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What is Sustainable Design?

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Situation of P&C Engineering teams today

- Capital replacement programs - aging EM, analog SS, and early generation microprocessor relays all demanding replacement.
- Designing new P&C systems with more complex functions and more configuration/application settings than ever before.
- Grid operating and business pressures demand reliability, efficient maintenance, minimized or no outages, and lowest cost.
- In an era of rapid technical and regulatory change, new designs may need replacement in 15 years.
- Sustainable design is becoming critical to survival.

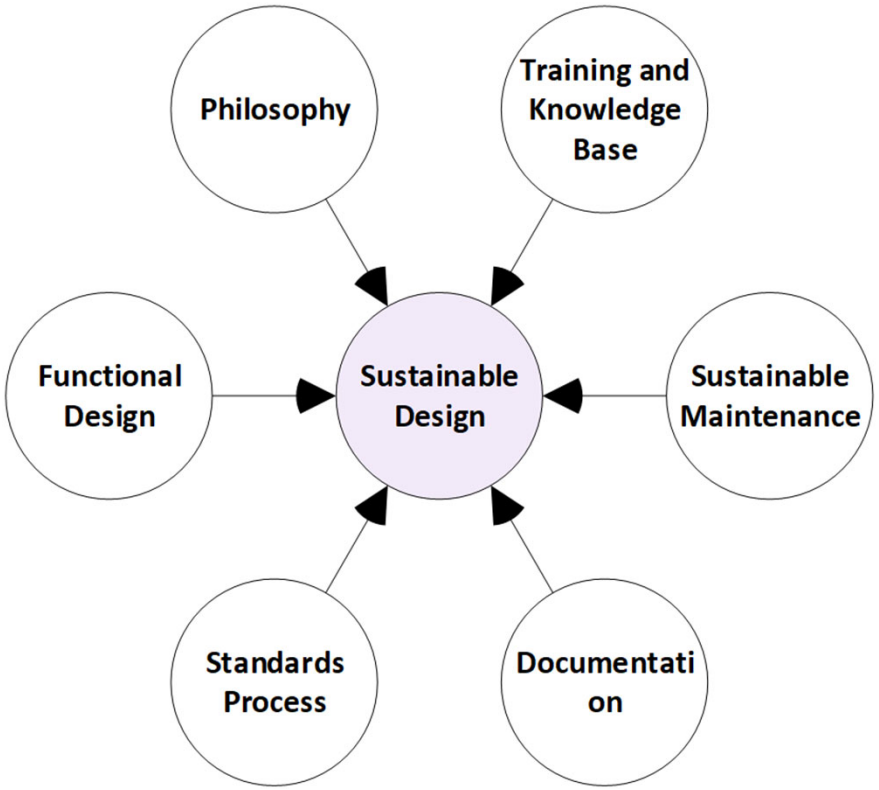
What is sustainable design?

"Sustainable design of protection, automation, and control (PAC) systems comprises a combination of engineering design strategies and features, along with organizational management systems and team-member activities, which result in standardization of PAC installations along with performance data gathering and routine evolution of the PAC asset fleet in stages."

Achieving sustainability of today's PAC

- Microprocessor relays have been a beneficial and transformational development for PAC systems, but….
- They have introduced challenges:
  - Complexity of functions with thousands of settings
  - Shorter application and product lifespan
  - Communications and cyber security
- Relay applications face increasing regulatory requirements, operating conflicts and restrictions
- Sustainable design focuses on efficient adaptation to change

Elements of sustainable PAC design



- Documented P&C philosophy
- Standardized zone module functional designs
- Standards process for managing and updating designs
- Standard documentation packages
- Modularized installation units support sustainable maintenance and easy replacement
- Training programs and knowledge base help teams handle changes

