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Retro-Commissioning

Steve Hernandez, DNV GL

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Free technology

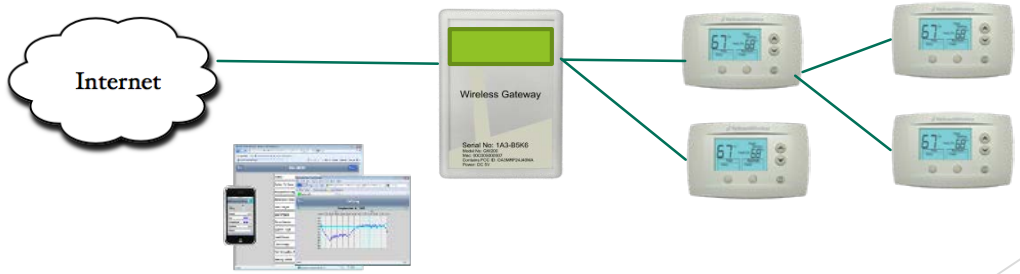
Smart networked thermostats

- Free equipment and installation
- Centralized management of heating and cooling equipment
- Monitor & control from a centralized web portal
- Typical 10% heating and cooling energy savings
- Must participate in limited number of community energy events



Participation requirements

- Must participate in 15 community energy events or 75% of all events, whichever is less
- At least 75% of devices have to participate to get credit for event
- Events are two hours and held 1 p.m.-7 p.m. (typically 3 p.m.-5 p.m.)
- South: 1 June – September 30; North: 1 July – September 30
- No events the day before or on holidays – 2 event max per week
- Facility cannot have an energy management system
- Prefer five or more thermostats



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SolarGenerations









SolarGenerations incentives

	Expected Performance-Based Buydown	Performance-Based Incentive
	Up to 25 kW size	25 kw – 500 kW size
Public, Low Income, Non-profit	$490 per kilowatt	$0.0527 per kWh
Residential, Commercial, Industrial	$245 per kilowatt	$0.0264 per kWh

SolarGenerations offering

- Continuously open
- Eligible for system size up to 500 kW
- Incentives are paid up front for small systems (EPBB) and over time for larger systems (PBI)

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Agenda

- Defining retro-commissioning
- Benefits of retro-commissioning
- Retro-commissioning process
- NV Energy incentives
- Example project

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Defining retro-commissioning (RCx)

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What is retro-commissioning?

- Monitoring based
- Identifies building operation issues
- Establishes baseline energy use
- Implements and commissions energy conservation measures
- Verifies ongoing savings
- Identifies further opportunities

Retro-commissioning approach

Equipment performance	
Control sequences	Set points/schedules, controls equipment calibrations, coordination, manual overrides
Air/water balance	
Maintenance practices	
Equipment condition	

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Benefits of retro-commissioning

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Energy benefits

Improved energy performance

- Equipment operation
- System integration
- Controls optimization
- Set points and schedules
- Air and water balance
- Correcting maintenance deficiencies

