

Project Implementation schedule

Describe the implementation schedule for the project.

Analysis Contact(s)

Provide contact information for the personnel responsible for tracking installations and for estimating loss reductions, including company name, individual(s) name, address, phone and email.

Section 2: Equipment Loading

Provide the hourly customer loads at this location in the report year. If individual loads use only some of the equipment contributing to the efficiency improvement, disaggregate the loads so that load can be determined for each piece of equipment.

Determine

(1) the average load on the line at its input on weekdays between 3:00 p.m. and 6:00 p.m., June through August

(2) total energy delivered to the line.

Where possible, the annual billed sales to the customers served by the equipment should be used as a check on the total energy usage assumed. Where these data are not available, describe the system configuration (e.g., secondary network) or database limitations that prevent such comparison.

Section 3: Base and Efficient Cases

Calculate and document energy losses for the efficient and base cases as outlined below.

Baseline-Case Losses

Compute the annual base losses in kWh as

$$\text{loss}_{\text{base}} = \sum_t [\text{kVA}_t + \text{FLC}]^2 \times \text{FLLL}_t + 8766 \times \text{NLL}_t$$

where

t = hour
FLC = full-load capacity or other convenient reference load
FLLL_t = load losses at FLC
NLL_t = no-load loss per hour

Compute the pre-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{base}} = \sum_h \{[\text{kVA}_h + \text{FLC}]^2 \times \text{FLLL}_h\} \div H + \text{NLL}_h$$

where

h = hour in the coincident peak period
H = number of hours in the coincident peak period

Where various pieces of equipment are subject to different loadings (e.g., the transformer bank serves the entire load, while each section of secondary serves half the load), compute losses for each type of equipment or load grouping.

Provide manufacturer's specifications or standard-reference data for typical baseline equipment for FLC, FLLL, and NLL.

Provide the spreadsheet in which the base losses are computed.

Efficient-Case Losses

Compute the annual losses of the efficient equipment as

$$\text{loss}_{\text{efficient}} = \sum_t [kVA_t \div FLC]^2 \times FLLL_e + 8766 \times NLL_e$$

where

- t = hour
- FLC = full-load capacity
- FLLL_e = load losses at full load
- NLL_e = no-load loss per hour

Compute the post-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{efficient}} = \sum_h \{ [kVA_h \div FLC]^2 \times FLLL_e \} \div H + NLL_e$$

where

- h = hour in the coincident peak period
- H = number of hours in the coincident peak period

Provide manufacturer's specifications or standard-reference data for typical baseline equipment for FLC, FLLL, and NLL.

Provide the spreadsheet in which the efficient-case losses are computed.

Savings

$$\text{Energy Savings} = (\text{loss}_{\text{base}} - \text{loss}_{\text{efficient}}) \times (1 + \text{UELF})$$

where

- UELF = Upstream Energy Loss Factor, the annual average change in losses on the primary distribution and transmission systems per kWh reduction in secondary losses

$$\text{Peak Savings} = (\text{peakloss}_{\text{base}} - \text{peakloss}_{\text{efficient}}) \times (1 + \text{UPLF})$$

where

- UPLF = Upstream Peak Loss Factor, the change in losses on the primary distribution and transmission systems per kWh reduction in secondary losses in the coincident peak period

If the utility has estimates of load-related losses on the primary distribution and transmission systems, and uses those estimates in screening customer end-use efficiency measures, it may add those losses to the load reduction due to efficiency improvements on the secondary distribution system. Provide the derivation of the estimate of primary and transmission losses, and demonstrate the consistency of the claimed losses with the loss values used for the savings behind the customer meter.

Section 4: Screening Inputs

Measure Life

Document the life of each type of added equipment, including reference to the utility's depreciation studies. The efficient case analysis is typically performed over the lifetime of the major components. Where some equipment has a useful life shorter than the analysis period, describe the rationale for the analysis period and assumptions regarding the replacement cost of equipment with lives shorter than the analysis period.

Discount savings with respect to existing equipment over time, to the extent that the utility would make this (or a similar) change in configuration in the foreseeable future to meet peak load or reliability requirements.

O&M Cost Effects

Include any foreseeable changes in O&M costs related to the changes in equipment and to any changes in operating practices.

Cost

Document the actual cost of the project, including equipment, internal and contract labor, allocated overheads, design, engineering, and permitting.

T&D Loss Reductions – Substation Transformer Analysis Protocol

This protocol defines the requirements for analyzing and documenting loss reductions due to installation of efficient substation transformers in any of the following contexts:

- **Incremental:** installation of one or more high-efficiency transformers instead of a new standard-efficiency transformer
 - when a new transformer is required at a new substation,
 - to increase capacity at an existing substation,
 - to replace a failed or failing transformer
- **Retrofit:** replacement of an existing transformer with a more efficient transformer, which may be more efficient due to higher-efficiency materials (such as an amorphous core) or due to lower capacity (with lower core losses).

Addition of a transformer or substation to change power flow on the network should be analyzed with the System Reconfiguration Protocol.

The Analysis Protocol is divided into four sections:

Section 1: Project Information

Section 2: Equipment Loading

Section 3: Base and Efficient Cases and Savings

Section 4: Screening Inputs

Section 1: Project Information

Project Title

Provide a unique title for the project. Example: "Installation of low-loss amorphous-core transformers at the Midway 138-12.5 kV substation".

Location

Identify the location of the project, by substation name, number, and address.

Technology Description

Describe the transformer(s) affected, including voltages and capacity.

Describe the high-efficiency transformer(s) installed in the project. Provide manufacturer specifications.

If this project consists of the incremental increase of efficiency at a new transformer, describe the standard-efficiency transformer that would have been installed under standard utility practice.

If this project consists of the retrofit of a lower-loss transformer in place of an existing transformer, describe the existing equipment that was replaced.

Project Implementation schedule

Define the implementation schedule for the project, including the date at which the transformer(s) were energized by month.

Analysis Contact(s)

Provide contact information for the personnel responsible for tracking installations and for estimating loss reductions, including company name, individual(s) name, address, phone and email.

