Preventing Electrical Pollution

Working with Customers to Control Electrical Pollution
Idaho Power's Approach

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For the
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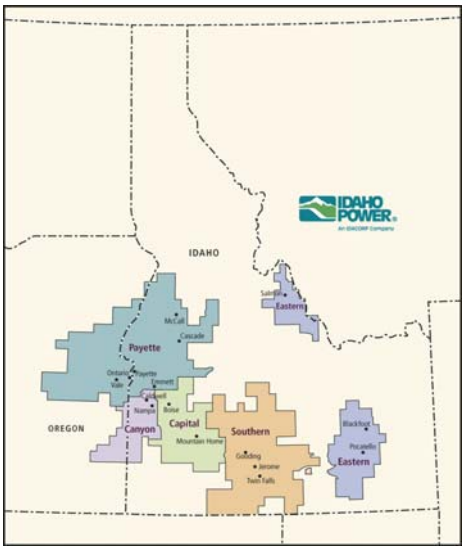
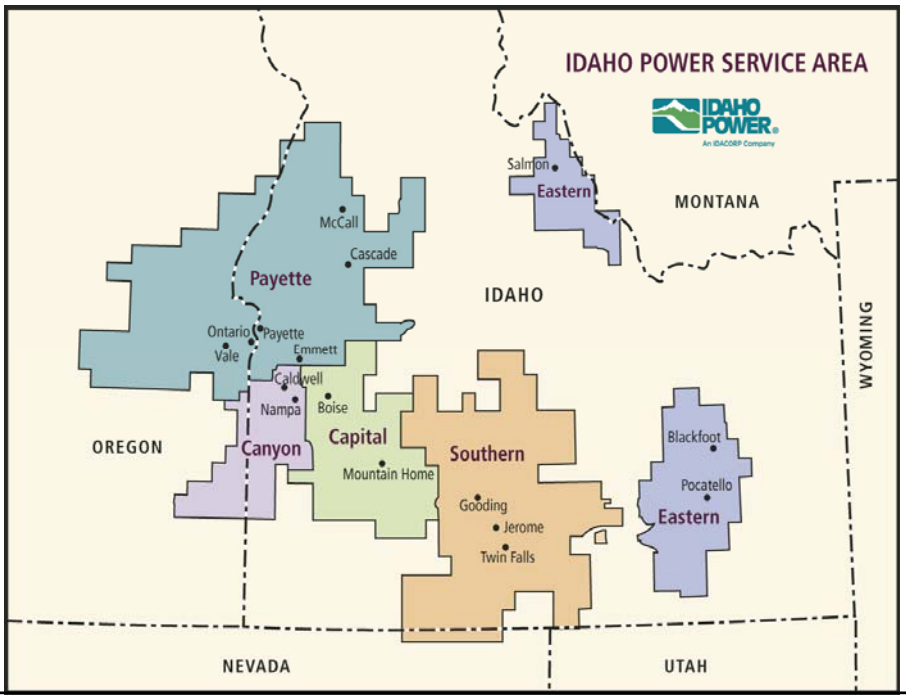
The Idaho Power Company

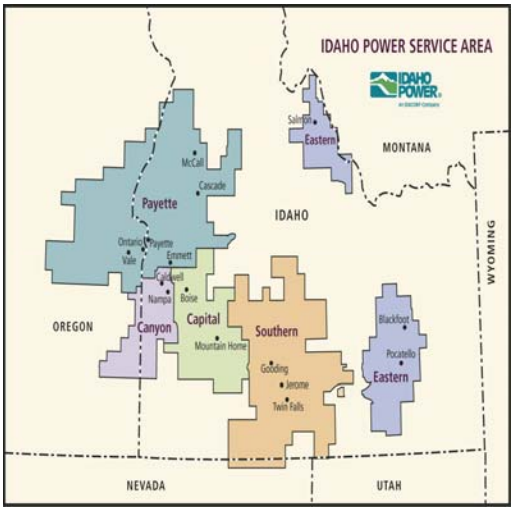
- Headquarters in Boise, Idaho
- Began operations in 1916
- 24,000 square mile service area
- Southern Idaho and eastern Oregon
- Population of 978,000
- 474,000 customers
  - 395,000 Residential
  - 61,000 Commercial & Industrial
  - 18,000 Irrigation
- 1900 employees
- 3300 MW of Generation
- (60% Hydro, 30% Coal, 10% Gas)
- 3200 MW Summer Peak