Non-energy benefits

Improved non-energy aspects

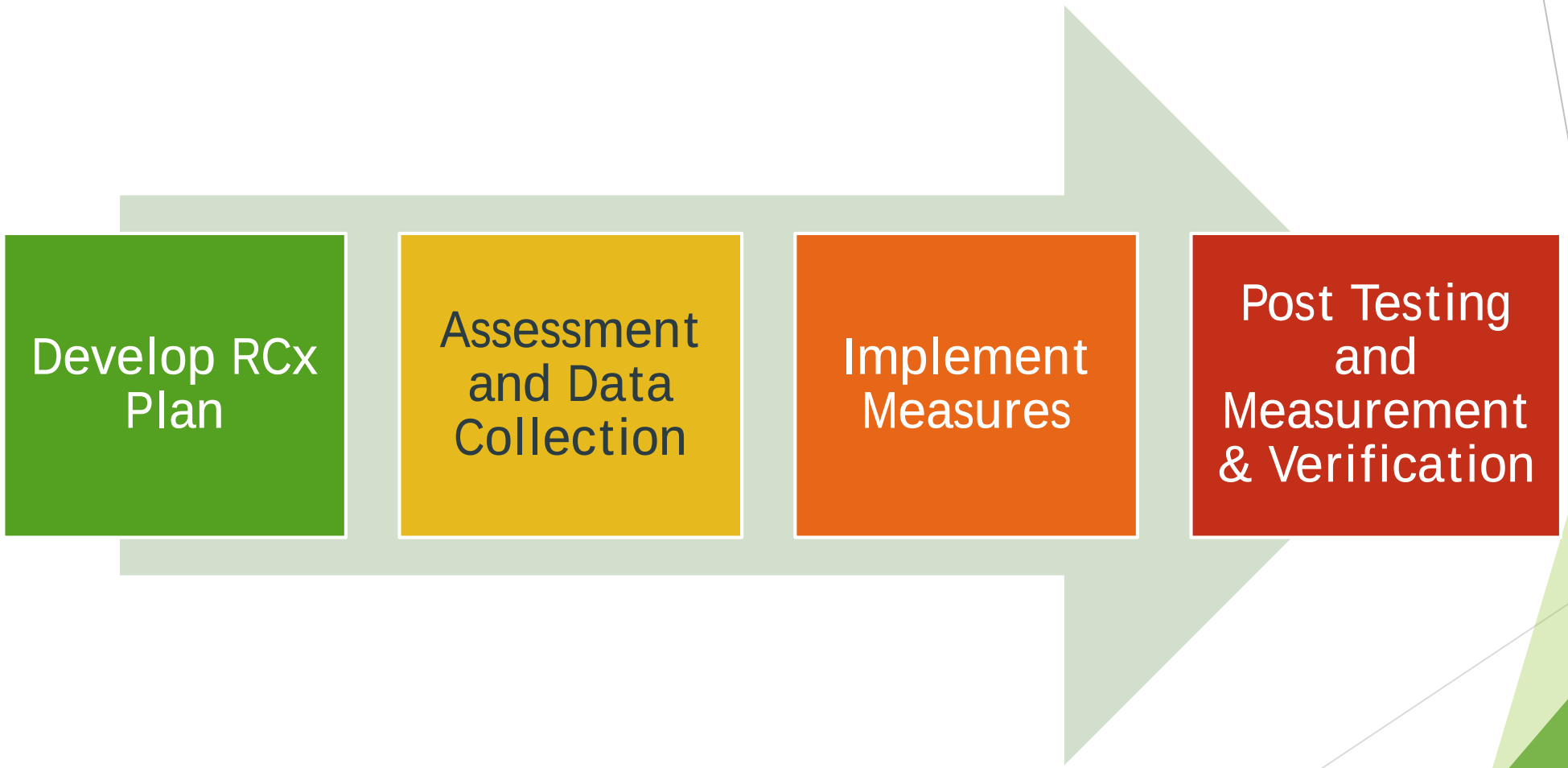
- Thermal comfort
- Indoor air quality
- Maintenance planning
- Documentation
- System and equipment operations familiarity
- Capital improvement planning

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Retro-commissioning process

Retro-commissioning process



Develop plan

- Identify scope of RCx effort (specific systems, whole building)
- Identify specific data to be collected pre and post
- Define responsibilities
- Establish reporting formats and timeline
- Specify pre/post data analysis methods and procedures

Assessment & data collection

- Visual inspection
- Measurement and verification (air balance, water balance, energy use - building and equipment)
- Surveys/interview (identify known issues)
- Review operation/ maintenance history

Assessment & data collection

Issues List

Discrepancies identified in the assessment

Identified with urgency and cost estimates to correct (corrections could be low cost, no cost or high cost)

The issues list is the planning document for scheduling and implementing corrective measures and system improvements

Implement measures

Managed using the issues list

Document start, completion and cost of implementation for each measure

Can use end user's maintenance work order tracking or other management tools

Some measures may be deferred

Post testing/M&V

Inspection

Measurements (spot check) of TAB adjustments

Energy use
(building level and/or equipment level, regression analysis and normalization)

