



Automatic Demand Response (AutoDR) Options in nLight: nLight® ECLYPSE® Embedded OpenADR VEN compared to nADR VEN

Overview

This document discusses the application and specification of the different automatic demand response (AutoDR) options for the nLight system.

nLight offers two different means of interfacing with an electrical utility’s OpenADR Virtual Top Node (VTN) server to initiate an automatic load shed response:

- nLight ECLYPSE (nECY) Embedded OpenADR 2.0a Virtual End Node (VEN)
- nADR OpenADR 2.0a VEN

Both means utilize the OpenADR protocol to receive information about DR events and automatically initiate a load reduction response in the nLight system. However, there are differences in how each mean initiates the load shedding response in the nLight system and in how they are applied to the nLight solution.

Summary

	nECY Embedded OpenADR	nADR
<i>What Is it?</i>	Software module for nECY that adds an OpenADR VEN to the Controller	Physical device that functions as an OpenADR VEN and communicates with nECY’s and/or nGWY2’s over a LAN
<i>How to Order?</i>	Order “ADR” license option on nECY	Order nADR device
<i>Number of VEN’s Required per Site</i>	(1) ADR license per each nECY	nADR: (1) nADR per up to (5) nECY/nGWY2 nADR L400: (1) nADR L400 per (1) nECY or nGWY2 L400
<i>Networked Devices Supported</i>	nLight AIR devices only	nLight, nLight AIR, and XPoint Wireless devices
<i>OpenADR 2.0 Profile</i>	OpenADR 2.0a VEN	OpenADR 2.0a VEN
<i>Site Network Requirements</i>	Must support outbound https connection to VTN server IP address	Must support (a) outbound https connection to VTN server IP address, and (b) local TCP/IP connection to all nECY Controllers and/or nGWY2 Gateways at site
<i>Automatic Dimming Mechanism</i>	Invokes ADR maximum light output setting (new) – does not change or re-initialize other Device Settings	Initiates nLight Profile that typically changes “Occupied Bright Level” Device Settings
<i>Manual Occupant Control above DR Dimming Level</i>	Not Allowed	Allowed
<i>How to Test?</i>	Test ADR levels from nECY web interface	Test nLight Profiles from nLight Explorer application, nGWY2 GFX (if installed), or SensorView software

nLight ECLYPSE Embedded AutoDR

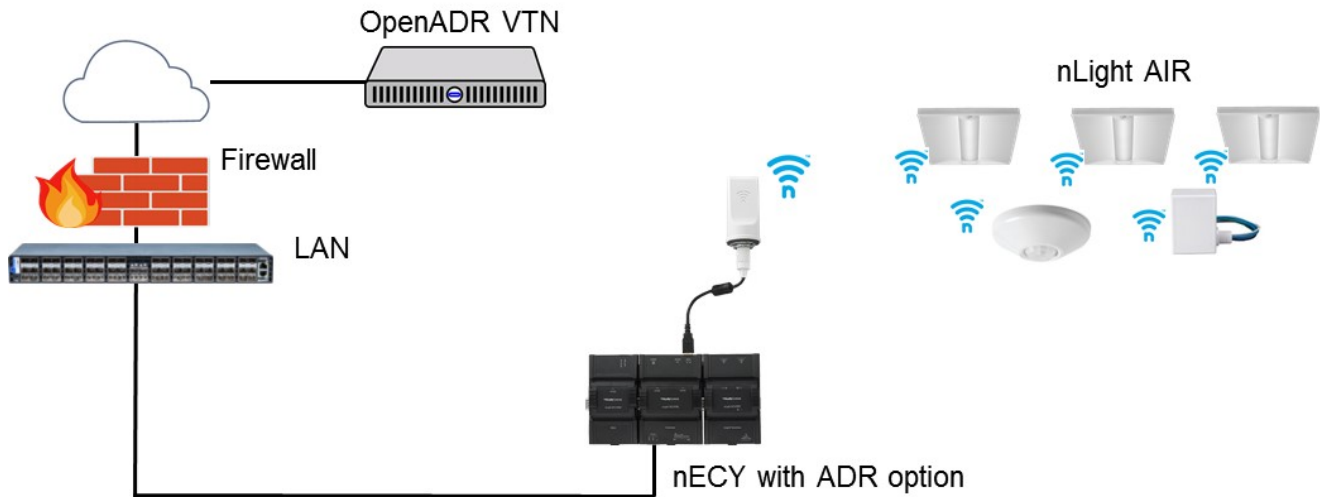


Figure 1 - nLight ECLYPSE Embedded OpenADR System Diagram

The nECY is available with a software module that embeds OpenADR 2.0a VEN capability directly into the controller, eliminating the requirement for a separate system component that acts as a VEN. Ordering the nECY with the “ADR” option enables this software module and provides the nECY with the ability to control nLight AIR devices to reduced light levels during DR events.

nLight and XPoint Wireless devices do not support the Embedded AutoDR option of the nECY; the nADR solution should be used for these devices.