Section 2: Equipment Loading

Provide the hourly load the transformer or substation in the current year and identify:

- (1) the maximum load on the equipment
- (2) the average load on the equipment on weekdays between 3:00 p.m. and 6:00 p.m., June through August (the coincident peak period)

Section 3: Base and Efficient Cases

Calculate and document energy losses for the efficient and base cases as outlined below.

Baseline-Case Losses

For each transformer included in the project, compute the annual pre-project losses in kWh as

$$\text{loss}_{\text{base}} = \sum_t [(kVA_t + FLC)^2 \times FLLL_b + 8766 \times NLL_b]$$

where

- t = hour
- FLC = full-load capacity
- FLLL_b = load losses at full load
- NLL_b = no-load loss/hour

Compute the pre-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{base}} = \sum_h \{[(kVA_h + FLC)^2 \times FLLL_b] \div H + NLL_b\}$$

where

- h = hour in the coincident peak period
- H = number of hours in the coincident peak period

Provide manufacturer's specifications, test results, or standard-reference data for the baseline transformer for FLC, FLLL, and NLL.

Provide the spreadsheet in which the base losses are computed.

If this project consists of the incremental increase of efficiency at a new transformer, provide information demonstrating that the assumed base efficiency is in fact standard practice, including:

Current Industry Practice – Document current industry practice using articles from industry journals, manufacturers' sales data, recent distribution standards from other utilities, and/or similar sources.

Applicant Practice – Document the utility's own recent standard practices through purchase records, distribution standards, and similar documents. Provide data on peak forecasts for the substation, supporting the adequacy of the base equipment.

If this project consists of the retrofit of a lower-loss transformer in place of an existing transformer,

Describe the existing equipment that was replaced.

Provide information demonstrating that the existing equipment could have remained in service.

Document that the existing equipment was functioning properly.

Provide certification that the existing equipment was adequate to meet anticipated loads.

Describe the disposition of the existing equipment. If the equipment has been or may be returned to service, explain how that return to service would not offset the claimed loss reductions.

Describe the manner in which the equipment was selected for replacement, and provide documentation to demonstrate that the retrofit was undertaken for loss reduction, rather than actual or imminent failure or inadequacy.

Efficient-Case Losses

For each transformer included in the project, compute the annual post-project losses in kWh as

$$\text{loss}_{\text{efficient}} = \sum_t [kVA_t \div FLC]^2 \times FLLL_e + 8766 \times NLL_e$$

where

- t = hour
- FLC = full-load capacity
- FLLL_e = load losses at full load
- NLL_e = no-load loss/hour

Compute the post-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{efficient}} = \sum_h \{ [kVA_h \div FLC]^2 \times FLLL_e \} \div H + NLL_e$$

where

- h = hour in the coincident peak period
- H = number of hours in the coincident peak period

Provide manufacturer's specifications the installed transformer for FLC, FLLL, and NLL.

Provide the spreadsheet in which the efficient-case losses are computed.

Savings

$$\text{Energy Savings} = (\text{loss}_{\text{base}} - \text{loss}_{\text{efficient}}) \times (1 + \text{TELF})$$

where

- TELF = Transmission Energy Loss Factor applicable to the transmission system upstream from the project substation

$$\text{Peak Savings} = (\text{peakloss}_{\text{base}} - \text{peakloss}_{\text{efficient}}) \times (1 + \text{TPLF})$$

where

- TPLF = Transmission Peak Loss Factor applicable to the transmission system upstream from the project substation

If the utility has estimates of load-related losses on the transmission system, and uses those estimates in screening customer end-use efficiency measures, it may add those losses to the load reduction due to efficiency improvements at distribution substations. For transmission substations, the utility may compute TLF as the portion of transmission losses attributable to voltages equal to or higher than those of the input voltage to the transformer.

Provide the derivation of the estimate of transmission losses, and demonstrate the consistency of the claimed losses with the loss values used for the savings behind the customer meter.

Section 4: Screening Inputs

Measure Life

Document the life of each type of added equipment, including reference to the utility's depreciation studies. The efficient case analysis is typically performed over the lifetime of the major components, in this case the transformers. Where some equipment has a useful life shorter than the analysis period, describe the assumptions regarding the replacement cost of equipment with lives shorter than the analysis period.

Where the utility would make a similar investment in the foreseeable future to meet peak load or reliability requirements, the analysis period should be limited to the period prior to that need date, and reflect the present value of the differences in capital costs.

Operations Effects

The estimates of baseline and efficiency case losses should reflect the operating practices expected to be in place for the base and efficient equipment.

O&M Cost Effects

Include any foreseeable changes in O&M costs related to the change in equipment (including the effect of replacing old equipment with new equipment) and to any changes in operating practices.

Cost

Document the actual cost of the project, including equipment, internal and contract labor, allocated overheads, design, engineering, and permitting.

T&D Loss Reductions – System Reconfiguration Analysis Protocol

This protocol defines the requirements for analyzing and documenting loss reductions due to changes undertaken to change network power flows and reduce losses, including (but not necessarily limited to) any of the following contexts:

- Addition of a substation or substation transformer.
- Addition of a new primary circuit or transmission line.
- Addition of capacitors.

The Analysis Protocol is divided into four sections:

Section 1: Project Information

Section 2: Equipment Loading

Section 3: Base and Efficient Cases and Savings

Section 4: Screening Inputs

Section 1: Project Information

Project Title

Provide a unique title for the project. Example: "Installation of new Midway 138-12.5 kV substation and reconfiguration of feeders K181 and K182".

Location

Identify the location of the project, by substation name, number, and address; line number and connecting substations; and/or other relevant identification.

Technology Description

Describe the equipment added, including voltages and capacity, and the major network elements (lines and substations) affected by the reconfiguration.

If the project includes the addition of capacitors, describe the connection of the capacitors (e.g., shunt, series), their kVAR capacity, and the levels to which they can be switched.

Project Implementation schedule

Define the implementation schedule for the project, including the date at which each major project element was put into service.

Analysis Contact(s)

Provide contact information for the personnel responsible for tracking installations and for estimating loss reductions, including company name, individual(s) name, address, phone and email.