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NV Energy incentives

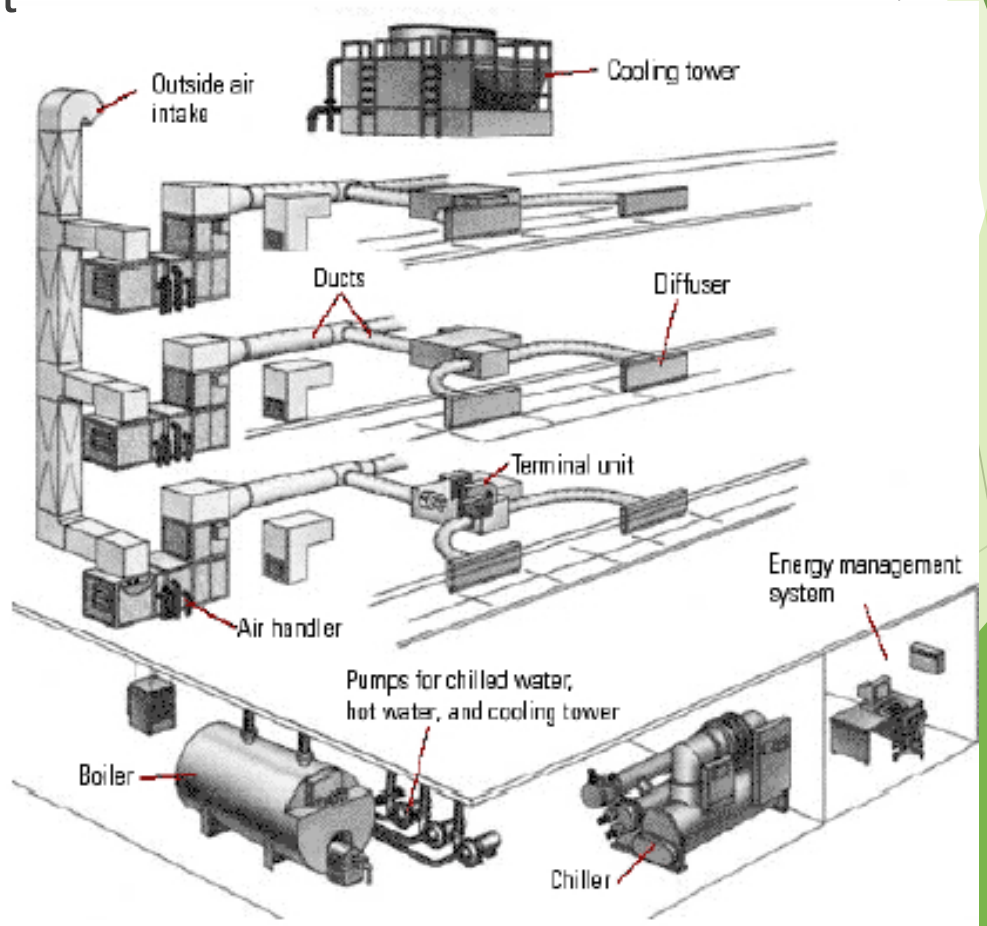
NV Energy incentives

Custom incentive application

- $0.10/kWh first year peak savings, plus $0.05/kWh first year non-on-peak savings
- Incentive capped at 100% of project costs
- Project costs include material, labor, burden/overhead, taxes, delivery fees, rental costs
- Documentation: Invoices, paid purchase orders, schedule of values, AIA payment requests, signed contracts

Qualifying measures

- Chilled water supply temperature reset
- Chilled water plant optimization
- Chiller sequencing strategy
- Condenser water reset
- Flow optimization
- Static pressure reset
- EMS controls upgrades
- Optimize economizer settings
- VAV box control optimization
- Supply air temperature reset
- Implement schedule controls modifications (HVAC, lighting)



Data requirements

- Pre and post
- Trend data
- Regression analysis – normalized
  - Outside air temperature
  - Occupancy schedules
  - Production metrics
- Detailed energy calculations
- Submit all assumptions, methodologies, calculations and raw data