Sequence of Operations – Embedded OpenADR

See Figure 1 for a simplified diagram of end-to-end communication between OpenADR VTN server and nLight AIR networked devices.

1. The nECY receives a DR event signal from the OpenADR VTN server.
2. The nECY invokes the appropriate “Automated DR Level” setting in nLight AIR devices connected to it, corresponding to the severity of the event indicated in the DR signal.
3. Each nLight AIR device is capped at its individual Automated DR Level setting; distributed control algorithms within each device are capable of controlling to light levels below the Automated DR Level setting (e.g., in response to daylight, occupancy, or manual wall controls) but they cannot exceed this maximum output level.
4. At the end of the event the Automated DR Level is released by the nECY and networked devices can output light levels up to their normal High Trim setting.

Notes:

- Networked control devices supporting ECLYPSE Embedded OpenADR have ADR settings enabled out-of-box with the following default settings (can be changed during system startup):
 - **Automated Demand Response:** Enabled
 - **Automated Demand Response Low Level:** 90% max light output
 - **Automated Demand Response Medium Level:** 80% max light output
 - **Automated Demand Response Max Level:** 70% max light output
- Automated DR Level settings are individually configurable for specific luminaires, devices, or zones.
 - Light outputs of 100% to 1% (in 1% increments) and “Off” can be configured for each severity of Automated DR Level.
 - Luminaires can be enabled or disabled to respond to ADR events invoked by the nECY.
- The nECY can issue a Test Event to demonstrate DR commissioning to the owner and/or commissioning agent.

Configuration

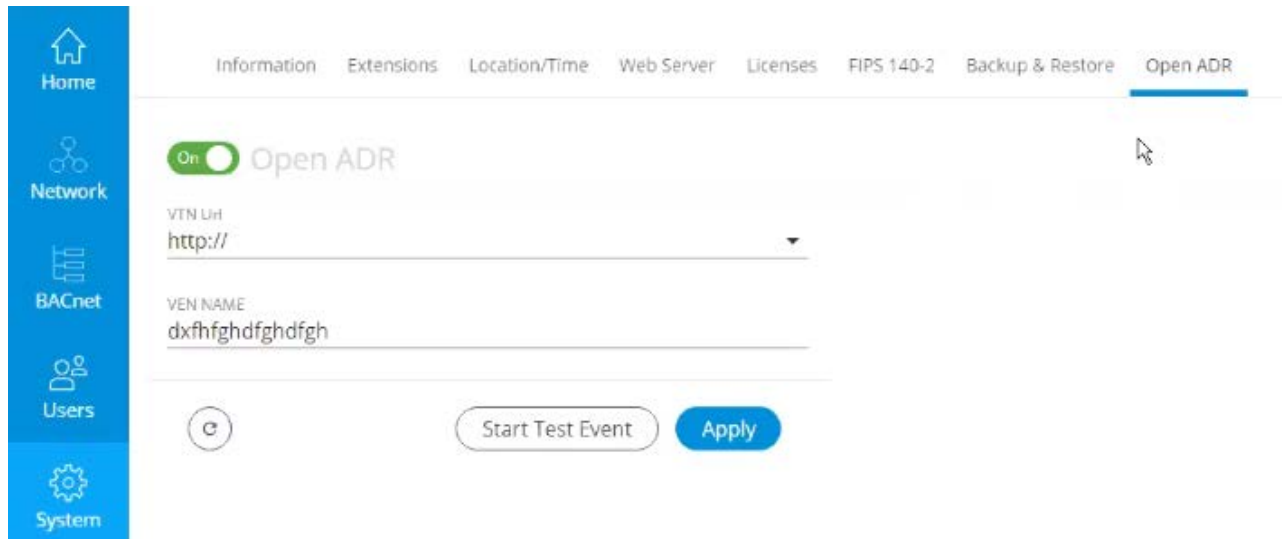


Figure 2 - ECLYPSE Web Interface for ADR Configuration

The IP address of the OpenADR VTN server is configured in the nECY’s web server interface, as shown in Figure 2. This interface allows for configuration using http or https connection to the VEN.

