

Mass Market DR

Sponsored by TVA & PLMA

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**COOPER** Power Systems

Cooper Power Systems Portfolio

Automation & Communication Solutions



- #1 DR Technology Provider
- #2 AMI PLC Provider
- #1 Planning Software
- #1 Smart Sensors

Reliability & Power Quality



- #1 Overhead Switchgear
- #1 Capacitors
- #1 Voltage Regulators

Connection & Components



- #1 High Voltage Fuses
- #2 Surge Arresters
- #2 Molded Rubber Accessories

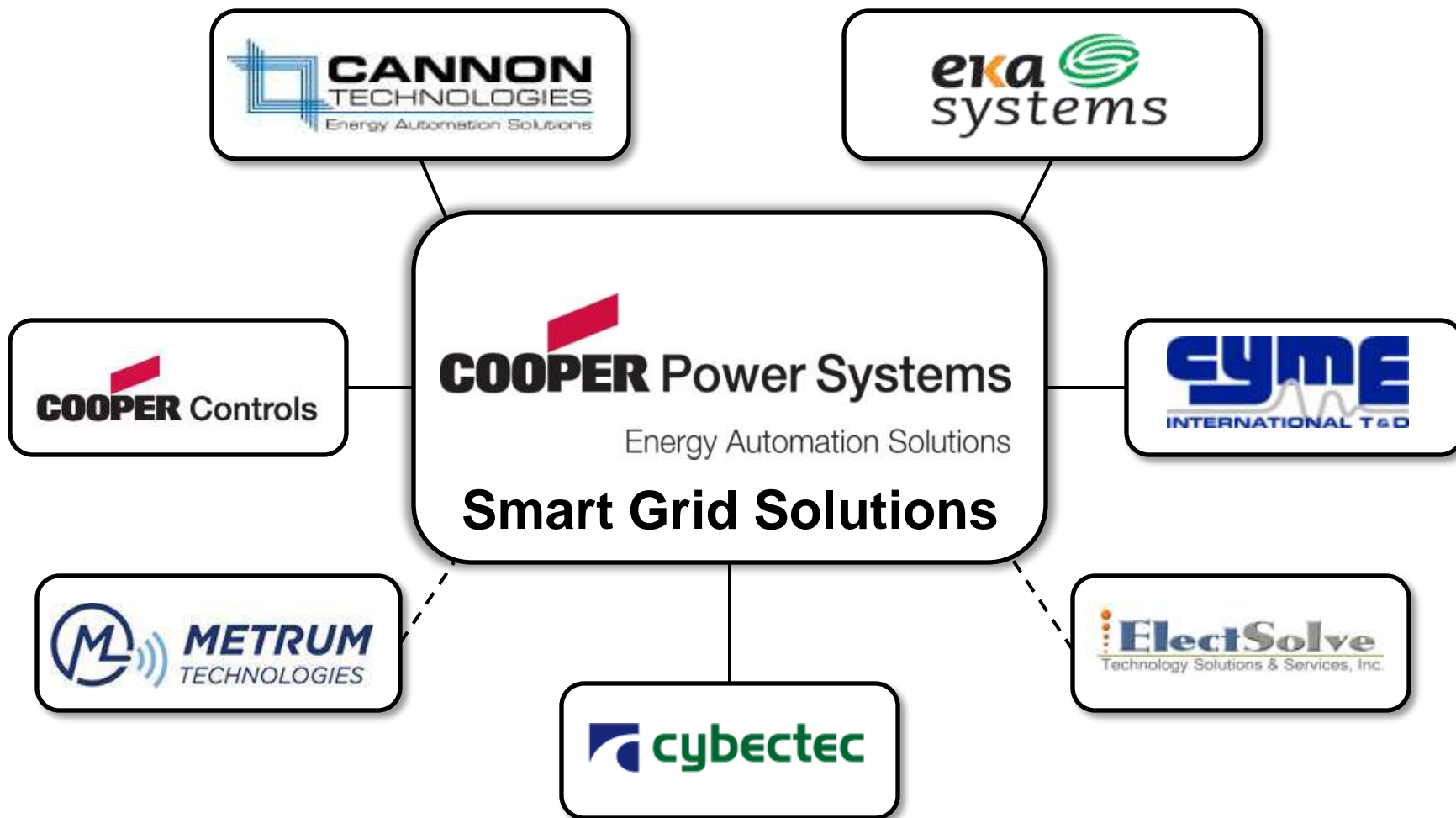
Transformers



- #1 Natural Ester Dielectric Fluid
- #2 Distribution Transformers

Industry Leading Products and Extensive Portfolio

Energy Automation Solutions (EAS)



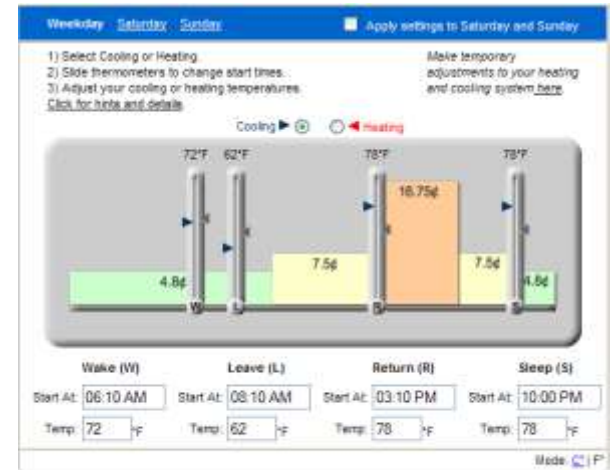
One team focused on software, controls, and communications with 280+ engineers focused on intelligent grid solutions

➤ **Over 250 deployed systems**

- Scalable Solution – Investor Owned Utilities, Cooperative, and Municipal.
- 3.5GW of DR in utility programs across North America

➤ **#1 Residential DR Equipment**

- Over 550,000 PCTs delivered
- Over 3,000,000 Load Control Switches delivered
- 400,000-500,00 devices delivered annually
- Customers with >350,000 units deployed



- **Value Assessment -> Budget**
 - Clearly define goals and objectives
 - Value and budget -> NPV Program
- **Plan, Manage & Execute**
- **Expand Your Control Strategies**
 - Contingency, Capacity, Economics
 - Multiple time frames – 4 hours, 1 hour, 30 min.
- **Field Equipment**
 - Installation, Support, & Equipment -> primary costs
 - Look under the hood