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Example project

Retro-commissioning example

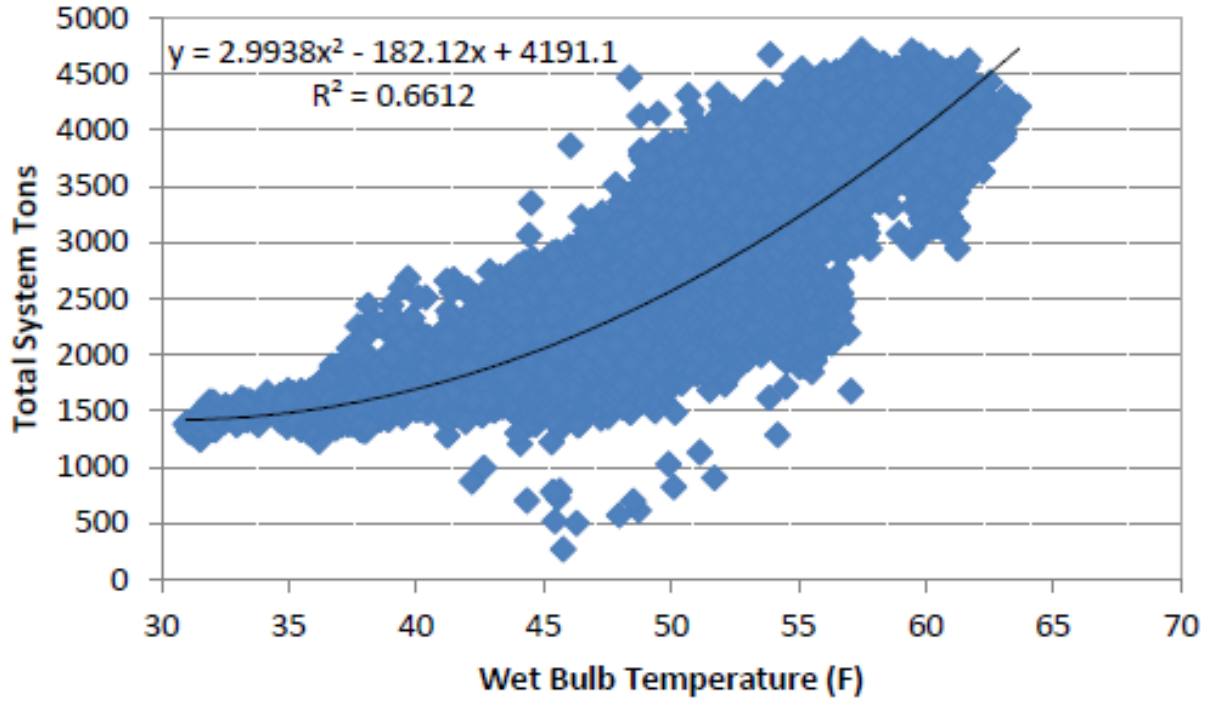
Chilled water plant optimization

- An assessment and analysis was performed for the chiller plant
- A calculation was performed based on the hourly trend data collected
- This information was used to calculate the total system power usage (kW)
- The operation of each of the system components was analyzed to establish the retro-commissioning plan

Retro-commissioning example

Establishing the baseline

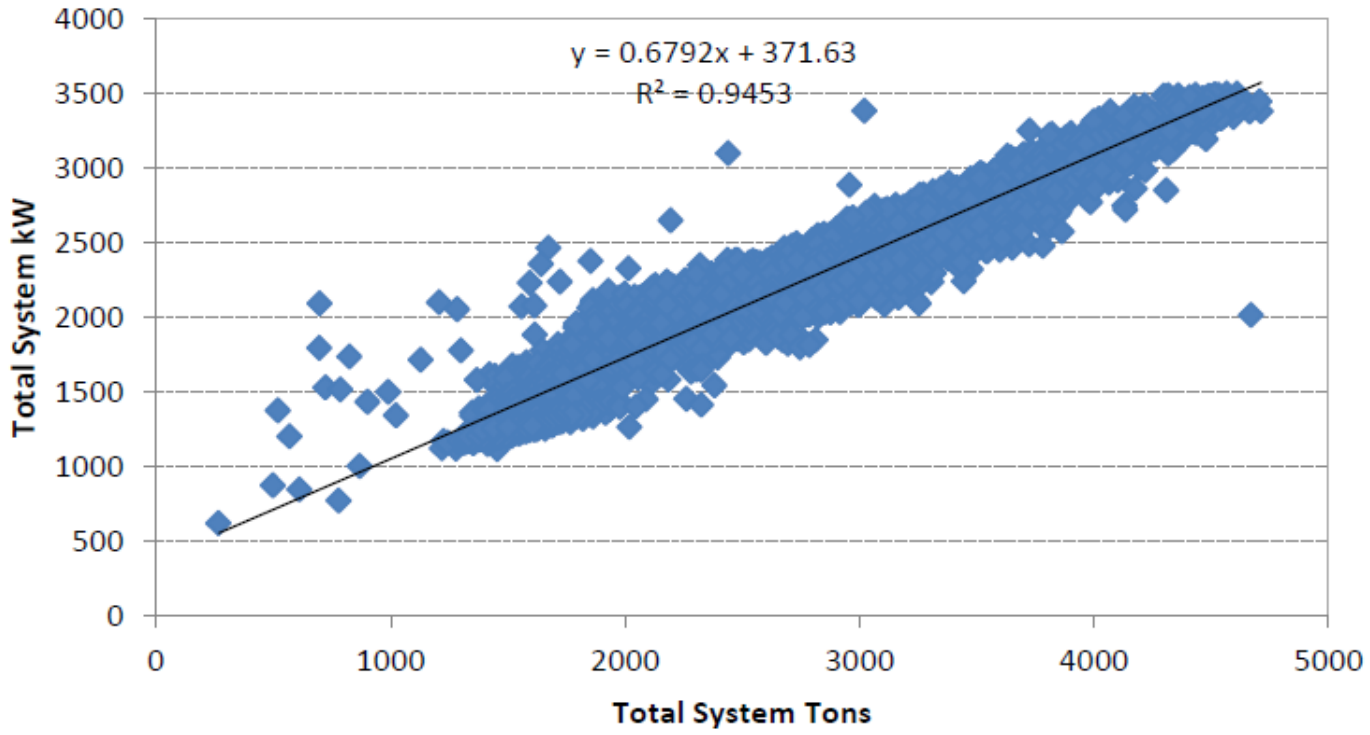
- Three months of trend data was collected
- Models were created to calculate system tonnage for a given wet bulb temperature for the data collection period