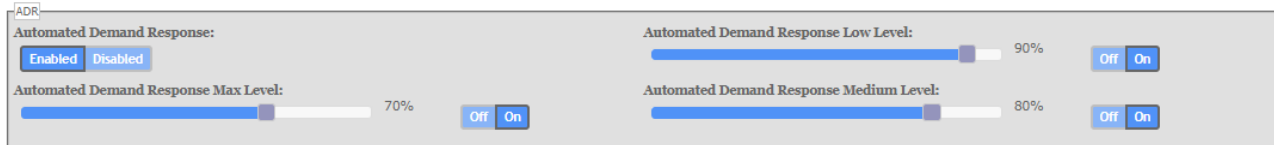


Figure 3 – Device “Default Settings” Configuration for Embedded AutoDR Response

The Automated DR Levels can be configured for specific luminaires, devices or zones using SensorView software interface, as shown in Figure 3. The Automated DR Level maximum outputs are set by default to:

- Low – 90% Maximum output
- Medium – 80% Maximum output
- Max – 70% Maximum output

Application Requirements

The utility VTN server must support OpenADR 2.0a VEN clients.

The nECY must have an outbound https connection to the OpenADR VTN IP address (TCP 443).

nADR

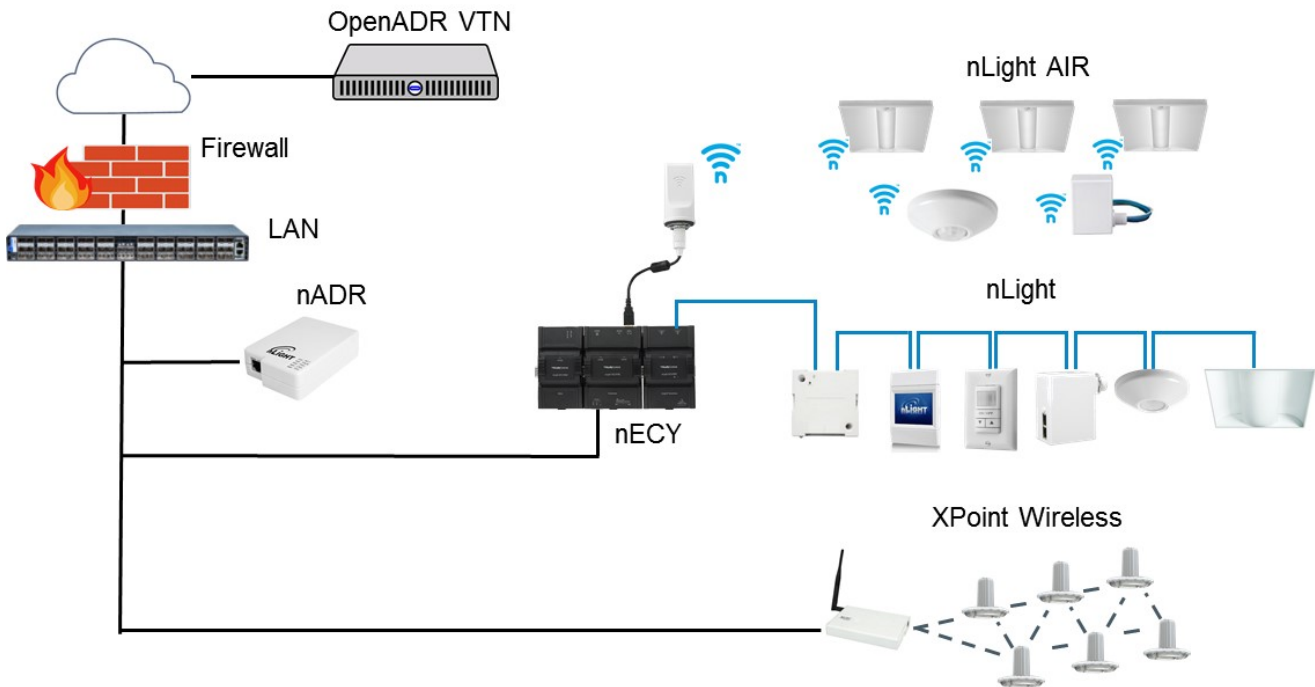


Figure 4 - nLight nADR System Diagram

The nADR is a system component that functions as an OpenADR 2.0a VEN and communicates with nECY controllers and/or nGWY2 gateways over a LAN. When the nADR receives a DR event signal from the VTN, it can start an associated nLight Profile corresponding to the severity level of the DR event (e.g., Moderate, High, Special). The appropriate nLight Profile is started on all corresponding nECY controllers and/or nGWY2 gateways, that in turn transmit programmed Device Settings to individual luminaires and devices. nADR can be used by nLight, nLight AIR, and XPoint Wireless devices.

Sequence of Operations - nADR

See Figure 4 for a simplified diagram of end-to-end communication between OpenADR VTN server and nLight, nLight AIR, and XPoint Wireless networked devices.

1. The nADR receives a DR event signal from the OpenADR VTN server.
2. The nADR starts the nLight Profile corresponding to the severity of the event indicated in the DR signal. The “start Profile” instruction is initiated on each nECY and nGWY2 configured in nADR.
3. Each designated networked nLight, nLight AIR, and/or XPoint Wireless device receives new Device Settings, as defined in the nLight Profile. This typically corresponds to an “Occupied Bright Level” Setting with reduced light levels.