Planning, Marketing and Managing

Program Budget

Marketing

- Collateral
- Campaign
- Incentives

System Infrastructure

- IT Equipment
- Head End Software
- Communications

DR Equipment

Installation

- Device Install
- Walk Away
- Service Visits

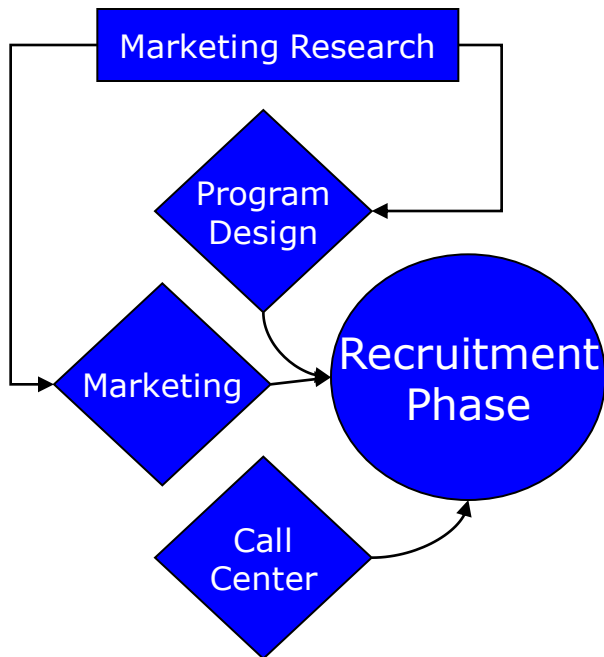
Program Evaluation

- Marketing Effectiveness
- Satisfaction
- M&V

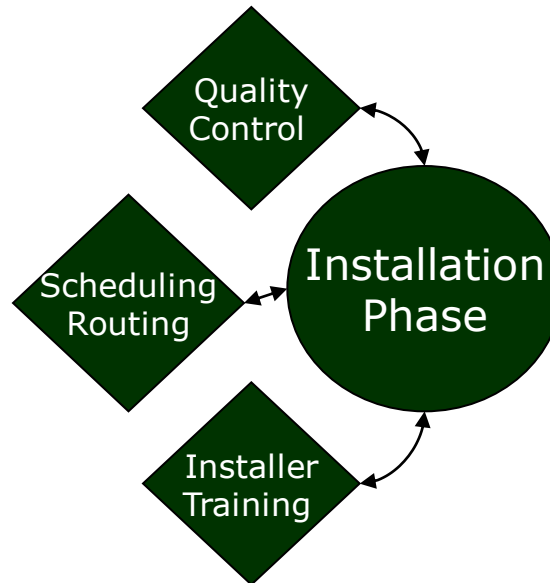
DR Program Cost Categories	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
One-Time Costs										
Program Start-Up	\$ 2,500	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Vukon Load Management Software	\$ 25,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Test Equipment & Software	\$ 6,500	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Participant Targeting	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Program Awareness	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Program Management										
Implementation Management	\$ 46,697	\$ 77,628	\$ 66,370	\$ 48,558	\$ 25,143	\$ 29,326	\$ 29,486	\$ 26,657	\$ 26,829	\$ 30,637
Canon's Project Management	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000	\$ 6,000
Head End and Communications										
Vukon Load Management Software License Renewal	\$ -	\$ 24,000	\$ 24,000	\$ 24,000	\$ 24,000	\$ 24,000	\$ 24,000	\$ 24,000	\$ 24,000	\$ 24,000
Vukon Hosting Fee	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600	\$ 6,600
Communications Costs	\$ 18,000	\$ 18,000	\$ 18,000	\$ 18,000	\$ 18,000	\$ 18,000	\$ 18,000	\$ 18,000	\$ 18,000	\$ 18,000
DR Equipment Costs										
Residential LCRs	\$ 388,100	\$ 795,400	\$ 520,100	\$ 271,700	\$ 22,900	\$ 23,600	\$ 23,600	\$ 24,000	\$ 24,400	\$ 24,800
Residential PCTs	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Commercial LCRs	\$ 56,875	\$ 108,125	\$ 79,875	\$ 42,375	\$ 3,290	\$ 3,375	\$ 3,250	\$ 3,250	\$ 3,250	\$ 3,375
Commercial PCTs	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
DR Installation Costs										
Installing First Residential LCR	\$ 254,325	\$ 488,075	\$ 360,425	\$ 187,200	\$ 15,750	\$ 18,275	\$ 18,425	\$ 18,500	\$ 18,800	\$ 17,100
Installing Subsequent Residential LCRs	\$ 10,500	\$ 20,955	\$ 14,770	\$ 7,735	\$ 665	\$ 665	\$ 700	\$ 700	\$ 700	\$ 700
Installing First Residential PCT	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Installing Subsequent Residential PCTs	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Installing First Commercial LCR	\$ 20,430	\$ 36,790	\$ 26,620	\$ 16,300	\$ 1,170	\$ 1,200	\$ 1,170	\$ 1,170	\$ 1,170	\$ 1,260
Installing Subsequent Commercial LCRs	\$ 11,400	\$ 21,700	\$ 16,050	\$ 8,450	\$ 950	\$ 650	\$ 650	\$ 650	\$ 650	\$ 650
