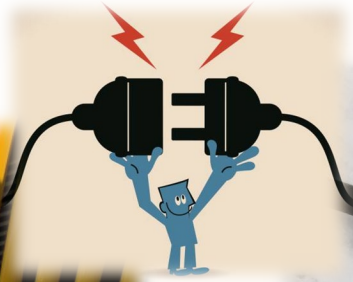
THE POWER BADGER – *THE* ENGINE HEATER CONTROLLER

BY BMI



Patented technology

WHAT IS AN ENGINE BLOCK HEATER & WHO USES THEM?

Engine block heaters are used in cold climates to help an internal combustion engine start

A **block heater** is used in cold climates to warm an engine prior to starting.

The most common design of block heater is an electrical heating element embedded in the engine's cooling system, called an immersion-type heater.

- Gasoline engines generally benefit from a block heater at temperatures below 0° F
- Diesel engines benefit from a block heater at temperatures below 35° F
  - Some diesel engines are unable to start in cold temperatures without a block heater
  - If it gets cold enough (-20 and lower) some gas engines may not start without a block heater

Who uses block heaters?

- **Residential Ratepayers:** Diesel pickup trucks (installed on all diesel engines since @ 2003)
- **Business & Industrial:** Busses, Plow Trucks, Airport Equipment (tugs, conveyers ect..) delivery trucks (ex: UPS, FedEx, freight ect..) Railyards, Construction Equipment
- **Agricultural:** Tractors, Trucks & Farm Equipment, heat/pipe tape, heated livestock waterers

WHY ARE BLOCK HEATERS USED?

- **Pre-heating of an engine is primarily used to make it easier to start. Added benefits are:**
  - Saves fuel and reduces exhaust emissions during warmup cycle of engine
    - Engine reaches operating temperature sooner, so the engine does not run “rich” as long
  - The cabin heater produces heat sooner for comfort and to thaw the windshield
  - Less load on the starter and battery thereby prolonging their service lives
  - Less engine wear due to improved oil circulation
  - Reduces the need for a remote starter, thereby further saving fuel and emissions (less run time)
  - Block heaters are also found on the diesel engines in standby generators, to reduce the time taken for the generator to reach full power output in an emergency

BLOCK HEATERS SOUND GREAT…. SO WHAT'S THE PROBLEM??

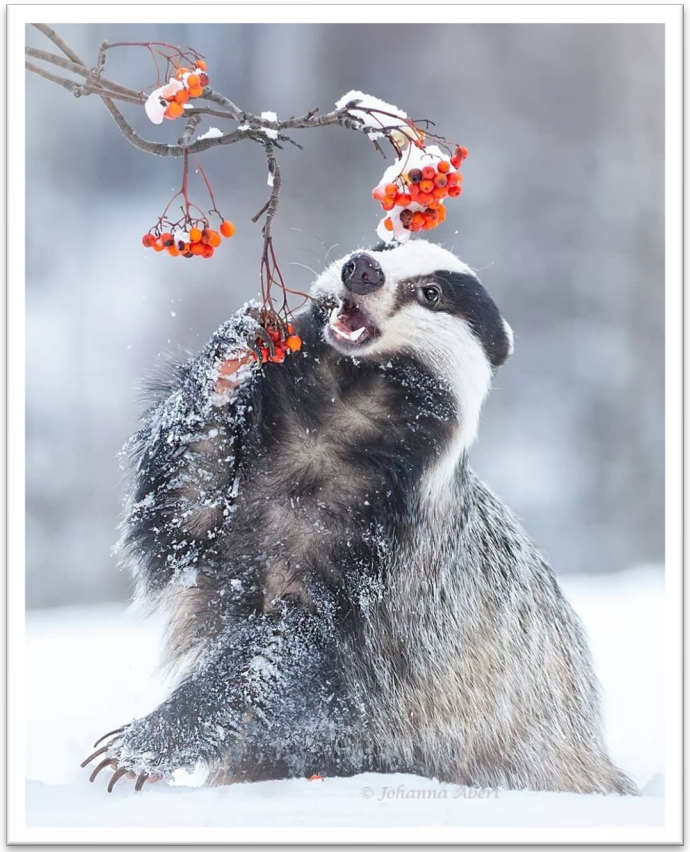
- **No control – they are on all the time, as soon as they are plugged in**
  - Uncontrolled resistive heating load
    - No on/off switch – like leaving a hair dryer on all the time!
    - No thermostat
    - No way for the ratepayer to know how long to plug it if for…. so what do most people do??

      ……. they just plug it in all the time….. wasting energy

- **They use lots of energy…. average 400-1500 watts!**
  - Heaters are proportionally sized for their heating load, larger engine, larger heater
    - Small car gasoline engine heaters are 400-500 watts
    - Diesel pickup trucks (like the kind you see parked in residential driveways): 600-1000 watts
    - Semi trucks/busses/equipment: 1250-2000 watts!