Section 2: Equipment Loading

Provide the hourly loads on each of the major affected network elements for the last full year prior to the installation of the first element of the project.

For the current year, provide the hourly loads on

- (1) each of the major affected network elements identified above
- (2) each major element of the project (e.g., line, transformer or substation) in.

For capacitors, provide

- (1) the hourly loads in the current year on the substation or other equipment to which the capacitors are attached.
- (2) the hours in the current year for which the capacitors were activated at each kVAR level

Based upon the loading of the new equipment, identify N load patterns, such that each hour within the year is reasonably well represented by a load pattern and N is a tractable number for modeling and evaluation.

At least one load pattern should represent typical power flows during the coincident peak period (weekdays between 3:00 p.m. and 6:00 p.m., June through August).

The load pattern should be representative of the hours modeled, in terms of the direction of power flow, the level of power flow, and the operation of capacitors.

Describe the load-pattern selection process.

Identify the hours that are represented by each load pattern.

Loss reductions in some hours may be zero or nearly so (e.g., hours in which capacitors are switched off, hours with very low flows on the affected equipment). These hours may be ignored, so long as any increase in no-load losses is also insignificant.

Section 3: Base and Efficient Cases

Calculate and document energy losses for the efficient and base cases as outlined below.

Baseline-Case Losses

Using computer software appropriate to the application, model the relevant portions of the distribution and/or transmission system for each load pattern n (where $n = 1$ to N). Compute $loss_n$, the sum of load and no-load losses in the study area for load pattern n .

Where possible, compare the transmission flows and losses modeled for the load pattern for the actual metered loads in some hours of the pre-project historical period. Where such comparisons are not possible, explain why.

Determine annualized base pre-project losses in kWh as

$$loss_{base} = \sum_n loss_{n,b} \times hours_n \quad (1)$$

where

n = load pattern, $n = 1$ to N
 $loss_{n,b}$ = total modeled base losses in the study area
 $hours_n$ = hours in load pattern n

Compute the pre-project losses in the coincident peak period in kW as

$$peakloss_{base} = \sum_n loss_{n,b} \times hours_n + H \quad (2)$$

where

n = load pattern, for those load patterns representing the coincident peak period
 H = number of hours in the coincident peak period

Provide the spreadsheet in which the base losses are computed.

Post-project Losses

Using actual metered data where available and modeling results otherwise (using the same software used in the base case), compute total load and no-load losses in the study area for each load pattern for the actual conditions in the report year, with the project.

Compute annual post-project losses as

$$\text{loss}_{\text{efficient}} = \sum_n \text{loss}_{m,n,e} \times \text{hours}_n + \sum_t \text{loss}_{a,t} \quad (3)$$

where

$\text{loss}_{m,n,e}$ = losses in modeled load pattern n with the post-project actual configuration
 t = hours in the year, excluded hours expected to have negligible loss reductions
 $\text{loss}_{a,t}$ = actual losses in hour t in the report year

Compute the pre-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{base}} = \sum_n \{ \text{loss}_{a,e} \times \text{hours}_n + \sum_h \text{loss}_{a,h} \} \div H \quad (4)$$

where

n = load pattern, for those load patterns representing the coincident peak period
 h = hour in the coincident peak period in the report year
 H = number of hours in the coincident peak period

For comparison, provide the total modeled losses for the year and in the coincident peak period, with the post-project configuration.

Savings

$$\text{Energy Savings} = (\text{loss}_{\text{base}} - \text{loss}_{\text{efficient}}) \times (1 + \text{TELF})$$

where

TELF = Transmission Energy Loss Factor applicable to the transmission system upstream from the study area

$$\text{Peak Savings} = (\text{peakloss}_{\text{base}} - \text{peakloss}_{\text{efficient}}) \times (1 + \text{TPLF})$$

where

TPLF = Transmission Peak Loss Factor applicable to the transmission system upstream from the study area

If the utility has estimates of load-related losses on the transmission system, and uses those estimates in screening customer end-use efficiency measures, it may add those losses to the load reduction due to reconfiguration on the distribution system. For reconfigurations that affect flows on the transmission system, the utility may compute TLF as the portion of transmission losses attributable to voltages equal to or higher than those modeled in the study area.

Provide the derivation of the estimate of transmission losses, and demonstrate the consistency of the claimed losses with the loss values used for the savings behind the customer meter.

Section 4: Screening Inputs

Measure Life

Document the life of each type of added equipment, including reference to the utility's depreciation studies. The efficient case analysis is typically performed over the lifetime of the major components. Where some equipment has a useful life shorter than the analysis period, describe the rationale for the analysis period and assumptions regarding the replacement cost of equipment with lives shorter than the analysis period.

Where the utility would make this (or a similar) change in configuration in the foreseeable future to meet peak load or reliability requirements, the analysis period should be limited to the period prior to that need date, and reflect the present value of the differences in capital costs.

Operations Effects

The estimates of baseline and efficiency case losses should reflect the operating practices be expected to be in place in each configuration.

O&M Cost Effects

Include any foreseeable changes in O&M costs related to the additional equipment and to any changes in operating practices.

Cost

Document the actual cost of the project, including equipment, internal and contract labor, allocated overheads, design, engineering, and permitting.

T&D Loss Reductions – Voltage Conversion Analysis Protocol

This protocol defines the requirements for analyzing and documenting loss reductions due to increasing the voltage on an existing primary circuit or transmission line, where the voltage increase is not needed for additional capacity to meet load.

Where increasing the voltage on a primary circuit or transmission line is expected to significantly change power flow on the network, the effect on losses should be analyzed with the System Reconfiguration Protocol.

The Analysis Protocol is divided into four sections:

Section 1: Project Information

Section 2: Equipment Loading

Section 3: Base and Efficient Cases and Savings

Section 4: Screening Inputs

Section 1: Project Information

Project Title

Provide a unique title for the project. Example: "Increase Halfland-to-Midway transmission line from 69 kV to 115 kV."

Location

Identify the location of the project, by utility line number and names of substation(s) connected.

Technology Description

Describe the lines affected, including conductors, length, and pre- and post-project voltages.

