Solutions for Single Spaces
Energi TriPak™
1. To understand lighting control strategies

2. To understand what the Energi TriPak family is

3. To understand what problems the Energi TriPak can solve for our customers

4. To recognize the products that make up the Energi TriPak

5. To apply Energi TriPak products to an assortment of application
Lighting Control Strategies

10 Energy Saving Lighting Control Strategies

- Dimming
- High-End Tuning
- Occupancy / Vacancy Sensing
- Daylight Harvesting
- Personal Dimming Control
- Scheduling
- Controllable Window Treatments
- Load Shedding
- Plug Load Control
- System Integration
Lighting Control Strategies

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- Daylight Harvesting
- Appliance Control

When used together these strategies have created saving opportunities greater than 70% lighting energy savings and regularly achieve savings greater than 60%.¹
Lighting Control Strategies

7 Strategies the Energi TriPak supports

- Dimming
- High-End Tuning
- Occupancy / Vacancy Sensing
- Daylight Harvesting
- Personal Dimming Control
- Scheduling
- Controllable Window Treatments
- Load Shedding
- Plug Load Control
- System Integration
Dimming

- Allows the “perfect” level light as well as either empowers or improves all the other lighting control strategies.

Typical Lighting Energy Savings: See Other Strategies
High-End Tuning

- Set the maximum light level in a space based on customer preference or design requirements
  - Field Adjustable

Typical Lighting Energy Savings: 10-20%
Occupancy/Vacancy Sensing

- Gradually dim lights to a low level or turn lights Off when space is unoccupied
  - Occupancy Sensing
    - Auto-On/Auto-Off
  - Vacancy Sensing
    - Manual-On/Auto-Off

Typical Lighting Energy Savings: 20-60%
Daylight Harvesting

• Dim electric light or switch it off during the day to take advantage of available sunlight. Two styles of daylighting:
  • Switching (/Bi-Level/Step-Dim)
  • Continuous Dimming

Typical Lighting Energy Savings: 20-60%
Personal Dimming Control

- Provide personal choice and control of light levels to accommodate the different task and activities in an area.
- Allow different occupant to adjust light levels in they work space to the “perfect” light level for their eyes and the task at hand.
- Permit control from multiple locations.

Typical Lighting Energy Savings: **20-60%**

![Image of light bulb in full on and dim modes](image-url)
Scheduling

- Provides scheduled changes to the building system based on time of day
  - Lights: On/Preset/Off
  - Shades: Open/Preset/Close
  - Sensors: Enable/Disable
  - Controls: Enable/Disable
- More than just Sweep On/Sweep Off

Typical Lighting Energy Savings: Variable

![Image showing 7am: Dim and 7pm: Off]
Controllable Window Treatment

- Motorized shades allow for quiet, automatic and manual control of window treatment in order to reduce glare and solar heat gain
- Effects the energy usage of both Lighting and HVAC systems

Typical Lighting Energy Savings: Variable

[Image of motorized shades in open and closed positions]
Load Shedding

- Automatically reduces lighting loads during peak electricity usages times.

There are two types of load shedding:
- Demand Response
- Peak Load Management

Typical Lighting Energy Savings: Variable
Plug Load Control

- Automatically turns off loads after occupants leave a space. There are two styles of plug load control:
  - Receptacle Circuit Control
  - Plug-In Control

Typical Plug Load Energy Savings: 10-15%
Integration

- Share information across systems or platforms.
  - Contact Closure
  - RS232/Ethernet
  - BACnet IP

Typical HVAC Energy Savings: Variable
Single Space Solutions

The Energi TriPak Family of Products
The Energi TriPak

Three categories of devices

Transmitting devices

**Sense**
- Radio Powr Savr wireless sensors
  - Occupancy/vacancy
  - Daylight

Adjust
- Pico wireless control
  - Wall-mount
  - Tabletop
  - Hand-held

Load controllers

**Conserve**
- NEW PowPak™ load controllers
  - Dimming module with EcoSystem™
  - Relay module
  - Contact closure output module

  - Plug-in dimming module
  - Plug-in appliance module
  - Stairwell fixture

**Maestro Wireless®**
- Dimmer
- Switch
- Tabletop lamp dimmer
Energi TriPak – “Sense”

The “Sense” aspect of the Energi TriPak is made up of the Radio Powr Savr™ family of sensors:

- Wireless Occupancy Sensors
  - Ceiling-Mount
  - Wall-Mount
  - Corner-Mount
  - Hallway-Mount

- Daylight Sensors
  - Ceiling-Mount

These devices contain a battery with an estimated 10 year life and are designed to be quickly and easily placed, without the need to pull conduit or cable.
The “Adjust” portion of the Energi TriPak is made up of the PICO™ family of remote controls:

- Wireless Remote Controls
  - Hand-Held
  - Wall-Mount
  - Pedestal-Mount
- Keypad Configurations such as:
  - 2-Button w/ and w/o Raise/Lower
  - 3-Button w/ and w/o Raise/Lower

These devices contain a battery with an estimated 10 year life and are designed to be quickly and easily placed, without the need to pull conduit or cable.
Energi TriPak – “Conserve”

The “Conserve” products of the Energi TriPak consist of load controllers and they come in various form factors:

- PowPak
  - Dimming PowPak w/ EcoSystem™
  - SoftSwitch PowPak
  - SoftSwitch PowPak w/ Contact Closure Output
- Stairwell Fixture and Stairwell Fixture Kits
- Plug-In Appliance and Dimming Module
- Maestro Wireless Wall Switches and Dimmers
  - Various dimming styles available
- Maestro Wireless Tabletop Lamp Dimmer

The Conserve products are all wireless receivers and draw power from a wired connection.
Maestro Wireless

- Simple retrofit of existing wallbox switches and/or dimmers
- 120V/227V, no neutral required versions
- Compatible with multiple location companion switches for simple 3-way
- INC/HAL/MLV/ELV/3F/SW
- Advance Programming Mode

Dimmer  Switch
Stairwell Solutions

- Radio Powr Savr Occupancy Sensor communicates with the integral wireless dimmer installed in the fixture
- Automatic jumps from high-end to low-end light levels, and vice versa, occupants enter and leaving stairwell
- Field adjustable high-end and low-end light levels

Unoccupied: 20% light level
Occupied: 80% light level
Plug-In Modules

• Switches plug loads off when not in use through manual and/or automatic controls
• Use with task lighting, monitors, printers, and personal heaters
• Easy plug-in installation, no tools required
• Simple button press programming

15A Switching Module  300W Dimming Module
PowPak Modules

• Great in all applications
• Provides local integration to VAV and other local 3rd party systems
• Cost competitive digital dimming
• Advanced Lighting Control with 7 of the 10 strategies
• Contractor or End-User start-up possible
Energi TriPak Solution

System Limits & Strategies

- **Dimming**
- **High-End Tuning**
- **Occupancy / Vacancy Sensing**
- **Daylight Harvesting**
- **Personal Dimming Control**

System Limitations

- **Single Space Solution**
- Create a solution using one or multiple conserve products and link with:
  - up to 1 RF Daylight Sensor
  - up to 6 RF Occupancy Sensors
  - up to 9 RF PICO Remotes
- Up to a max of 10 RF Devices

- **Plug Load Control**
- **System Integration**
Benefits of Energi TriPak

• Easy to install and program
  – All devices use wireless communication, reducing wiring labor and materials
  – Default functionality fits many applications
  – Simple button-press programming, no commissioning required

• Cost Effective
  – Energi TriPak saves Installation Time... Saves Money!
  – Energi TriPak saves Materials... Saves Money!
  – Energi TriPak saves Energy... Saves Money!
There are four core technologies at work in the Energi TriPak family of products:

- Clear Connect™ RF Communication
- Lutron Extended Battery Life
- XCT™ Passive Infrared Occupant Sensing
- EcoSystem™ Digital Lighting System
Clear Connect™ RF Technology

Clear Connect™ RF technology uses a low-power, non-licensed frequency band as defined by FCC Title 47 Part 15.231. Operating at Lutron’s chosen frequency of 434MHz helps ensure that no other devices interfere with Lutron’s wireless communications.9

- Frequency Band: 410-470MHz
- Uses: *Intermittent* Control Signals
- Emission Limits: Low-Power \( (\frac{125}{3}) \times f(\text{MHz}) = \frac{21250}{3} \mu \text{V/m} @ 3\text{m} \)

For comparison, this table three well known wireless bands.