Installing First Commercial PCT	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Installing Subsequent Commercial PCTs	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Costs for Other Implementation-Related Items										
Costs for "Work Awaits"	\$ 2,640	\$ 5,040	\$ 3,720	\$ 1,980	\$ 290	\$ 200	\$ 200	\$ 200	\$ 200	\$ 200
Costs for Service Visits	\$ 6,800	\$ 25,600	\$ 38,000	\$ 44,400	\$ 45,000	\$ 45,500	\$ 46,100	\$ 46,600	\$ 47,200	\$ 47,800
Costs for QC Visits	\$ 9,800	\$ 18,900	\$ 13,550	\$ 7,290	\$ 830	\$ 630	\$ 630	\$ 720	\$ 720	\$ 720
Costs for Maintenance Checks	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Program-Related Call Center Costs	\$ 21,193	\$ 40,469	\$ 29,895	\$ 15,984	\$ 1,313	\$ 1,339	\$ 1,348	\$ 1,365	\$ 1,374	\$ 1,409
Equipment & Installation Costs for Depreciation	\$ 18,955	\$ 54,590	\$ 93,535	\$ 94,410	\$ 85,635	\$ 98,725	\$ 97,775	\$ 89,040	\$ 100,090	\$ 101,745
DR Program Marketing Costs										
Collateral Development	\$ 20,000	\$ 10,000	\$ 5,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Direct Mail Campaigns	\$ 183,760	\$ 198,040	\$ 146,120	\$ 76,320	\$ 6,480	\$ 5,480	\$ 6,520	\$ 6,600	\$ 6,640	\$ 6,840
Residential Participant Incentives	\$ 40,000	\$ 116,420	\$ 172,780	\$ 202,280	\$ 204,700	\$ 207,280	\$ 209,660	\$ 212,500	\$ 215,160	\$ 217,660
Commercial Participant Incentives	\$ 5,480	\$ 15,020	\$ 23,640	\$ 27,720	\$ 28,040	\$ 29,360	\$ 29,680	\$ 29,000	\$ 29,320	\$ 29,640
DR Program Evaluation Costs										
Marketing Effectiveness Evaluations	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Participant Satisfaction Evaluations	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Program M&V	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000
Total DR Program Annual Budgetary Costs	\$ 1,994,555	\$ 2,077,322	\$ 1,692,410	\$ 1,145,893	\$ 558,046	\$ 596,265	\$ 561,314	\$ 586,552	\$ 572,103	\$ 578,736
PV of Annual Budgetary Costs	\$ 1,027,493	\$ 1,740,961	\$ 1,962,323	\$ 857,978	\$ 383,199	\$ 360,418	\$ 350,335	\$ 347,667	\$ 298,399	\$ 280,799
Cumulative PV Annual Budgetary Costs of DR	\$ 1,027,493	\$ 2,290,454	\$ 4,152,778	\$ 5,010,755	\$ 5,393,955	\$ 5,754,373	\$ 6,092,668	\$ 6,480,335	\$ 6,768,734	\$ 6,989,533
Cumulative Annual kW of Summer DR at the busbar	4,000	11,635	17,266	26,213	28,459	28,713	28,968	21,226	21,487	21,751
Cumulative Annual kW of Winter DR at the busbar	1,004	2,920	4,332	5,074	5,335	5,197	5,261	5,324	5,389	5,455
Cumulative PV Costs per Max kW of DR	\$ 257	\$ 240	\$ 241	\$ 248	\$ 264	\$ 279	\$ 291	\$ 302	\$ 312	\$ 321
NPV of Annual Budgetary Costs	\$ 16,989,533									
Cumulative Total Program DR (in kW) at the busbar	21,751									
PV of Program Costs per kW of DR	\$ 321									
PV of Program Costs per kW year of DR	\$ 44									