Describe and enumerate the transformers connected to the line, both at substations and (for distribution projects) line transformers. Explain how each category of transformer was converted to the higher voltage (replacement, change in taps).

For any transformer replaced as part of the project, describe and provide manufacturer specifications for the original and replacement transformers.

Describe the required replacement of poles, insulators, sectionalizers, and other ancillary equipment.

Project Implementation schedule

Define the implementation schedule for the project, including the replacement of transformers and insulators, as required.

Analysis Contact(s)

Provide contact information for the personnel responsible for tracking installations and for estimating loss reductions, including company name, individual(s) name, address, phone and email.

Section 2: Equipment Loading

Identify whether power flow on the line is unidirectional or bidirectional, and if the latter, the share of hours of the report year in which power flowed in each direction.

For each interval-metered location along the line affected, provide the hourly loads in the report year and identify:

- (1) the average load on the line at its input on weekdays between 3:00 p.m. and 6:00 p.m., June through August

(2) total energy delivered to the line.

Provide any available information regarding the distribution of load along the line, including

(1) hourly load for large loads among the line (e.g., for distribution circuits, large commercial and industrial customers; for transmission circuits, substations, industrial customers and wholesale loads)

(2) where hourly data are not available, the distribution of annual deliveries along the line

Include the sources of the data and estimates. Explain any corrections for misread or missing data.

Define segments of the line based on the location of large point loads and the density of smaller loads, so that within each segment either:

(1) the current is constant within the segment, or

(2) the change in current per mile is constant within the segment (i.e., uniformly distributed load).

(In either case, "constant" means "to the extent feasible given data limitations.")

Demonstrate that the power flows on the segments are consistent with one another and the power delivered to the line input.

Take hourly amperage directly from data logs or compute from power-flow data.

Section 3: Pre-project and Post-Project Cases

Calculate and document energy losses for the efficient and base cases as outlined below.

Pre-Case Losses

For each segment of the line, compute the annual pre-project losses in MWh as

$$\text{loss}_{\text{pre}} = \Phi \times k \times \sum_t A_{\text{pre},i,t}^2 \times R \div 10^6$$

where

t	= hour
$A_{\text{pre},i,t}$	= amperage flowing into the segment
R	= resistance of the segment in ohms
Φ	= 1.73 for three-phase lines and 1.00 for single-phase lines
k	= 1.0, for segments with constant current
	= $(0.67 \times A_o + 0.33 \times A_i) \div A_i$, for segments with constant change in current per mile
A_o	= amperage flowing out of the segment

Compute the pre-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{pre}} = \Phi \times k \times \sum_h A_{\text{pre},i,h}^2 \times R \div 10^3$$

where

h	= hour in the coincident peak period
H	= number of hours in the coincident peak period

Provide manufacturer's specifications, test results, or standard-reference data for the conductor for R.

$A_{\text{pre},i,t}$ will normally be equal to $A_{\text{post},i,t} \times V_{\text{pre}} \div V_{\text{post}}$

Provide the spreadsheet in which the base losses are computed.

Post-Case Losses

For each segment of the line, compute the annual post-project losses in MWh as

$$\text{loss}_{\text{post}} = \Phi \times k \times \sum_t A_{\text{post},i,t}^2 \times R \div 10^6$$

where

- t = hour
- $A_{\text{post},i,t}$ = amperage flowing into segment *i* in hour *t*
- R_e = resistance of the segment in ohms
- Φ = 1.73 for three-phase lines and 1.00 for single-phase lines
- k = 1.0, for segments with constant current
 = $(0.67 \times A_o + 0.33 \times A_j) \div A_i$, for segments with constant change in current per mile
- A_o = amperage flowing out of the segment

Compute the post-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{post}} = \Phi \times k \times \sum_n A_{\text{post},i,h}^2 \times R \div 10^3$$

Provide the spreadsheet in which the efficient-case losses are computed.

Savings

$$\text{Energy Savings} = (\text{loss}_{\text{pre}} - \text{loss}_{\text{post}}) \times (1 + \text{TELF})$$

where

- TELF = Transmission Energy Loss Factor applicable to the transmission system upstream from the project

$$\text{Peak Savings} = (\text{peakloss}_{\text{pre}} - \text{peakloss}_{\text{post}}) \times (1 + \text{TPLF})$$

where

- TPLF = Transmission Peak Loss Factor applicable to the transmission system upstream from the project

If the utility has estimates of load-related losses on the transmission system, and uses those estimates in screening customer end-use efficiency measures, it may add those losses to the load reduction due to efficiency improvements on primary distribution lines. For transmission lines, the utility may compute TLF as the portion of transmission losses attributable to voltages equal to or higher than those of the input voltage to the project line.

Provide the derivation of the estimate of transmission losses, and demonstrate the consistency of the claimed losses with the loss values used for the savings behind the customer meter.

Section 4: Screening Inputs

Measure Life

Document the life of each type of added equipment, including reference to the utility's depreciation studies. The efficient case analysis is typically performed over the lifetime of the major components. Where some equipment has a useful life shorter than the analysis period, describe the rationale for the analysis period and assumptions regarding the replacement cost of equipment with lives shorter than the analysis period.

Where the utility would make this investment in the foreseeable future to meet peak load or reliability requirements, the analysis period should be limited to the period prior to that need date, and reflect the present value of the differences in capital costs.

Operations Effects

The estimates of baseline and efficiency case losses should reflect the operating practices be expected to be in place for the base and efficient voltage levels.

O&M Cost Effects

Include any foreseeable changes in O&M costs related to the change in equipment (including the effect of replacing old equipment with new equipment) and to any changes in operating practices.

Cost

Document the actual cost of the project, including equipment, internal and contract labor, allocated overheads, design, engineering, and permitting.

T&D Loss Reductions – Conductor Analysis Protocol

This protocol defines the requirements for analyzing and documenting loss reductions due to installation of efficient conductors in any of the following contexts:

- **Incremental:** installation of lower-resistance conductor instead of standard conductors
 - when a new primary circuit or transmission line is constructed,
 - to increase the capacity of an existing line,
 - when a line is relocated due to highway widening or similar conditions,
 - to replace aging conductor that is becoming unreliable due to mechanical stress
- **Retrofit:** replacement of existing conductor with lower-resistance conductor, where the replacement is not otherwise necessary to meet utility reliability standards.