Retro-commissioning example

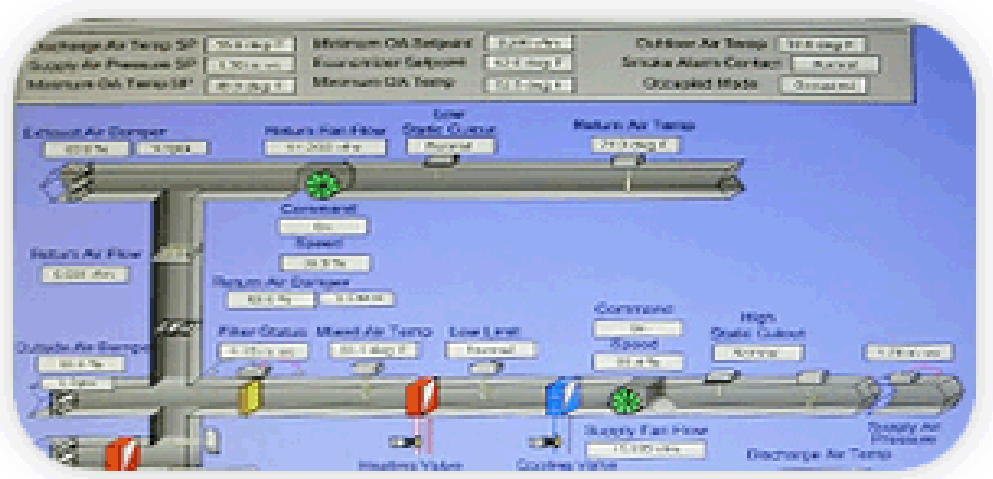
Establishing the baseline

- Another model was created to correlate total system tons to total system kW. A regression analysis was performed using typical meteorological year (TMY) data. This was used to establish the annual energy usage.



Retro-commissioning example

Implementing the plan









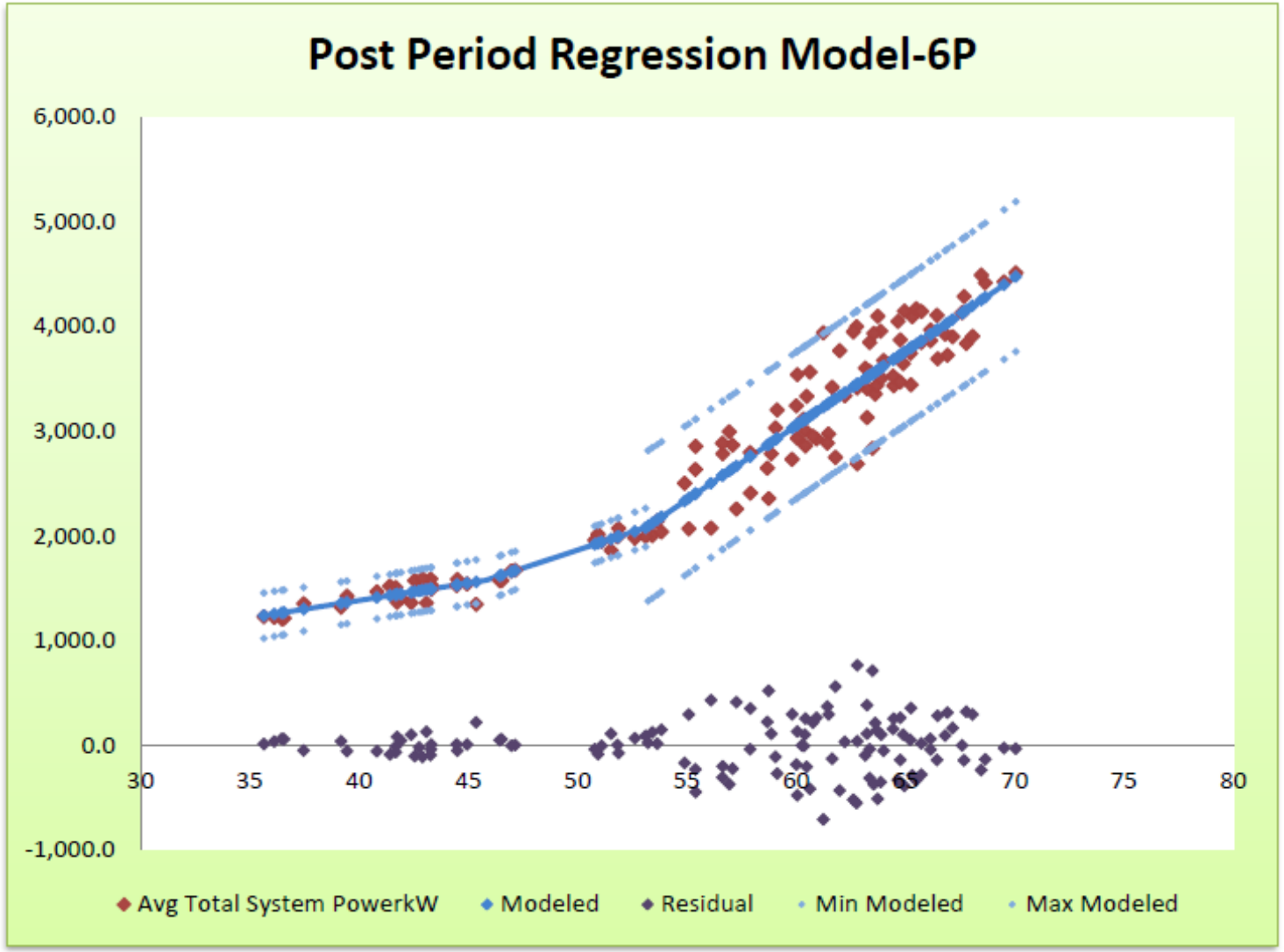
Retro-commissioning example

Establishing the post condition

- Three months of post trend data was collected
- A regression analysis was performed using typical meteorological year (TMY) data
- This was used to establish the annual energy usage and calculate the savings (kWh)