Power Quality Organization

- Power Quality Department created in 1996
- At this time in 2008
  - Total of 8 engineers and 5 technicians.
  - 5 engineers in customer service in the regions
  - 5 regional technicians work under corporate leadership
  - 3 engineers work as staff engineers at corporate headquarters



Power Quality Organization
Roles and Responsibilities

- Corporate staff PQ engineers
  - Develop procedures (harmonic mitigation process)
  - Develop software tools, training
  - System PQ and reliability monitoring
  - Special studies and assist PQ engineers and technicians
- Regional PQ engineers
  - Analyze and trouble-shoot customer systems
  - Represent the utility in mitigating polluting load effects
  - “Customer” training
- Technicians (stray voltage, harmonics, RFI)
  - Install monitors and gather data
  - trouble-shoot service level

Preventing Polluting Loads
Presentation Focus
Large ASD – Harmonic Issues

- To eliminate our problems
  - Regulatory rules
  - New business process
  - Existing load process
  - Customer assistance options
  - Education
  - Harmonic trend monitoring

Preventing Polluting Loads
Customer Load Requirements
Rule K

- Defined in the **General Service Requirements of the Idaho and Oregon Public Utilities Commissions' tariffs- Rule K**
  - Interference with Service
  - Requirements for Harmonic Control
  - Notice of change of load demand or its character.
  - Motor installation and allowable starting current
- **Use last to enforce compliance with the rules**

Preventing Polluting Loads
Interference with Service
Rule K

- The Company may refuse to supply loads of a character that may seriously impair service to any other Customer.
- Company may disconnect existing service if it is impairing service to any other Customer.
- Company may require the Customer to provide equipment, at the Customer's expense, to reasonably limit such interference.
  - Flicker
  - Voltage Fluctuations
  - Notching
  - Waveform Distortion

Preventing Polluting Loads
Harmonic Control
Rule K

- Customers are required to comply with the *Practices and Requirements for Harmonic Control in Electric Power Systems* as set forth in the current Institute of Electrical and Electronic Engineers ("IEEE") Standard 519.
- The values indicated by IEEE Standard 519 apply at the point where the Company's equipment interfaces with the Customer's equipment.

Preventing Polluting Loads
Change of Load or Character
Rule K

- The Customer shall give the Company prior notice before making any significant change in either the amount or electrical character of the Customer's electrical load.
  - Allows the Company to determine if any changes are needed with the Company's equipment or distribution system.
- The Customer may be held liable for damages to the Company's equipment resulting from the Customer's failure to provide said notice of change in electrical load.

Preventing Polluting Loads
Motor operation
Rule K

- All motors greater than 7 ½ HP must be approved by the Company.
- Changes to Company facilities necessary to limit the affects of flicker, voltage imbalance, voltage level, or reactive power requirements may be at the Customer's expense.
- Starting currents (as determined by tests or based on published data by manufacturers) of alternating current motors will not exceed the allowable locked rotor current values shown in the following table without permission of the Company.

Preventing Polluting Loads
Motor Starting Currents
Rule K

Allowable Locked Rotor Currents

	Single Phase Motors				Three Phase Motors								
	240 Volt				240 Volt				480 Volt				> 480
Rated Size HP	Starting Amps Allowed	KVA / HP	LR Code	I Full load Amps	Starting Amps Allowed	KVA / HP	LR Code	I Full load Amps	Starting Amps Allowed	KVA / HP	LR Code	I Full load Amps	
7.5	110	3.52	B	29									
10					141	5.85	G	24	71	5.90	G	12	
15					197	5.45	F	37	99	5.48	F	18	
20					250	5.19	F	49	125	5.19	F	24	
25					304	5.05	F	61	152	5.05	F	31	
30					360	4.98	E	73	180	4.98	E	37	
40					380	3.94	C	98	190	3.94	C	49	
50					400	3.32	B	122	200	3.32	B	61	
60					480	3.32	B	146	240	3.32	B	73	
75					600	3.32	B	183	300	3.32	B	92	
> 75	Consult Regional Engineering												

Preventing Polluting Loads
New Business
Customer Request

- **For all motor connections customer request form provides:**
  - Total combined horsepower (hp) of the motors at this meter
  - The hp of the largest motor at this meter
  - Is a single-phase to three-phase converter going to be used
  - Are any solid state electronic motor drives at this meter
  - The total horsepower connected to drives
- **If a drive connection is requested the request is forwarded to PQ engineer**

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Preventing Polluting Loads
New Business
Power Quality Engineers Role

- Determines harmonic limits for the location
  - Provide ASD connection **form letter** stating the specific IEEE limits for customer's location.
  - Work directly with customer, electricians and/or vendors to determine an adequate design.
  - Provide design approval or changes needed to make the ASD addition IEEE-519 compliant.

