and CO_2 reduction performance. This solution is highly attractive to corporations with fleets of facilities, and can span multiple jurisdictions.

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Table 1 Data requirements

<table>
<tr><th>Steps</th><th>Description</th></tr>
<tr><td>Step 1
Gather Data</td><td>A. Preliminary site assessment information (reference Preliminary Site Information request)

B. Quantitative information (scope of data requirements will vary with facility type. For example, large manufacturing facilities would examine #5. Smaller commercial facilities would have simplified data requirements. Our engineers would develop a specific information request relating to the facility type; that minimizes the data gathering requirements and which expedites the project activity.

<table>
<tr><th>#</th><th>Description</th><th>Status</th></tr>
<tr><td>1</td><td>Voltage profile – 2-4 weeks 2-5 minute interval resolution</td><td>Datalogging to be performed</td></tr>
<tr><td>2</td><td>Energy usage – 52 -104 week 15 or 30 minute interval resolution</td><td>Complete</td></tr>
<tr><td>3</td><td>Other relevant parameters</td><td>Site survey to be performed</td></tr>
<tr><td>4</td><td>Ambient Temperature (for HDD, CDD)</td><td>To be acquired for baseline period</td></tr>
<tr><td>5</td><td>Process variables, relevant for high level energy modelling, including measures of volume output (eg: for a cold store: tonnes output per SKU, SKU #, pallet daily movements (total end of day, daily incoming, daily outgoing)).</td><td>To be acquired for baseline period</td></tr>
</table>

These quantitative parameters will be selected during discussion with end-user site personnel, or HQ Energy leadership team. They may be readily available from site BMS/SCADA systems.</td></tr>
<tr><td>Step 2
Baseline energy modelling</td><td>Intended to set the baseline for future IPMVP verification activity.</td></tr>
<tr><td>Step 3
Planning the installation</td><td>Installation planning, logistics, project plan.</td></tr>
<tr><td>Step 4
Commercial settings</td><td>As a precursor, working out a Pathway beyond a first site will better inform the feasibility and the commercial offer.

The Pathway would include basic data of global sites and facilities. Data to include: Country, Site #, # supplies per site, Annual GWh per site (including number of supplies at each site), 50Hz or 60Hz.

Commercial offers available for corporate customers:

1. Outright purchase.
a. Quotation.
b. Commercial terms.
c. Agreement executed.

OR

2. Managed service model.
a. Zero Capital cost.
b. Shared savings.
c. Commercial terms.
d. Agreement executed.</td></tr>
<tr><td>Step 5
Deployment</td><td>Equipment deployed
Validation using baseline model vs actual energy usage, during post installation period.</td></tr>
</table>

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