<table>
<thead>
<tr>
<th>Frequency Band</th>
<th>Type of Use</th>
<th>Emission Limit</th>
<th>47 CFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>410-470MHz</td>
<td>Intermittent or Event Driven</td>
<td>21250(\mu\text{V/m})</td>
<td>12.231</td>
</tr>
<tr>
<td>902-928MHz</td>
<td>Spread Spectrum</td>
<td>1W</td>
<td>15.247</td>
</tr>
<tr>
<td>2.4-2.435GHz</td>
<td>Spread Spectrum</td>
<td>1W</td>
<td>15.247</td>
</tr>
</tbody>
</table>
Clear Connect™ RF Communication

Clear Connect RF

- Clear Connect RF technology is a restricted, radio frequency band that all Lutron wireless products use to communicate. This ensures no other devices interfere with Lutron’s lighting system.

2.4 - 5.0 GHz:
- Telephones
- Wi-Fi Networks
- Bluetooth Devices
- Wireless Security Cameras

434 MHz:
- Lutron Clear Connect RF technology devices
  - 30ft thru construction materials
  - 60ft line-of-sight (100ft for PICO)

In crowded frequency bands there is a high potential for RF interference.

In low traffic, restricted frequency band ensures flawless communication.
Clear Connect™ RF Communication

Two common RF network architectures:

- **Fixed Networks**
  - Dedicated sending, receiving, and computing stations provide RF coverage
  - Messages move through the network in a predetermined manner producing short delivery times
  - Location of source and destination device do not affect performance
  - Cares an RF backbone

- **Mesh Networks**
  - System devices form a “matrix” of possible message delivery routes
  - Messages can be relayed through any system device
  - Routing tables determine the path from source to destination
  - Assuming enough system devices, no repeaters are required (potentially lower cost)
Lutron Extended Battery Life

• 3rd party verify 10 year battery life
  • See “Estimating the Battery Life of an Occupancy Sensor” report
• Readily available batteries

![Battery Images]

CR2032  CR123A  CR2450
In accordance with NEMA testing standards, Lutron performed minor-motion coverage testing on the Maestro PIR occupancy sensor with XCT technology, and on four additional PIR occupancy sensors manufactured by others. The graphs clearly demonstrate that sensors with XCT technology have the superior ability to detect minor motion.

- sensor (Maestro In-Wall Sensor)
- greater than 75% detection rate
- 50% to 75% detection rate
- less than 50% detection rate
EcoSystem™ Digital Lighting System

- EcoSystem cabling is topology and polarity free.
- Power all EcoDevices using line voltage and connect using E1/E2 low-voltage link; Class 1 or Class 2
- Uses same wiring as a 0-10V ballast
EcoSystem™ Digital Lighting System

- Occupancy Area is created that includes all fixtures in the classroom
- Occupancy settings are adjusted for each area
- The occupied and unoccupied scene can be selected
EcoSystem™ Digital Lighting System

- PC Zones are created within the area
- PC Zones are fixtures that will always be controlled together (like a switch-leg)
- Pico wireless controls can be configured to control zones or recall a scene
- Pico can affect multiple zones or multiple areas
- Daylight rows are created within the area
- Daylight rows can overlap zones in EcoSystem
- 2 Daylight rows available with EcoSystem PowPak
- Field adjustable target light levels
• Design Goals:
  – No local control on the wall to prevent accidentally turning off the lights when occupied
  – Automatic shutoff of lights when the room is empty
Application: Restroom

- PowPak Relay installs in the ceiling and switches the lighting in the restroom
- Mix of corner mount and ceiling mount sensors to ensure coverage throughout
Application: Private Office

- Design Goals:
  - Personal control
  - Automatic shutoff of lights when the room is empty
  - Daylight harvesting
  - Task lighting control
  - Appliance Control
Application: Private Office

- Maestro Wireless switch easily replaces existing wall switch
- PowPak plug-in appliance module and MRF tabletop dimmer control plug loads
- One RPS occupancy sensor communicates with all load controllers
Application: Classroom

• Design Goals:
  – Multiple zones of control
  – Daylight harvesting
  – Automatic shutoff of lighting
Application: Classroom