Preventing Polluting Loads
New Business
Power Quality Engineers Role

Evaluates feeder model for harmonic resonant points that may be excited by the ASD addition.

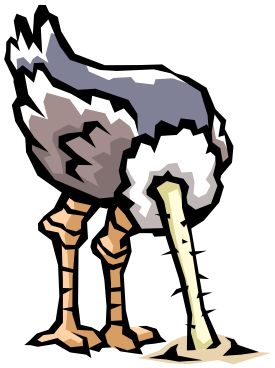
- If a significant resonant condition is suggested by the model provide a recommendation to the regional operation engineer or, design a solution to mitigate and initiate a project request.

Preventing Polluting Loads
New Business
Power Quality Technicians Role

- Site Inspection prior to connection
  - Filtering present verifies IEEE-519 compliance
  - Choke present apply 30% rule of thumb
  - No filtering or choke present apply the 20% rule of thumb.
  - If compliance questionable then test
  - Forward test results to PQ engineer for evaluation

Existing Polluting Loads
The Hard Part ?

- Do you need to find them?
  - Yes, or they will find your utility.
    - Capacitor control errors
    - Recloser coordination errors
    - Capacitor fuse failures
    - Telephone noise complaints
    - AMR burn ups
    - Resonance conditions
    - Elevated NEV
  - How do you find them?
  - How to get them cleaned up?



Existing Polluting Loads
Finding Them-Idaho Powers Plan

Identify the loads to be tested (2007-2012 ?)

- Feeders where we have known harmonic related issues:
  - Interference with other customer loads
  - Telephone noise
  - System issues
- All primary voltage customers
  - 1000 KW demand or more
  - 190 customers
- Municipal wells
- Ski lifts
- Irrigation loads over 100 hp not meeting our 30% rule

Existing Polluting Loads
Testing Them
Idaho Powers Plan

- All loads Identified are loaded into an MS Access data base.
- Scheduled for testing based on peak billing demand period.
- Customer is notified of scheduled testing and why.
- Test is completed and data entered into the data repository.
- PQ engineer analyses the data for compliance with IEEE-519.
- Customer sent a copy of all test results and compliance status.
- PQ engineer works with the customer to clean up the load.
  - Provides a menu of mitigation options

Power Quality Engineer
Customer Assistance Options

- Analysis of customer electrical design
- Equipment, installation, vendor recommendations
- Rate and programs design for non-compliant customers (being developed)
  - Utility owned filter facilities for fee
    - Industrial and large commercial primary voltage customers
    - Schedule 66- miscellaneous charges-all non residential
  - Power Quality loan program-$10,000 all customers
  - Loan program (2% buy down)-$100,000 for 5 years
    - Industrial and large commercial customers
  - One time grant offering (2-3 year?) replaces buy down cost

Preventing Load Pollution Employee Education

Gaining support throughout Idaho Power to prevent polluting loads

- Employee training
  - Executive management
  - Legal and rate-making personnel
  - Customer business representatives and marketing departments
  - Distribution designers, lineman, troublemen, meter techs
- Consistent processes

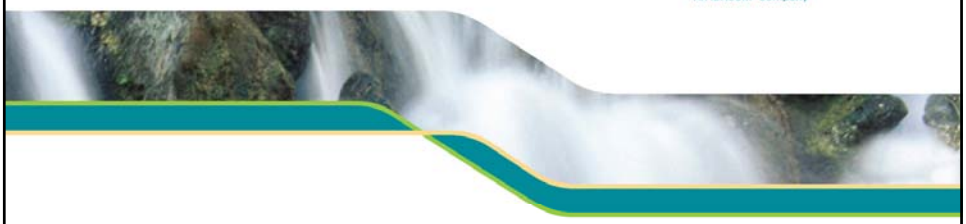
Preventing Load Pollution Industry and Customer Education

- Vendors, electrical contractors, end use organizations, others
  - PQ engineers must give five presentations to meet goal requirements.
    - Building operator associations
    - Irrigation and water user associations
    - Local IEEE meetings
- Inform customers of state PUC requirements
- PQ school for electricians
- State electrical inspectors?

Preventing Load Pollution
System Harmonic Monitoring

Watching over harmonic current trends

- PML 7650 and 8600 Ion meters
  - Complete power quality monitoring
- Selected commercial and industrial sites
  - All primary metered locations
- Substation and feeder monitoring
  - Irrigation feeders
  - Industrial feeders
  - Others as needed
- Automated meter reading



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