WHAT IS A BADGER?

According to Wikipedia: Badgers (mammal) are medium-sized short-legged omnivores



- Tenacious
- Rugged
- Powerful
- In control of their environment

SOOOO .... WHAT'S A POWER BADGER®?

According to the Manufacturer: Power Badger is an Energy Conserving Load Controller

- Tenacious
- Rugged
- Powerful
- In control of it's electrical load

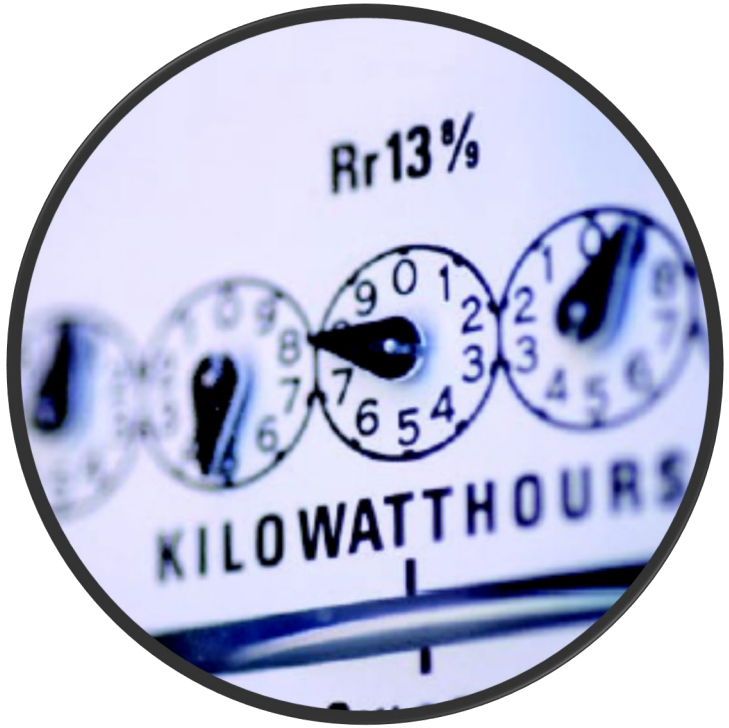
energy saving

WHAT DOES THE POWER BADGER CONTROLLER DO?

- Significantly reduces energy usage of the heating device while maintaining full purpose functionality
- Uses outside temperature data to control the heater according to required/anticipated load
- Controls energy usage of resistive-type heaters as used in many transportation and agricultural applications

WHY USE A CONTROLLER?

- Conserves energy for the Utility and $$$ for the ratepayer
- Stops wasted energy – needless and nonbeneficial usage
- Ensures the subject engine is ready to start using as little energy as possible



POWER BADGER - PRESENTATION VIDEO

HOW DOES THE POWER BADGER CONTROLLER WORK?