- EcoSystem wiring is connected to every ballast
- Digital technology allows the user to configure how the space is zoned
- All group programming is done using the buttons on the control or sensor being programmed
Application: Classroom

- **Red zone** – 1 Pico to turn the whiteboard lights on/off
- **Blue zone** – 1 Pico to select preset levels over desks
- **Green zone** – Row closest to the windows responds to the daylight sensor
- **Not shown** – All fixtures respond to the vacancy sensor
Application: Stairwell

• Design Goal Example:
  – Minimum light level at all times (15%)
  – Unoccupied light level 75%
  – At least three fixtures go to occupied level when person enters stairwell
  – Not capable of turning off from any control beside breaker
The Occupancy Sensor indicates room occupancy to the VAV terminal unit to open/close the HVAC damper/vent in the room from HVAC system.

CCO on the PowPak relay can also be used in this way.
Have you ever spent time designing / walking a job only to find out later that your design wasn’t within the customer’s budget/usage/ROI requirements?
Lutron QuEST Tool

Lutron Quick ESTimation Tool can help you qualify a project before you invest man-hours and capital in design and quoting.
When would you use it?

• Reduce chances of redesign by aligning expectations early
• Asks high-level questions that gives you budget, energy, code, ROI information.
• Only for **Energi TriPak Solutions** right now.
When would you use ETP App?

- After you have Qualified a job with Lutron QuEST, use the ETP Estimator.
- Mobile (iOS) platform ideal for audit
- Significantly reduce audit and design time
- Only for Energi TriPak Solutions right now.
How does ETP App Work?

Record Room-by-room and Project / Regional Information

Generate ETP Solution, Proposal, and BOM

LUTRON®
Tools and Other Useful Information

• Literature
  – Energi TriPak Design Guide – P/N 367-2110 with P/Ns & pricing!
  – PowPak EcoSystem Info Sheet – P/N 367-2097
  – PowPak Relay Info Sheet – P/N 367-2105
  – PowPak CCO Info Sheet – P/N 367-2117

• Website
  – Informational and Programming Videos available online
  – Live now with spec submittals, CSI specification, CAD icons, Revit models, and more

• Radio Powr Savr Technology Report
  – ClearConnect™ RF Communication
  – Battery Life
  – XCT™ Passive Infrared Occupancy Sensing

• Faceplate Engraving
  – Claro faceplates can be laser engraved for ease of use
Questions?

For questions/feedback:

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Systems Application Engineer
Central Area Systems Sales Engineer
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Lutron Technical Whitepapers

1. Clear Connect™ RF Technology
2. XCT™ Technology from Lutron®: The New Standard in Sensing
3. Battery Life Discussion – Contact your location System Sales Engineer or Lutron Rep Agent (DIMS)
1. Combined Lighting Energy Savings source: Although combined savings for a building from individual room strategies is not additive, solutions that utilize all strategies typically save 60% or more. Glenn Hughes, director of construction for The New York Times Company building in New York City reports 75% lighting energy savings using Lutron systems. Jeff Choma, manager of mechanical and electrical systems at Georgian College in Ontario, Canada reports 70% lighting energy savings using Lutron systems. Lighting energy savings exceeding 60% is frequently reported by customers using Lutron solutions as part of an overall energy-savings design program.

2. High-End Tuning source: Existing buildings were often designed to much higher light levels than currently recommended. Even in new and newly renovated spaces, unknown room conditions, architectural layout constraints, and design safety factors often create lighted environments that are considerably brighter than needed. High-end trim source: Pacific Gas & Electric Company. 1997. Dimming Controls for Lighting.


6. Scheduling source: When scheduling is used without occupancy sensing or vacancy sensing, 15% energy savings can be expected.


References

Important Notes:
• The Lutron QuEST Tool is ONLY available to Lutron Rep Agency and Lutron Sales Personnel.
• The Lutron ETP iOS App is free and will be available through the Apple App Store. This product will require an active myLutron account. Registration is required. Please contact your local Rep or Sales person for registration information.
Mesh Network Diagram
Occupancy/Vacancy Savings

Annual Lighting Energy Use

Occupancy/Vacancy Savings

For marketing & training purposes only
Specifications of Lutron® products subject to change
Review of current technical specification documents recommended
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