For any of these contexts, the installation of the lower-resistance conductor must not be needed for additional capacity to meet load.

Addition of a primary circuit or transmission line to change power flow on the network should be analyzed with the System Reconfiguration Protocol.

The Analysis Protocol is divided into four sections:

Section 1: Project Information

Section 2: Equipment Loading

Section 3: Base and Efficient Cases and Savings

Section 4: Screening Inputs

Section 1: Project Information

Project Title

Provide a unique title for the project. Example: "Reconductor Halfland-to-Midway 69 kV transmission line from 3/0 ACSR to 336.4 ACSR".

Location

Identify the location of the project, by utility line number, names of substation(s) connected, and any other relevant geographical descriptors for the project (e.g., the roadways along with the relocation project is required).

Technology Description

Describe the lines affected, including voltages and length.

Describe the high-efficiency conductors installed in the project. Provide manufacturer specifications.

If this project consists of the incremental increase of efficiency for a new or replacement line, describe the conductor that would be installed under standard utility practice.

If this project consists of the loss-driven retrofit of existing conductor, describe the existing conductor.

Project Implementation schedule

Define the implementation schedule for the project, including the spans installed by month.

Analysis Contact(s)

Provide contact information for the personnel responsible for tracking installations and for estimating loss reductions, including company name, individual(s) name, address, phone and email.

Section 2: Equipment Loading

Identify whether power flow on the line is unidirectional or bidirectional, and if the latter, the share of hours of the report year in which power flowed in each direction.

For each interval-metered location along the line affected, provide the hourly loads in the report year and identify:

- (1) the average load on the line at its input on weekdays between 3:00 p.m. and 6:00 p.m., June through August
- (2) total energy delivered to the line.

Provide any available information regarding the distribution of load along the line, including

- (1) hourly load for large loads among the line (e.g., for distribution circuits, large commercial and industrial customers; for transmission circuits, substations, industrial customers and wholesale loads)
- (2) where hourly data are not available, the distribution of annual deliveries along the line

Include the sources of the data and estimates. Explain any corrections for misread or missing data.

Define segments of the line based on the location of large point loads and the density of smaller loads, so that within each segment either:

- (1) the current is constant within the segment, or
- (2) the change in current per mile is constant within the segment (i.e., uniformly distributed load).

(In either case, "constant" means "to the extent feasible given data limitations.")

Demonstrate that the power flows on the segments are consistent with one another and the power delivered to the line input.

Take hourly amperage directly from data logs or compute from power-flow data.

Section 3: Base and Efficient Cases

Calculate and document energy losses for the efficient and base cases as outlined below.

Baseline-Case Losses

For each segment of the line, compute the annual pre-project losses in MWh as

$$\text{loss}_{\text{base},i} = \Phi \times k \times \sum_t A_{it}^2 \times R_b \div 10^6$$

where

- | | |
|--------|---|
| t | = hour |
| i | = segment number |
| A_i | = amperage flowing into the segment |
| R_b | = resistance of the segment in ohms |
| Φ | = 1.73 for three-phase lines and 1.00 for single-phase lines |
| k | = 1.0, for segments with constant current
= $(0.67 \times A_o + 0.33 \times A_i) \div A_i$, for segments with constant change in current per mile |
| A_o | = amperage flowing out of the segment |

Compute the pre-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{base},i} = \Phi \times k \times \sum_h A_{ih}^2 \times R_b \div H + 10^3$$

where

h = hour in the coincident peak period
 H = number of hours in the coincident peak period

Provide manufacturer's specifications, test results, or standard-reference data for the conductor for R_b .

Provide the spreadsheet in which the base losses are computed.

If this project consists of the incremental decrease of resistance for a new or replacement line, provide information demonstrating that the assumed base efficiency is in fact standard practice, including:

Current Industry Practice – Document current industry practice using articles from industry journals, manufacturers' sales data, recent distribution standards from other utilities, and/or similar sources.

Applicant Practice – Document the utility's own recent standard practices through purchase records, distribution standards, and similar documents. Provide data on peak forecasts for the line, supporting the adequacy of the base conductor.

If this project consists of the retrofit of lower-loss conductor solely for loss reductions,

Describe the existing conductor that was replaced.

Provide information demonstrating that the existing conductor could have remained in service.

Document that the existing conductor was functioning properly.

Provide certification that the existing conductor was adequate to meet anticipated loads.

Describe the disposition of the existing conductor.

Describe the manner in which the line was selected for retrofit, and provide documentation to demonstrate that the retrofit was undertaken for loss reduction, rather than actual or imminent failure or inadequacy.

Efficient-Case Losses

For each segment of the line, compute the annual post-project losses in MWh as

$$\text{loss}_{\text{efficient},i} = \Phi \times k \times \sum_t A_{it}^2 \times R_e + 10^6$$

where

t = hour
 i = segment number
 A_i = amperage flowing into the segment
 R_e = resistance of the segment in ohms
 Φ = 1.73 for three-phase lines and 1.00 for single-phase lines
 k = 1.0, for segments with constant current
 = $(0.67 \times A_o + 0.33 \times A_i) \div A_i$ for segments with constant change in current per mile
 A_o = amperage flowing out of the segment

Compute the post-project losses in the coincident peak period in kW as

$$\text{peakloss}_{\text{efficient},i} = \Phi \times k \times \sum_h A_{ih}^2 \times R_e \div H + 10^3$$

Provide manufacturer's specifications, test results, or standard-reference data for the conductor for R_c .

Provide the spreadsheet in which the efficient-case losses are computed.

Savings

$$\text{Energy Savings} = \sum_i (\text{loss}_{\text{base},i} - \text{loss}_{\text{efficient},i}) \times (1 + \text{TELF})$$

where

TELF = Transmission Energy Loss Factor applicable to the transmission system upstream from the project

$$\text{Peak Savings} = \sum_i (\text{peakloss}_{\text{base},i} - \text{peakloss}_{\text{efficient},i}) \times (1 + \text{TPLF})$$

where

TPLF = Transmission Peak Loss Factor applicable to the transmission system upstream from the project

If the utility has estimates of load-related losses on the transmission system, and uses those estimates in screening customer end-use efficiency measures, it may add those losses to the load reduction due to efficiency improvements on primary distribution lines. For transmission lines, the utility may compute TLF as the portion of transmission losses attributable to voltages equal to or higher than those of the input voltage to the project line.