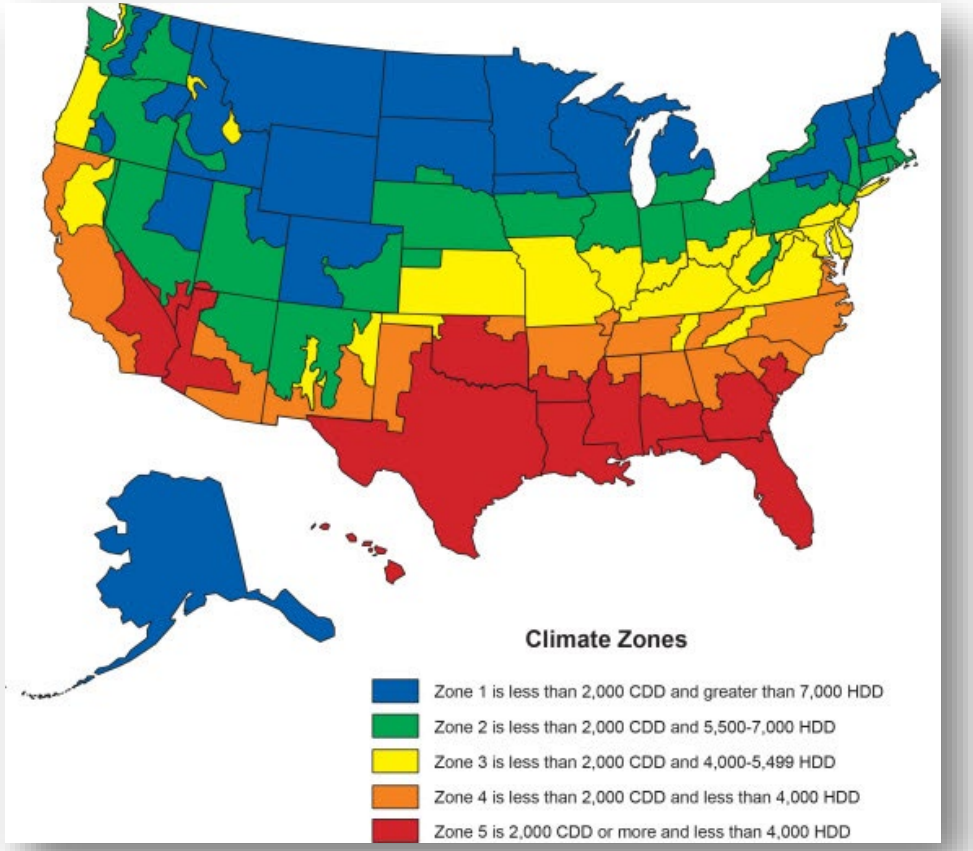
- Senses the outside temperature and tailors a suitable energizing program for the application
  - Control is based on the temperature, user selected mode and other user inputs
  - Timed Ready Mode (patented):
    - When the Power Badger is put into “Timed Ready” mode, the user will input their desired “Ready Time” (the time they intend to start the engine) into the controller. The controller then uses the outside temperature sensor and an algorithm to calculate the optimum time to begin heating the engine ahead of the user selected “Ready Time”.
    - **Example;** it is 30°F and the controller is set with a user desired “Ready Time” of 6:00am. The unit will turn on at the calculated time (temperature dependent) and remain steady-on until the selected “Ready Time” is reached (6am)., In the case of 30°F it would begin heating 2 hours ahead of 6am (4am).
  - Maintain Ready Mode:
    - When the Power Badger is put into “Maintain Ready” mode, the microprocessor senses the outside temperature and calculates a duty cycle for the heater. It divides the hour into 6 cycles (of ten total minutes each) and calculates how much of that ten minutes will be heater-on and how many will be heater-off.
    - **Example;** at 28°F / 2°C the unit would be at a 50% duty cycle. A 50% duty cycle would mean that the controller turns the heater on for 5 minutes on then off for 5 minutes,... repeating that cycle for 6 duty cycles every hour.

WHAT ARE SOME REAL-WORLD RATEPAYER APPLICATIONS FOR THIS CONTROLLER?

- Residential: Diesel Pickup Trucks
- Commercial / Industrial: Diesel Fleet Vehicles; Package delivery, Garbage, Heavy Equipment..
- Agricultural: Tractors, Farm Equipment, Livestock Tank Heaters, Pipe Tape/Wrap, Pad Heaters
- School Systems: Bus Fleets
- Municipal / State / Federal / Government Agencies / Airports / Railways / Bus Fleets
- Military: Reduces Energy Usage at Bases and when Using Generators in Remote Areas (trucks, generators, tanks)
- Aviation: Piston Engine Heaters / Warming Pads / Battery Blankets, Aviation Support Equipment (tankers, tugs, conveyers, food service trucks, de-icing equipment, disembarking equipment, ect..)

HOW MUCH ENERGY CAN BE SAVED BY USING A CONTROLLER?

- kWh Savings are dependent upon wattage load (heater size) and climate zone
  - Current Public Utility kWh credits (per controller unit) range from: 1540 kWh to 580 kWh
  - The more “temperate” or seasonally transitional days in a zone, the more energy the controller can save



KWH SAVED PER YEAR SINCE 2022

INCLUDES ONLY: WYOMING, IDAHO, NEVADA, UTAH & WASHINGTON

3.48 Million kWh Saved

7.82 Million kWh Saved

2022 | 2023 | 2024

5.54 Million kWh Saved

energy saving

BENEFITS OF IMPLEMENTING A BLOCK HEATER CONTROLLER MEASURE

- **Big Available kWh Savings**
  - 1150 (average) kWh savings per annual heating season (per controller) in western climate zones
  - 10 year expected life-span of the controller (only limited by relay cycles)
- **Easily and Cost-Effective Measure to Implement**
  - Average cost of 1.3¢ per kWh for product life savings (at full retail price)
  - No Installation Needed – just "plug-and-play"
  - Can literally be handed to a customer "over the counter" at stores, home shows, fairs, any place where the target utility ratepayers gather.
  - No upfront purchase of units necessary by implementer or utility. The product can be ordered by ratepayers directly from our website (using an instant rebate code system for utilities) and drop-shipped "as ordered" directly to the ratepayer or BMI can put stock in place (on consignment) on-site.
  - High Consumer Interest in the Product
  - High Ratepayer Use Rate
- **Very Low Impact to the Utility From Problem, Call Back, Complaint Standpoints**
  - Less than 1 in 2500 units have a service or user issue that effects immediate implementation
  - Any such issues are handled quickly and courteously by BMI's customer service or technical service team members
  - Most effective as a Prescriptive Measure, but can also be used as a Custom Measure for commercial fleets