DR Program Elements

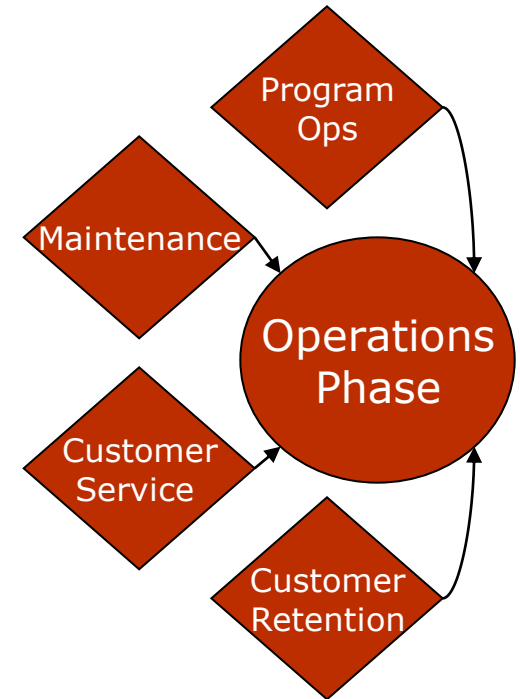
Market



Install



Execute



Measure. & Valid.

- **DR Groups and Gears**
 - **Allow finer control**
 - **Create multiple groups**
 - **Delivery Point (multiple blocks per delivery point)**
 - **Management Blocks**
 - **Use Scenarios**
 - **Create multiple gears (Allows you to target load reduction)**
 - **Cycling (30%, 50%, 70%)**
 - **Target Cycle, TrueCycle**
 - **Emergency (100%) – Short Term Control**
- **Market Management**
 - **Demand Ratchet**
 - **Automatic DR programs to manage peak**
 - **Automate DR to smooth peak**
 - **Energy Market**
 - **Short Term Emergency Program**

➤ Advanced Control Strategies

- TrueCycle & TrueCycle II
- Magnitude Cycle *S
- Target Cycle *S
- Pre-Cool with Temperature Ramp *PCT

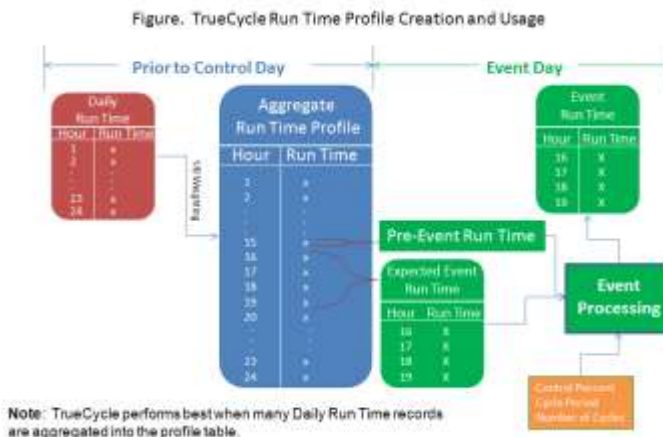
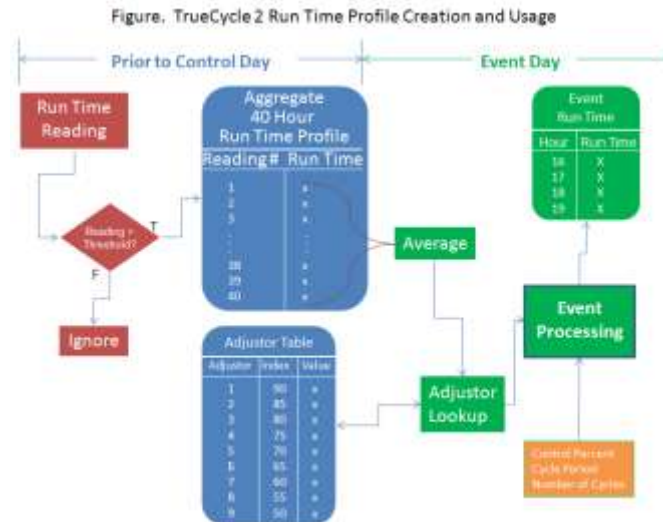
➤ Power Quality

- Under Voltage Load Shed *S
- Under Frequency Load Shed *S
- Cold Load Pickup
- Controlled Ramp In/Out

➤ Emergency Load Control

➤ Advanced Grouping and Addressing

➤ Sophisticated Data Logging



Note: TrueCycle performs best when many Daily Run Time records are aggregated into the profile table.



•Notes
PCT – Thermostat
S - Switch