Provide the derivation of the estimate of transmission losses, and demonstrate the consistency of the claimed losses with the loss values used for the savings behind the customer meter.

Section 4: Screening Inputs

Measure Life

Document the life of each type of added equipment, including reference to the utility's depreciation studies. The efficient case analysis is typically performed over the lifetime of the major components. Where some equipment has a useful life shorter than the analysis period, describe the assumptions regarding the replacement cost of equipment with lives shorter than the analysis period.

Where the utility would make a similar investment in the foreseeable future to meet peak load or reliability requirements, including the need to replace aging conductor, the analysis period should be limited to the period prior to that need date, and reflect the present value of the differences in capital costs.

Operations Effects

The estimates of baseline and efficiency case losses should reflect the operating practices be expected to be in place for the base and efficient conductors.

O&M Cost Effects

Include any foreseeable changes in O&M costs related to the change in conductor (including the effect of replacing old conductor with new conductor) and to any changes in operating practices.

Cost

Document the actual cost of the project, including equipment, internal and contract labor, allocated overheads, design, engineering, and permitting.

VI. Appendices

A. Prototypical Building Energy Simulation Model Development

B. Custom Analysis Template

C. Documentation Summary Worksheet for Custom Projects

D. TRM Maintenance and Update Process

Appendix A – Prototypical Building Energy Simulation Model Development

Many of the savings values from the TRM are derived from DOE-2.2 simulations of typical commercial buildings. These prototypes were originally developed for the TRM document filed jointly by the Ohio electric utilities (*Technical Reference Manual (TRM) for Ohio Senate Bill 221, Energy Efficiency and Conservation Program and 09-512-GE-UNC*, October 15, 2009). They are based on building prototypes originally developed to calculate savings for California’s Database for Energy Efficient Resources (DEER), with certain parameters adjusted to Ohio building practice based on Duke Energy program experience and a review of the U.S. Energy Information Administration’s (EIA) Commercial Buildings Energy Consumption Survey (CBECS). The following sections provide a description of the prototypical buildings and a summary of key modeling assumptions.

Commercial Building Prototype Model Development

Commercial sector prototype building models were developed for a series of small commercial buildings with packaged rooftop HVAC systems, including assembly, big box retail, fast food restaurant, full service restaurant, grocery, light industrial, primary school, small office and small retail buildings. A large office prototype was also included to analyze measures associated with built-up HVAC systems. The following sections describe the prototypical simulation models used in this analysis.

Assembly

A prototypical building energy simulation model for an assembly building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table 11.

Table 11. Assembly Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	34,000 square feet Auditorium: 33,240 SF Office: 760 SF
Number of floors	1
Wall construction and R-value	Concrete block, R-5
Roof construction and R-value	Wood frame with built-up roof, R-12
Glazing type	Multipane Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Auditorium: 1.9 W/SF Office: 1.55 W/SF
Plug load density	Auditorium: 1.2 W/SF Office: 1.7 W/SF
Operating hours	Mon-Sun: 8am – 9pm
HVAC system type	Packaged single zone, no economizer
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

A computer-generated sketch of the prototype is shown in Figure 2.

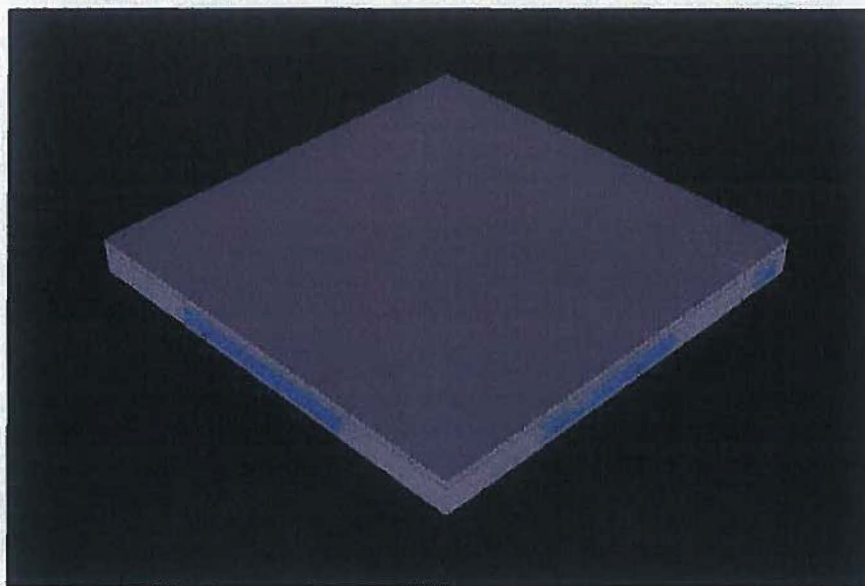


Figure 2. Assembly Building Rendering

Big Box Retail

A prototypical building energy simulation model for a big box retail building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table 12.

Table 12. Big Box Retail Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	130,500 square feet Sales: 107,339 SF Storage: 11,870 SF Office: 4,683 SF Auto repair: 5,151 SF Kitchen: 1,459 SF
Number of floors	1
Wall construction and R-value	Concrete block with insulation, R-7.5
Roof construction and R-value	Metal frame with built-up roof, R-13.5
Glazing type	Multipane; Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Sales: 2.15 W/SF Storage: 0.85 W/SF (Active) 0.45 W/SF (Inactive) Office: 1.55 W/SF Auto repair: 1.7 W/SF Kitchen: 2.2 W/SF
Plug load density	Sales: 1.15 W/SF Storage: 0.23 W/SF Office: 1.73 W/SF Auto repair: 1.15 W/SF Kitchen: 3.23 W/SF
Operating hours	Mon-Sun: 10am – 9pm
HVAC system type	Packaged single zone, no economizer

Characteristic	Value
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

A computer-generated sketch of the prototype is shown in Figure 3.