 - a. Occupant overrides above “Occupied Bright Level” are allowed in typical profile event unless wall stations are completely disabled.
4. At the end of the event, the nLight Profile is stopped by the nADR. The “stop Profile” instruction is initiated on the appropriate nECY controllers and nGWY2 gateways.
5. Each designated networked nLight, nLight AIR, and/or XPoint Wireless device resumes the previously operating Profile (typically “Default Settings”).

Notes:

- A single nLight Profile can be assigned to each of corresponding to the following OpenADR event types:
 - Normal
 - Moderate
 - High
 - Special
 - Error
- nLight Profiles are not configured out of box, and must be created during system startup.
 - The most typical practice for DR-associated nLight Profiles is to configure a setting called “Occupied Bright Level,” which sets the target light output associated with normal occupied condition. This setting allows light outputs of 100% to 1% (in 1% increments).
 - Within any nLight Profile, a Device Setting such as “Occupied Bright Level” can be configured individually (i.e., to different levels) for specific luminaires, devices, or zones.
 - Specific luminaires, devices or zones can be included or excluded from each DR-associated nLight Profile created.
- All nECY controllers and nGWY gateways with networked devices requiring automated demand response should be added to the nADR’s list of controllers/gateways. nADR-initiated nLight Profiles are not forwarded from an nECY/nGWY2 to other nECY/nGWY2 in the system – unlike BACnet-initiated nLight Profiles, which, once started on an nECY, are forwarded to start on other nECY controllers.
- DR events can be tested by using nLight Explorer, nGWY2 GFX (if installed), or SensorView to manually start a Profile to observe the lighting configuration.