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Retro-commissioning example



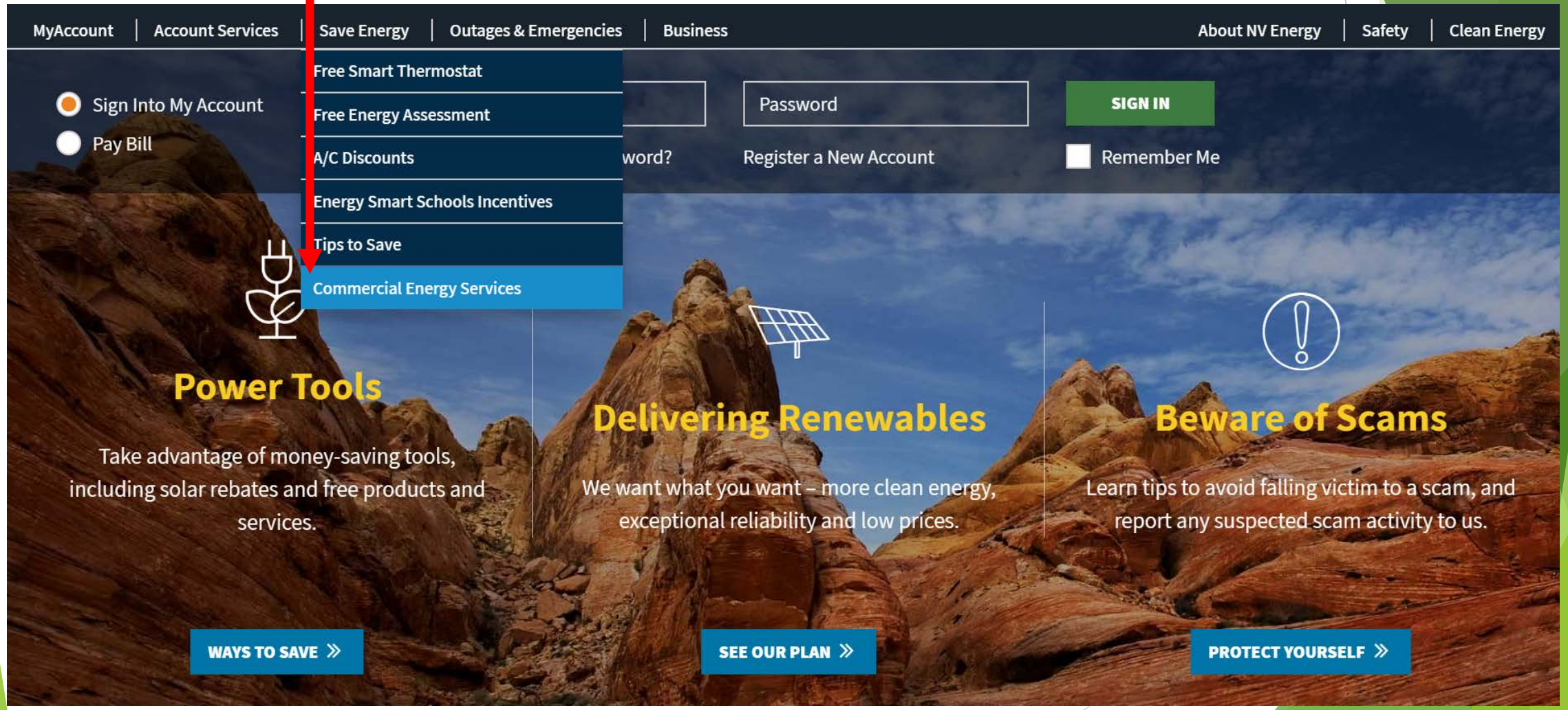
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Retro-commissioning example

Statistics Regression Analysis Models Summary			
Month	Baseline Energy Use (kWh)	Projected Post Energy Use (kWh)	Energy Savings (kWh)
1	1,091,263	951,964	139,299
2	1,058,979	895,766	163,214
3	1,382,651	1,131,185	251,466
4	1,562,551	1,249,114	313,437
5	1,984,967	1,634,454	350,513
6	2,414,833	2,149,071	265,762
7	2,708,073	2,468,321	239,752
8	2,780,991	2,526,323	254,669
9	2,166,354	1,857,783	308,571
10	1,740,406	1,444,470	295,936
11	1,311,614	1,081,718	229,896
12	1,064,638	931,792	132,846
Total	21,267,321	18,321,961	2,945,360

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Application screenshot



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Application screenshot

Understand Your Usage



Find out how your business uses energy with PowerShift free energy assessments, incentivized audits or by checking your interactive **MyAccount energy dashboards**.