PUBLIC UTILITIES - DIFFERENT APPROACHES TO IMPLEMENTATION/ROLLOUT – BUSINESS & INDUSTRIAL

- B&I Case: Rocky Mountain Power (Utah, Wyoming & Idaho, since 2021)
  - Upstream vendor partners, in-person visits to all types of potential end-users

- B&I Case: NV Energy (Nevada, since 2022)
  - Schools focused Team– in-person visits to district bus garages and county decision makers

- B&I CASE: Pacific Power (Washington, since 2024)
  - Upstream vendor partners – in-person visits to truck fleet managers, municipalities and school system/s bus garages

PUBLIC UTILITIES - DIFFERENT APPROACHES TO IMPLEMENTATION/ROLLOUT - - RESIDENTIAL

- Residential: Rocky Mountain Power (since 2021)
  - **Utah** - In-person events, email blasts directing to online rebate application and controller purchases
  - **Wyoming** - In-person events like home shows, fairs and rodeos
  - **Idaho** –In-person events like home shows and fairs (East Idaho Fair is the biggest)

- Residential: NV Energy (Nevada, since 2022)
  - In-person events and email blasts

BLOCK HEATER CONTROLLER MEASURE IMPLEMENTATION

- **Many public utilities already have an existing Block heater controller measure in place**
  - Current measure may be out of date or not crediting enough kWh for the controller's potential
  - Existing measures were likely was written using an old-school simple timer and not a *smart controller* technology
  - Existing measure may be under utilized or forgotten about
  - Most ratepayers don't know about such measures and incentives in place for block heater controllers

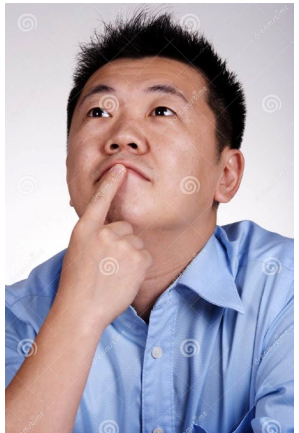
- **Establishing a new Measure for block heater controllers with a public utility**
  - Several 3rd party "white papers" are available to support data needs
  - Established and proven track record with western public utilities as a model
  - Known and widely used measure with 3rd party implementors such as CLEAResult, Innovation Resources & Evergreen Efficiency
  - Increased kWh savings goals require innovative approaches to efficiency

QUESTIONS?

- Suggested questions: ☺
  - I hate wasted energy!… how can I get started with block heater controllers right away?
  - My utility has been looking for additional ways to save energy for our ratepayers,….

    do you have any 3rd party research “white papers” on block heater controllers?
  - Is there anyone I can talk to that has experience with block heater controls as an

    effective measure at a public utility?
- Could my energy efficiency program use a (very cost efficient) new measure for kWh savings?

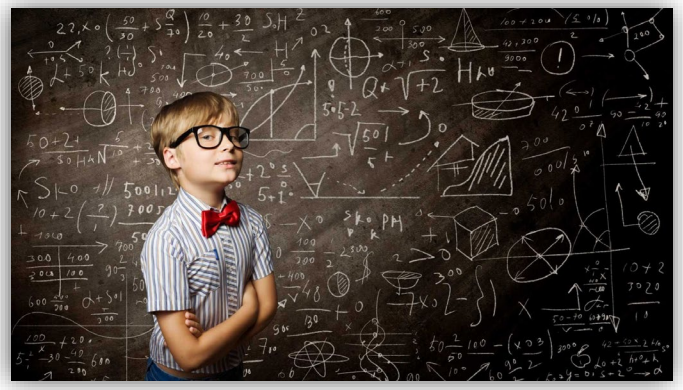


RESOURCES

Independent Studies / "White Papers" Related to The Power Badger®

- Prodigy Study – 3rd Party testing and documentation of kWh savings using the Power Badger with actual electrical loads. https://thepowerbadger.com/public-utilities/
- The Regional Technical Forum (Oregon) - (Large) 3rd party produced data file documenting kWh savings related to the real-world use of block heater controllers. https://rtf.nwcouncil.org/measure/engine-block-heater-controls/

  This study includes the specific backup data used for current Public Utility efficiency measures (with Rocky Mountain Power and NV Energy) as are now in place (in UT, ID, WY & NV) for the Power Badger.
- **Dynamic Energy Savings Estimator: www.thepowerbadger.com**



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