Configuration

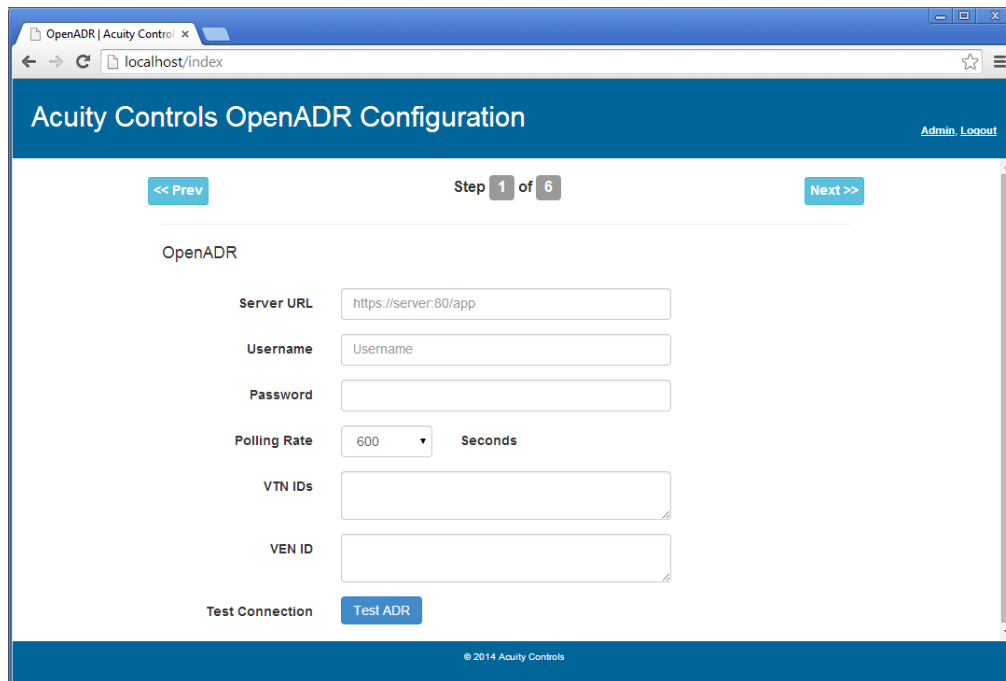


Figure 5 - nADR Web Interface showing VTN Configuration Parameters

The IP address of the OpenADR VTN server is configured in the nADR’s web server interface, as shown in Figure 5. The IP addresses of nECY controllers and nGWY2 gateways requiring automated demand response is also configured in the nADR web server interface.

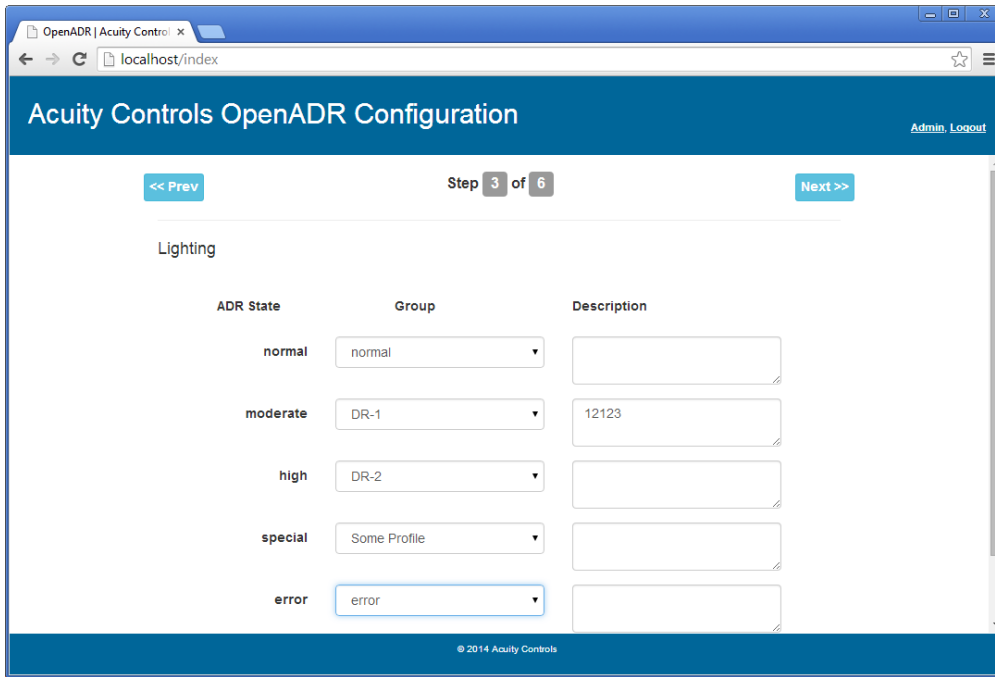


Figure 6 - nADR Web Interface showing nLight Profiles associated with DR event types

The nADR’s web interface configures the nLight Profiles associated with each specific DR event type, as shown in Figure 6.

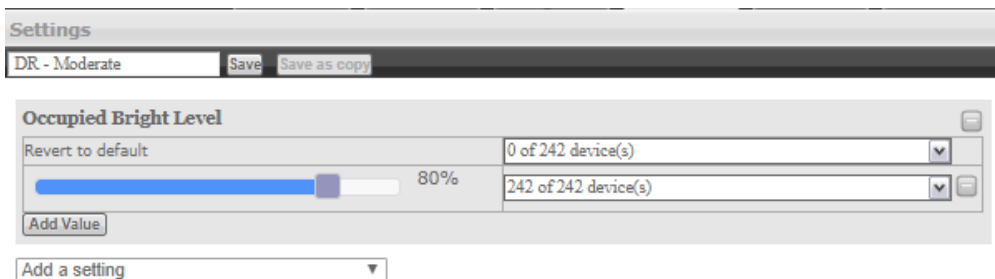


Figure 7 - Example Profile Settings for nADR Application

The device settings for DR-associated Profiles can be configured for specific luminaires, devices or zones using SensorView software interface, as shown in Figure 7.