Incentives & No-Cost Offers



Reduce operating expenses with incentives for energy efficiency and demand response equipment, and qualified custom projects that cut your energy costs.

Small Business Customers

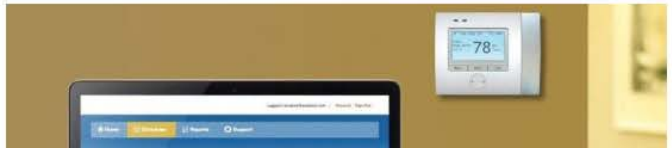


Save money on energy efficiency projects and lower your energy bill with energy-efficient lighting and equipment incentives, free Smart Thermostats and technical support tailored to small businesses.

Contractor Network



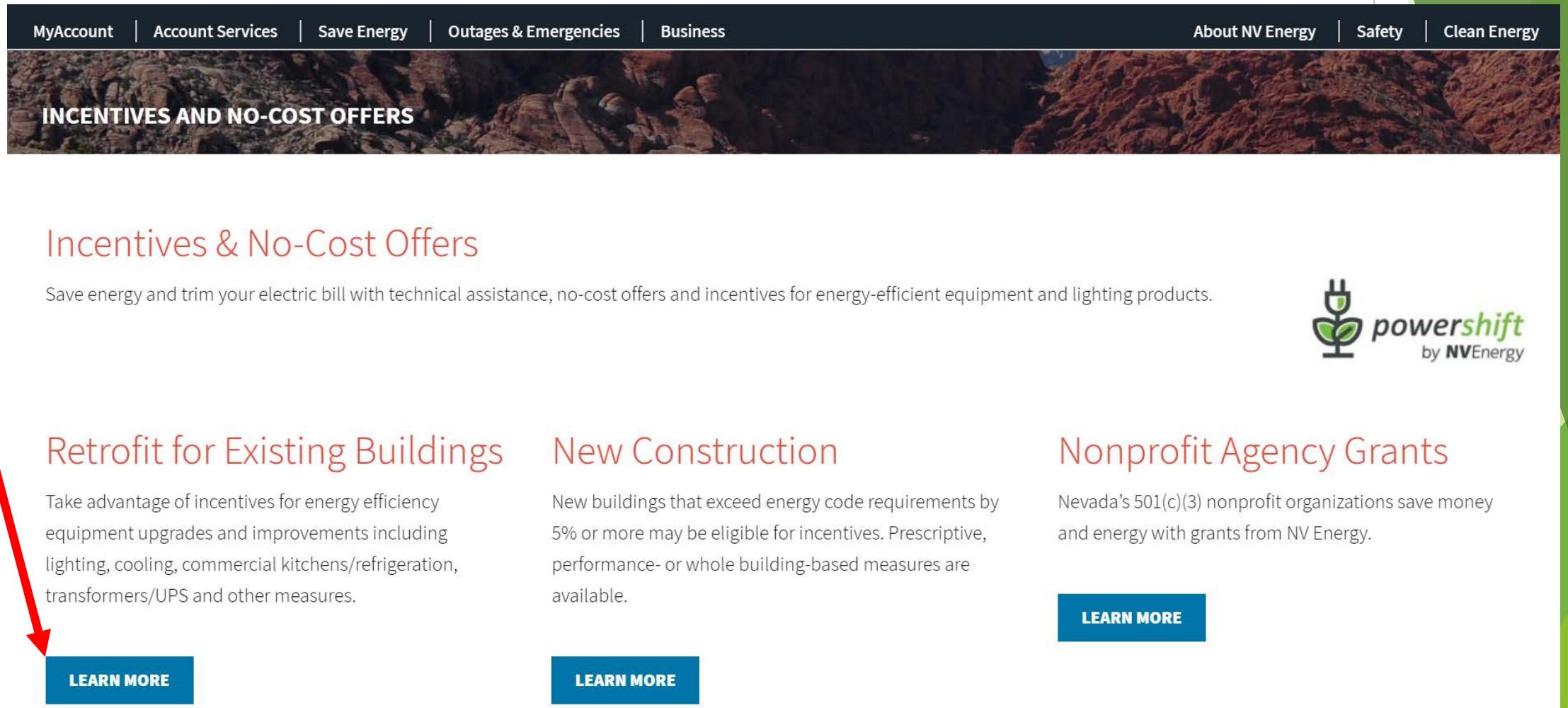
Energy Smart Tools



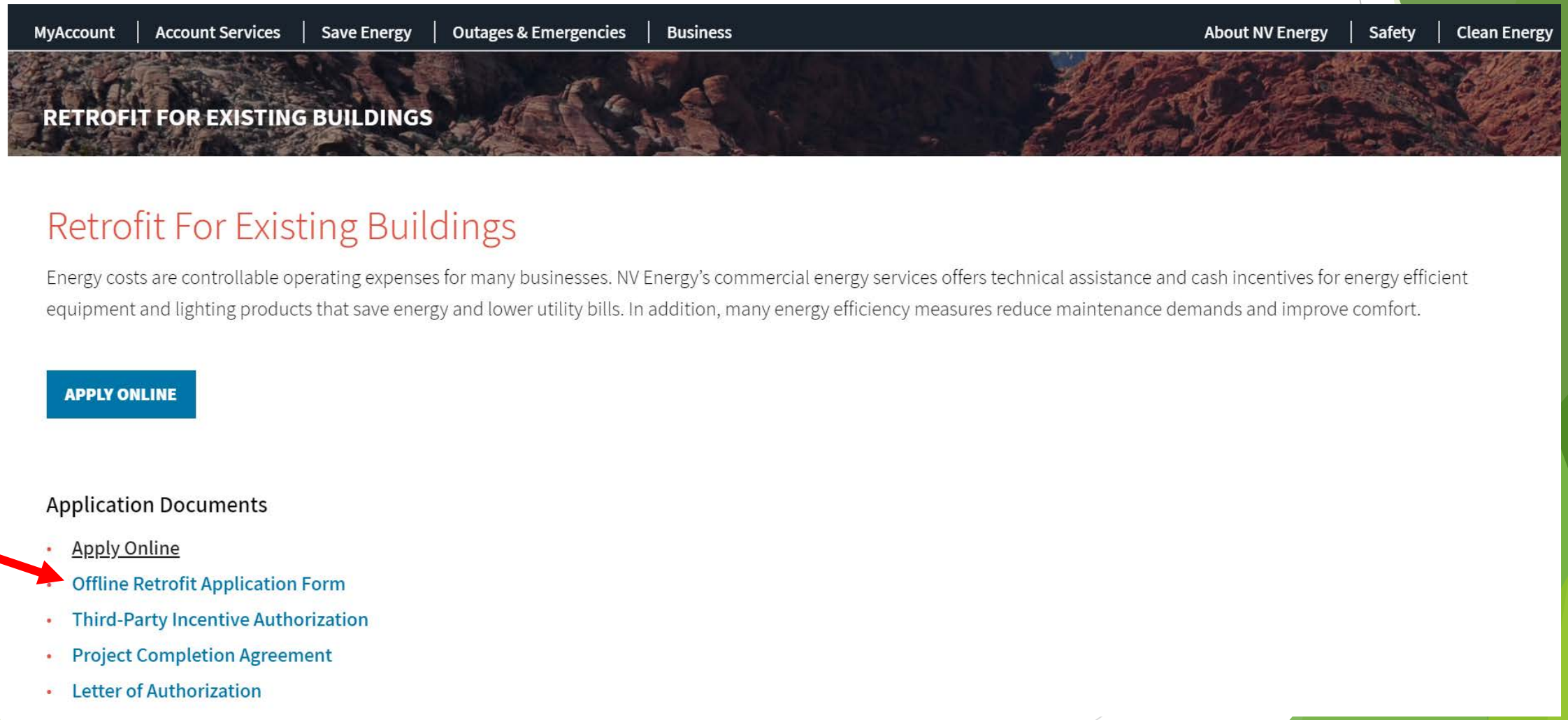
Classes & Events



Application screenshot



Application screenshot



Application screenshot

Custom Technology Form
2018

Important note: Supporting documentation and energy savings calculations are required, see Retrofit Specifications, Section 8.
INCOMPLETE APPLICATIONS WILL NOT BE REVIEWED

Please see bottom of page for Retro-Commissioning Application Area

EXAMPLE					
Description	On-Peak kWh	On-peak$/kWh	Non On-Peak kWh	Non On-peak$/kWh	Subtotal
Example: Replaced (2000) 5W Cold Cathode CFL with (2000)2W LED in the pylon sign. The sign operates 24 hours with special chasing effect as shown in the short video submitted. Fixture operating hours: 8760 hrs/yr Scintillating load factor: 0.8 (4 lamps on,1 lamp off)	3,514	$0.10	38,534	$0.05	$2,278.10

Item 1					
Description	On-Peak kWh	On-peak$/kWh	Non On-Peak kWh	Non On-peak$/kWh	Subtotal
		$0.10		$0.05	$0.00

Item 2					
Description	On-Peak kWh	On-peak$/kWh	Non On-Peak kWh	Non On-peak$/kWh	Subtotal
		$0.10		$0.05	$0.00

Thank you!

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