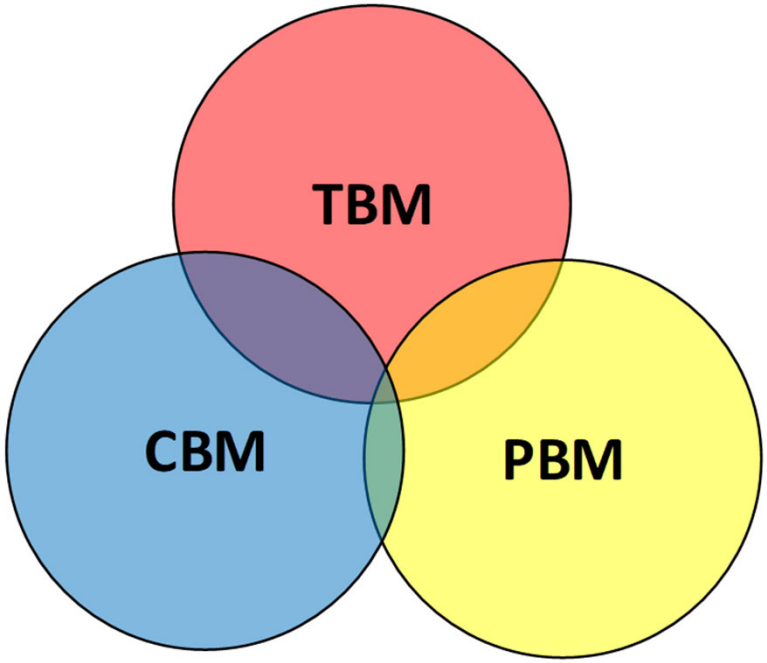
Philosophy documentation – the foundation

- Durable principles of PAC design guide creation of design standards. Effort up front saves work later, achieves consistency
  - Protection approaches (application rules, redundancy & backup rules; zone protection schemes, elements, settings; compliance; logic; special applications)
  - Design – mechanical construction, wiring, replaceability, naming standards
  - User interfaces – test & maintenance, indications, control
  - Communications – (protection, integration, networking, monitoring, operational and event data, security)
  - Standards development/maintenance & project execution processes
- Organization gains core understanding of P&C design with knowledge base, updated periodically as practices evolve

Standards process

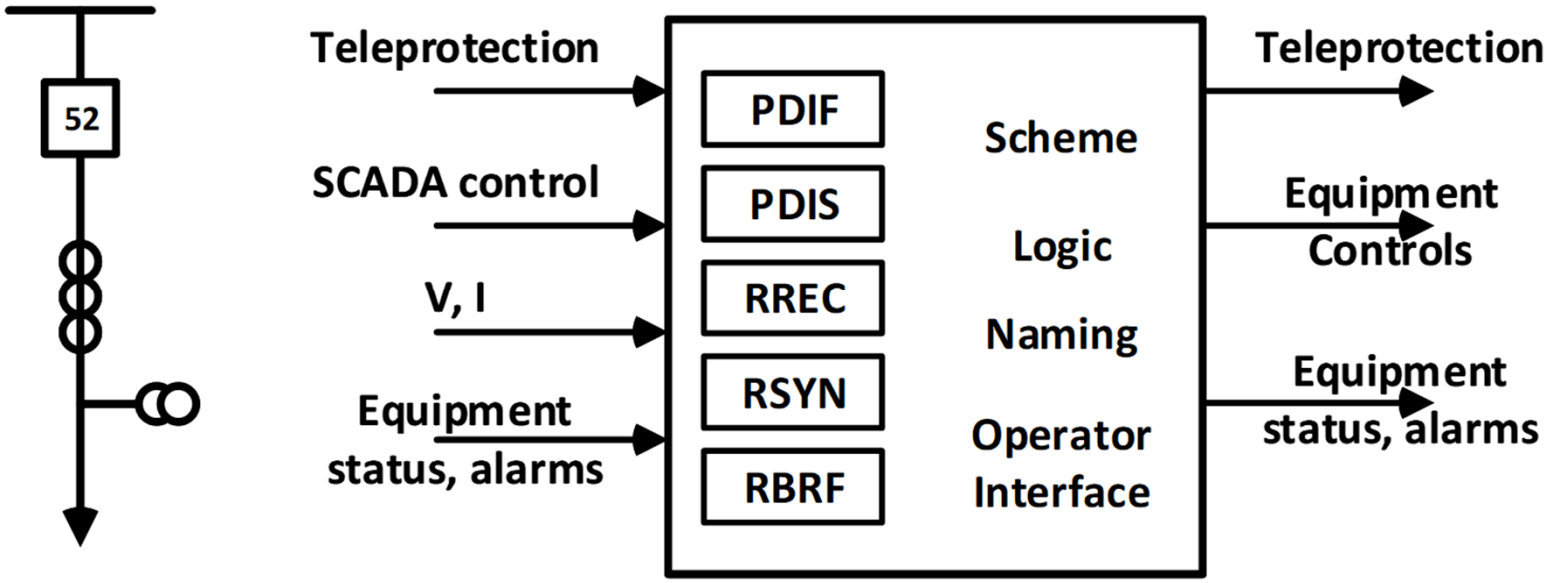
- Use fixed standard design in projects – only critical changes for 3–5-year cycle, then launch next generation standard
- Separate parallel next-generation standard development track - new products and design changes; test & prepare for launch.
- Fixed design packages with coded options and setting templates – projects are consistent, error-free, fast install & commission
- Create durable standard development/maintenance laboratory
- Tie standards & projects to configuration management systems
- Track processes and projects - workflow management systems

