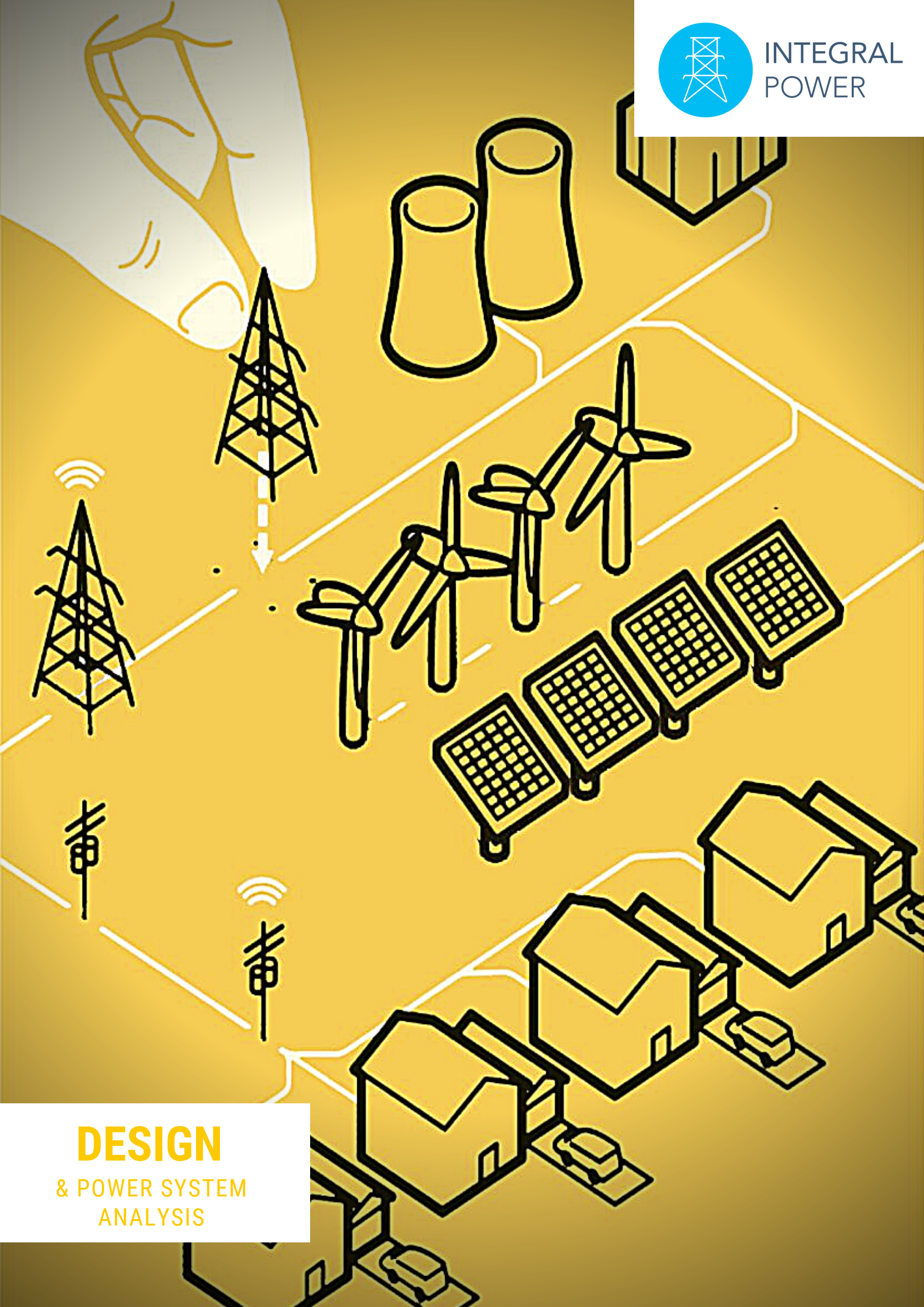
INTEGRAL POWER



DESIGN

& POWER SYSTEM ANALYSIS

SUBSTATION DESIGN

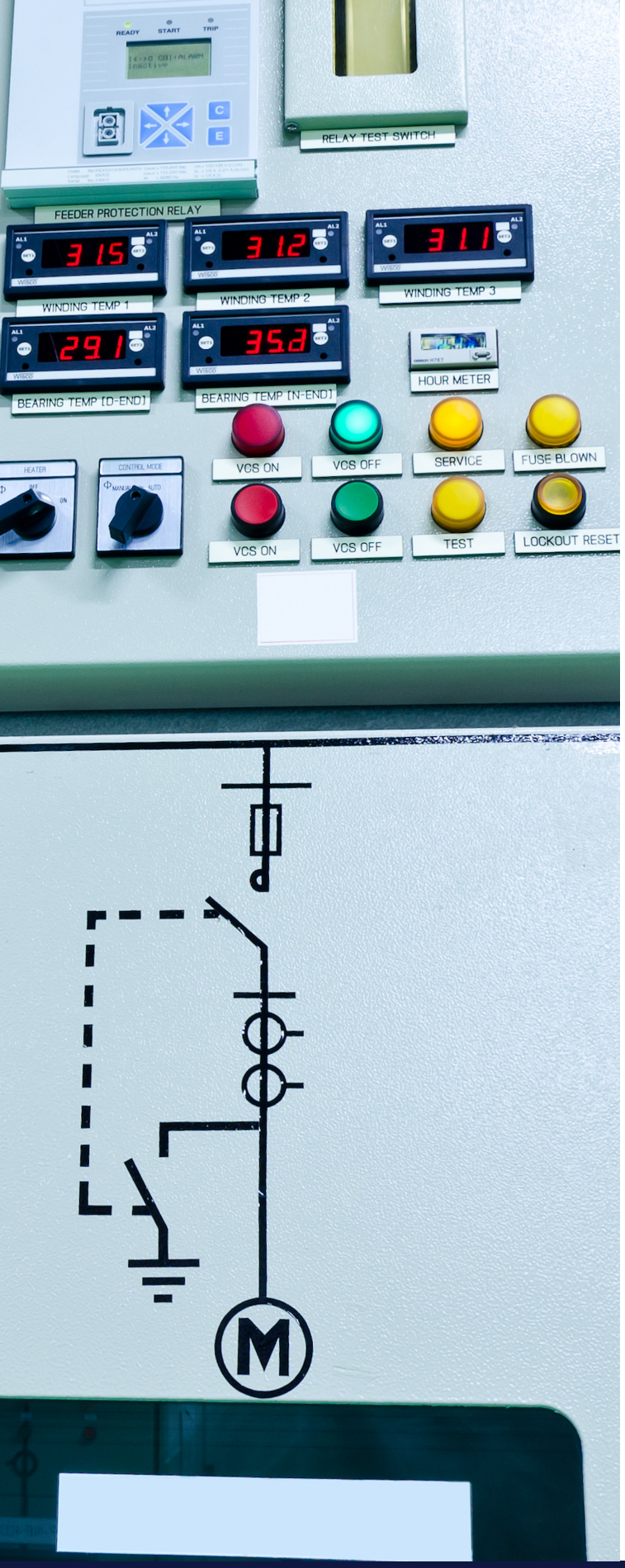
For over a decade, Integral Power has been providing end-to-end high voltage solutions to Power Generation, Transmission, Distribution, Industrial, Resource, Infrastructure and Renewable Energy sectors.

As a trusted partner to Australia's largest renewable and power transmission companies, we continue to deliver successful, large-scale projects including Solar and Wind farms and high voltage Transmission and Distribution Substations.

Integral Power has delivered High Voltage Substation design packages for numerous mission critical installations across Australia. With an experienced in-house design capability, we are ready to take on both AIS and GIS substation projects up to 220kV.

Our design engineers come from various backgrounds including, Power Systems, Electrical Control Systems and Civil Engineering, covering all disciplines involved in substation design – Primary, Secondary, SCADA, Communications, Protection, Civil, Structural, Testing and Commissioning.

Integral Power's testing and commissioning team performs Primary, Secondary & Functional testing for Substation assets. Deploying our comprehensive fleet of in-house test equipment ensures first class safety and quality while meeting project schedules and avoiding costly delays.



Our design services include:

Primary Design:
Load Flow, Fault Studies, Earthing Design, Insulation Coordination, Electromagnetic Interference, Lightning Protection, Substation/Switchyard Layouts & 3D Elevations, BoMs & Cable Schedules

Grid Connection:
Grid Connection Design, Generator Performance Standard (GPS), Grid Connection Studies, PSSE & PSCAD Models for AEMO & complete range of Power System Analyses. Click here for details.

Secondary Design:
Schematics, Terminations, Protection and Control Cable Schedules, Protection Design & Coordination and Protection Settings including conventional and advanced substations protection schemes

Substation Automation:
Control Design including SCADA, HMI, PLC, RTU, IED configuration across various protocols including IEC61850

Civil Design:
Structural Design, Earthworks, Drainage, Roads, Foundations, Transformer Bunding, Structures, Fencing and Buildings

Safety in Design:
Safety Management across the entire Construction phase along with Operational and Functional Safety Risk Assessments

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POWER SYSTEM ANALYSIS

Short-circuit Analysis