Notes:

- nLight Profiles are not configured out-of-box and must be created by the controls startup technician.
- nLight Profiles are configured with priority relative to each other; it is important to ensure that DR-associated Profiles have higher priority than Profiles associated with normal operation, and to ensure



that high-severity DR Profiles are higher priority than low-severity DR Profiles. If Profile priorities are not appropriately configured, the network may operate at unexpected settings during DR events.

- At the start of each Profile, a networked device re-initializes its internal state machine, forcing it to re-evaluate conditions such as occupancy status, etc.
- nLight Profiles may be initiated by nLight Explorer application, nGWY2 GFX (if installed), or SensorView application to demonstrate DR commissioning to the owner and/or commissioning agent.

Application Requirements

The utility VTN server must support OpenADR 2.0a VEN clients.

The nADR must have an outbound https connection to the OpenADR VTN IP address (TCP 443).

The nADR must be connected to the same LAN subnet as other nECY controllers and nGWY2 gateways. See document “*nLight System Backbone IT Information*” for additional details regarding specific TCP and UDP port requirements.

Glossary

ADR or AutoDR

An acronym for “Automated Demand Response.” A term describing the ability for an electrical utility or grid operator to initiate a load reduction event during periods of high electrical demand. In commercial applications, typically an HVAC or lighting control system featuring AutoDR capability would be programmable to automatically respond to a demand response event by (a) reducing electrical demand during the event and, (b) restoring normal service at the end of the event. This term is used generically and does not refer to any specific protocol or implementation.

DR

An acronym for “Demand Response.” A term describing the concept of reducing electrical demand at a facility during periods of high utility electrical demand or high electricity price.

DRAS

An acronym for “Demand Response Automation Server.” This refers to a server, typically operated by an electrical utility, that is responsible for publishing demand response event data in real time.

nLight Automated Demand Response Level

This is a Default Setting in nLight AIR devices that determines the maximum light output that a device can operate during a given type of Demand Response event. The Automated Demand Response Level can be uniquely configured for each nLight Device or Zone. This level can also be set to “off” for non-essential lighting applications. The nECY invokes the appropriate Automated Demand Response Level setting, as determined by DR event type (e.g., moderate, high, critical severity) on all connected devices during a DR event. Devices with Automated Demand Response “Disabled” will not respond when an Automated Demand Response level is invoked.

nLight Profile

This is a specific configuration of Device Settings, such as Occupied Bright Level and Occupancy Time Delay, that is saved within an nLight ECLYPSE controller or nLight Gateway and deployed to individual devices in response to a schedule, BACnet change of state, manual wall control, or nADR status change. nLight Profiles are configured with a priority level, so that if multiple Profiles are active, the device adopts the settings defined in the highest-priority Profile. Typically, the nADR device is configured to trigger a specific Profile for a given AutoDR event severity level.

OpenADR

An acronym for “Open Automated Demand Response.” OpenADR is a specific set of standards and protocols managed by the OpenADR Alliance, a body composed of industry and utility partners. OpenADR. According to the OpenADR Alliance, “Open Automated Demand Response (OpenADR) is an open and standardized way for electricity providers and system operators to communicate DR signals with each other and with their customers using a common language over any existing IP-based communications network, such as the Internet.” Within the OpenADR standards there are multiple types of Automated Demand Response Profiles defined, such as 1.0, 2.0a, and 2.0b, indicating functionality and compatibility.

OpenADR 2.0a Profile

This defines the type of VEN supported by the nLight system. This should not be confused with the concept of an nLight Profile, which is used within the nLight system to distributed changes to Device Settings to nLight, nLight AIR, and XPoint Wireless networked devices.



VEN

An acronym for “Virtual End Node.” This is the technical term for an OpenADR client that receives an OpenADR signal from a server, also known as “Virtual Top Node” (VTN).

VTN

An acronym for “Virtual Top Node.” This is the technical term for an OpenADR server that transmits an OpenADR signal. VENS and other VTNs can be configured to receive OpenADR signals from a VTN.