Sustainable maintenance design



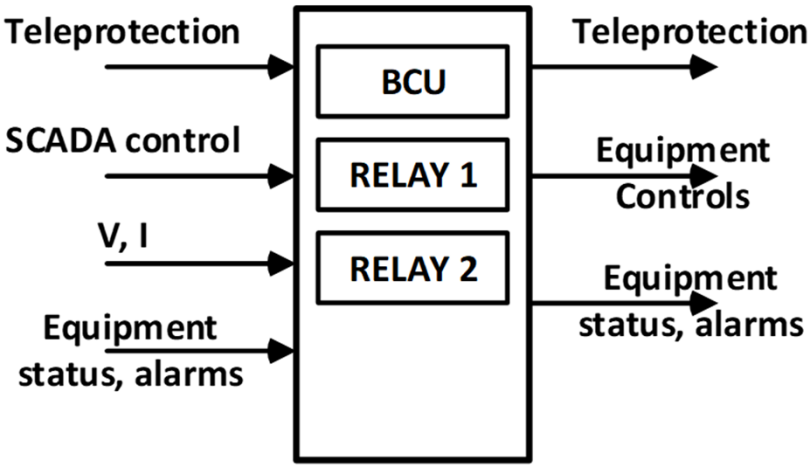
- CBM requires documented and highly standardized designs
  - Design maps monitoring features for all elements
  - Design includes diagnostic help and alarming
  - Supports gathering asset statistics for APM of PAC systems

Standard designs that are replicated



Every zone becomes a specified module

Mapping functional design into products…



- Design standard maps functional design into products
- Includes:
  - Design
  - Documentation
  - Templates
  - Calculation sheets
  - Test plans

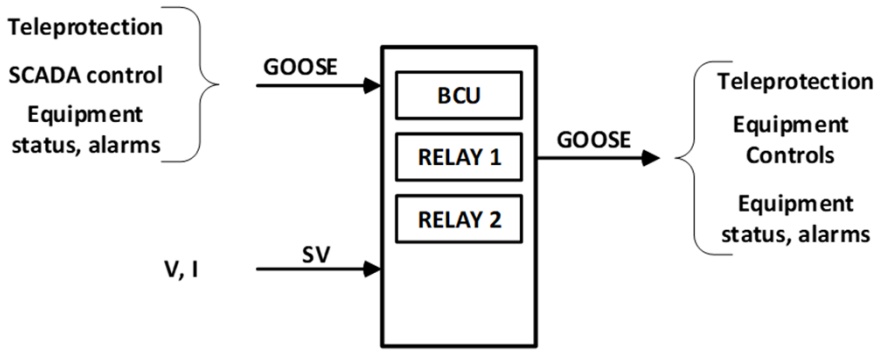
…and physical design

Standards as knowledge base

- Standard documentation package
  - Description
  - Drawings
  - Maintenance documentation / test plans
  - Communications design
  - Relay and device documentation

- Training and knowledge base
  - Teach everyone to standard designs
  - Training based on standard documentation package
  - Uses standard development laboratory
  - Institutional knowledge is recorded in the standard, and philosophy
    - Creates SMEs
    - Captures field knowledge and experience

Role of IEC 61850



- Functional design maps into SSD
- Standard designs use SSD for complete specification of device models
- Designs easily lab tested
- Engineering uses standard tools
- Self-documented in XML
- Live device testing using safe procedures
- Supports CBM through self-monitoring
- Future support for distributed functionality

Benefits

- Consistency of installations
- Supports live no-outage replacements
- Consistency of design
- Faster project execution
- Effective, focused training
- Easier event analysis
- More efficient supply chain operation

Wrap Up

- P&C engineering and utility business see accelerating change:
  - Stressed grids with changing behaviors
  - Shorter application and service lifespan of microprocessor devices
  - Outages harder to get as demands for reliability grow
- Sustainable design means:
  - Create complete PAC philosophy for consistency and flow of design
  - Use stable standard design packages for years with tools, documentation, workflow, processes; & clean launch of next generation
  - Faster and lower cost projects, easier installation & commissioning, easier maintenance, outage-free & fast sustainable replacements of obsolete panels.

Questions?

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