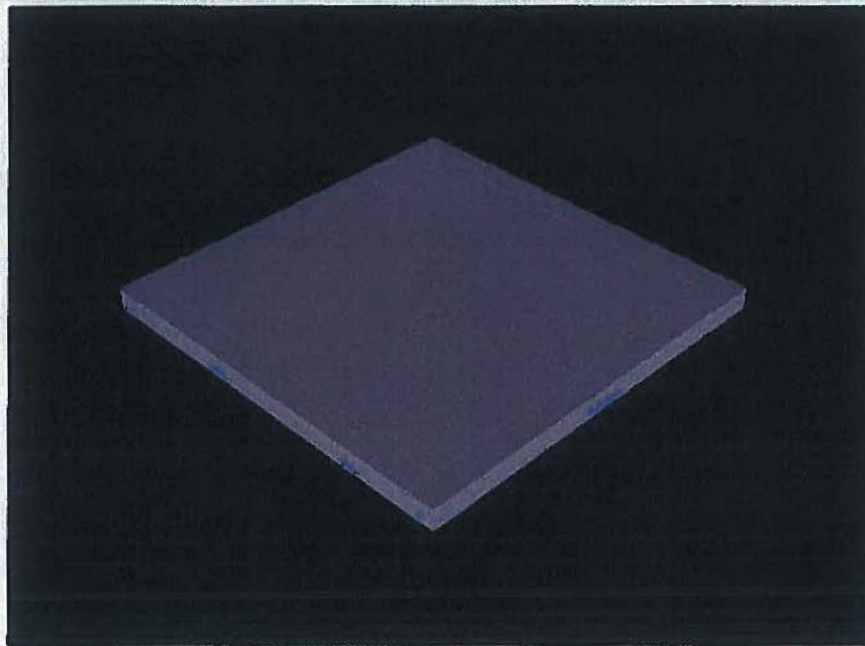


Figure 3. Big Box Retail Building Rendering

Fast Food Restaurant

A prototypical building energy simulation model for a fast food restaurant was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table 13.

Table 13. Fast Food Restaurant Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	2000 square feet 1000 SF dining 600 SF entry/lobby 300 SF kitchen 100 SF restroom
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer, R-7.5
Roof construction and R-value	Concrete deck with built-up roof, R-13.5
Glazing type	Multipane Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Dining: 1.7 W/SF Entry area: 1.7 W/SF Kitchen: 2.2 W/SF Restroom: 0.9 W/SF

Characteristic	Value
Plug load density	0.6 W/SF dining 0.6 W/SF entry/lobby 4.3 W/SF kitchen 0.2 W/SF restroom
Operating hours	Mon-Sun: 6am – 11pm
HVAC system type	Packaged single zone, no economizer
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

A computer-generated sketch of the prototype is shown in Figure 4.

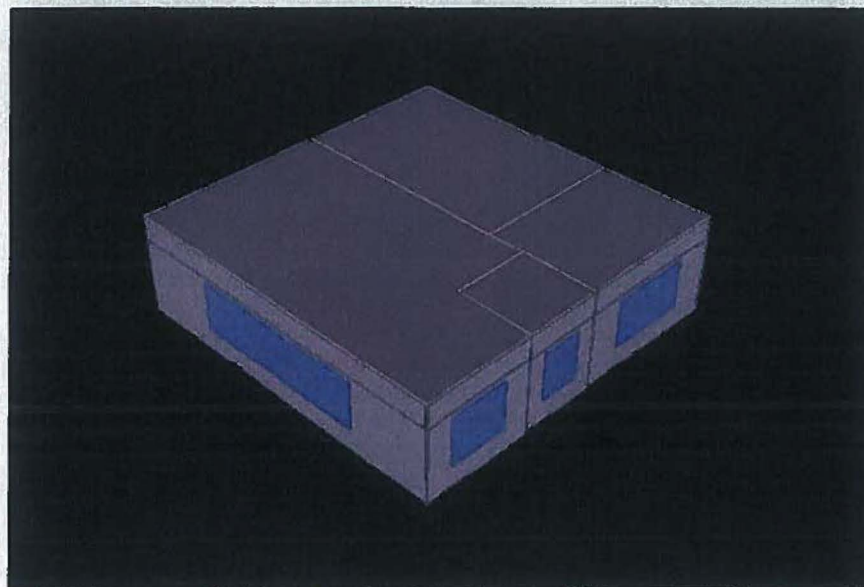


Figure 4. Fast Food Restaurant Building Rendering

Full-Service Restaurant

A prototypical building energy simulation model for a full-service restaurant was developed using the DOE-2.2 building energy simulation program. The characteristics of the full service restaurant prototype are summarized in Table 14.

Table 14. Full Service Restaurant Prototype Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	2000 square foot dining area 600 square foot entry/reception area 1200 square foot kitchen 200 square foot restrooms
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer, R-7.5
Roof construction and R-value	Wood frame with built-up roof, R-13.5
Glazing type	Multipane; Shading-coefficient = 0.84 U-value = 0.72

Characteristic	Value
Lighting power density	Dining area: 1.7 W/SF Entry area: 1.7 W/SF Kitchen: 2.2 W/SF Restrooms: 1.5 W/SF
Plug load density	Dining area: 0.6 W/SF Entry area: 0.6 W/SF Kitchen: 3.1 W/SF Restrooms: 0.2 W/SF
Operating hours	9am – 12am
HVAC system type	Packaged single zone, no economizer
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

A computer-generated sketch of the full-service restaurant prototype is shown in Figure 5.