Calculates the available short-circuit currents at various locations across the power system. Evaluation of equipment fault ratings ensures that the equipment can withstand and where required, interrupt electrical faults. The results of a short circuit study are critical for proper system design as well as establishing appropriate equipment specification.

Load Flow / Power Factor Study
Analyses the system's capability to supply the connected load under steady state conditions, determines the appropriate continuous ratings of electrical equipment and the optimum location and characteristics of reactive power compensation.

Motor Starting Study
Evaluates the motor's impact on the power system and the power system's impact on the motor. Motor starting studies are typically performed for new motor installations to ensure system reliability, provide data for motor protection, and to identify any system modifications that may be necessary to avoid starting problems. The study will also recommend solutions to address any problem that may surface as a result of the analysis performed.

Stability Analysis
Evaluates the dynamic behaviour of the generating sources and system voltages during transient conditions such as system faults or start-up. Typical recommendations include details of the load shedding scheme, including the sequence of load separation, critical clearing times and type of relay.

Harmonic Analysis
Calculates harmonic voltages and currents across the electrical distribution system. This determines the effect of adding harmonic producing loads into a system. If the calculated magnitudes of harmonic voltages and/ or currents are excessive, our engineers will determine the optimal corrective solution to reduce the harmonic quantities to within acceptable limits.

Protection Coordination Analysis
Determines the characteristics, ratings, and settings of over current protective devices that will ensure that the minimum unfaulted load is interrupted when the pro- tective devices isolate a fault or overload anywhere in the distribution system. In addition, the devices and settings are selected to pro- vide satisfactory protection against overloads on equip- ment and interrupt short circuits as rapidly as possible. The coordination study evaluates protective relay char- acteristics and settings, fuse ratings, circuit breaker ratings, characteristics, and trip settings.

Arc Flash Analysis
Calculates arc flash hazards associated with performing elec- trical work at locations across the power system in accor- dance with NFPA 70E and IEEE1584, requirements.
Calculations include flash protection boundary, PPE require- ment and incident energy, with the resulting information be- ing provided on arc flash warning labels to be affixed to the distribution system electrical equipment.

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