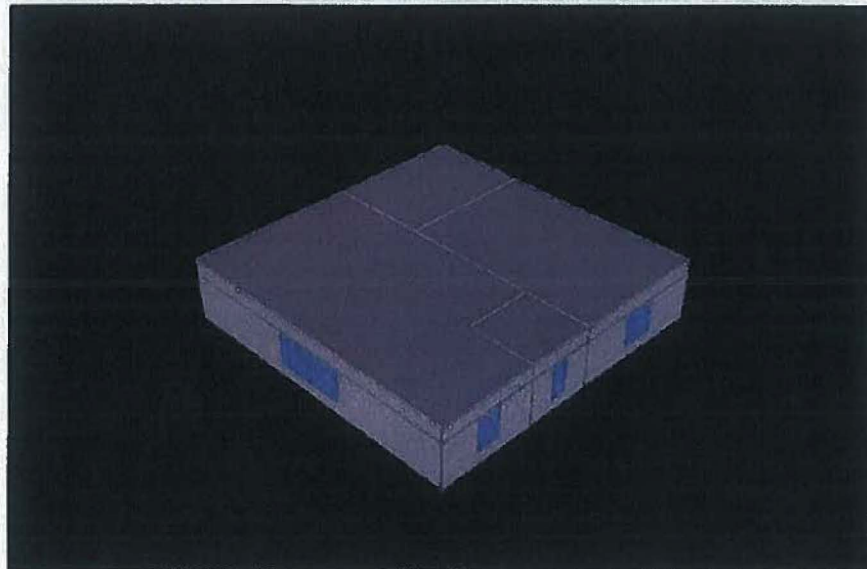


Figure 5. Full Service Restaurant Prototype Rendering

Grocery

A prototypical building energy simulation model for a grocery building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table 15.

Table 15. Grocery Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	50,000 square feet Sales: 40,000 SF Office and employee lounge: 3,500 SF Dry storage: 2,860 SF 50 °F prep area: 1,268 SF 35 °F walk-in cooler: 1,560 SF

Characteristic	Value
	- 5 °F walk-in freezer: 812 SF
Number of floors	1
Wall construction and R-value	Concrete block with insulation, R-5
Roof construction and R-value	Metal frame with built-up roof, R-12
Glazing type	Single pane clear
Lighting power density	Sales: 3.36 W/SF Office: 2.2 W/SF Storage: 1.82 W/SF 50°F prep area: 4.3 W/SF 35°F walk-in cooler: 0.9 W/SF - 5°F walk-in freezer: 0.9 W/SF
Equipment power density	Sales: 1.15 W/SF Office: 1.73 W/SF Storage: 0.23 W/SF 50°F prep area: 0.23 W/SF + 36 kBtu/hr process load 35°F walk-in cooler: 0.23 W/SF + 17 kBtu/hr process load - 5°F walk-in freezer: 0.23 W/SF+ 29 kBtu/hr process load
Operating hours	Mon-Sun: 6am – 10pm
HVAC system type	Packaged single zone, no economizer
Refrigeration system type	Air cooled multiplex
Refrigeration system size	Low temperature (-20°F suction temp): 23 compressor ton Medium temperature (18°F suction temp): 45 compressor ton
Refrigeration condenser size	Low temperature: 535 kBtu/hr THR Medium temperature: 756 kBtu/hr THR
Thermostat setpoints	Occupied hours: 74°F cooling, 70°F heating Unoccupied hours: 79°F cooling, 65°F heating

A computer-generated sketch of the prototype is shown in Figure 6.

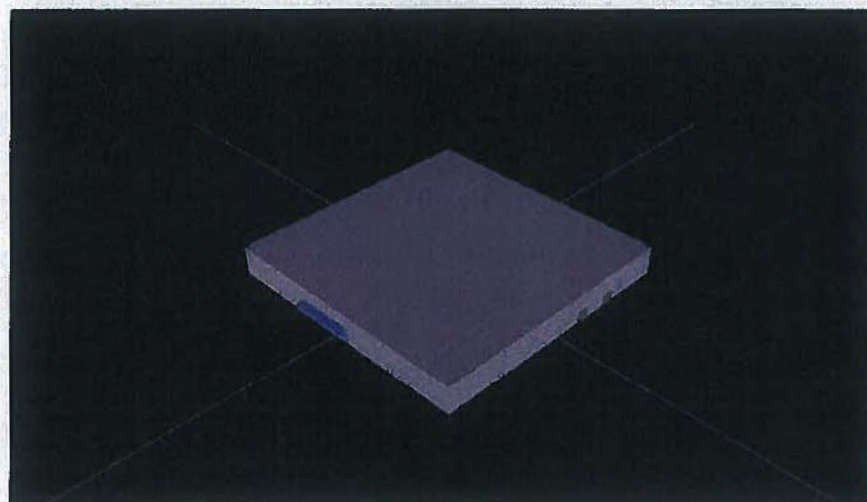


Figure 6. Grocery Building Rendering

Large Office

A prototypical building energy simulation model for a large office building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table 16.

Table 16. Large Office Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	350,000 square feet
Number of floors	10
Wall construction and R-value	Glass curtain wall, R-7.5
Roof construction and R-value	Built-up roof, R-13.5
Glazing type	Multipane; Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Perimeter offices: 1.55 W/SF Core offices: 1.45 W/SF
Plug load density	Perimeter offices: 1.6 W/SF Core offices: 0.7 W/SF
Operating hours	Mon-Sat: 9am – 6pm Sun: Unoccupied
HVAC system types	1. Central constant volume system with perimeter hydronic reheat, without economizer; 2. Central constant volume system with perimeter hydronic reheat, with economizer; 3. Central VAV system with perimeter hydronic reheat, with economizer
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.
Chiller type	Water cooled and air cooled
Chilled water system type	Constant volume with 3 way control valves,
Chilled water system control	Constant CHW Temp, 45 deg F setpoint
Boiler type	Hot water, 80% efficiency
Hot water system type	Constant volume with 3 way control valves,
Hot water system control	Constant HW Temp, 180 deg F setpoint
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

Each set of measures was run using each of three different HVAC system configurations – a constant volume reheat system without economizer, a constant volume reheat system with economizer and a VAV system with economizer. The constant volume reheat system without economizer represents system with the most heating and cooling operating hours, while the VAV system with economizer represents a system with the least heating and cooling hours. This presents a range of system loads and energy savings for each measure analyzed.

A computer-generated sketch of the prototype is shown in Figure 7. Note, the middle floors, since they thermally equivalent, are simulated as a single floor, and the results are multiplied by 8 to represent the energy consumption of the 8 middle floors.

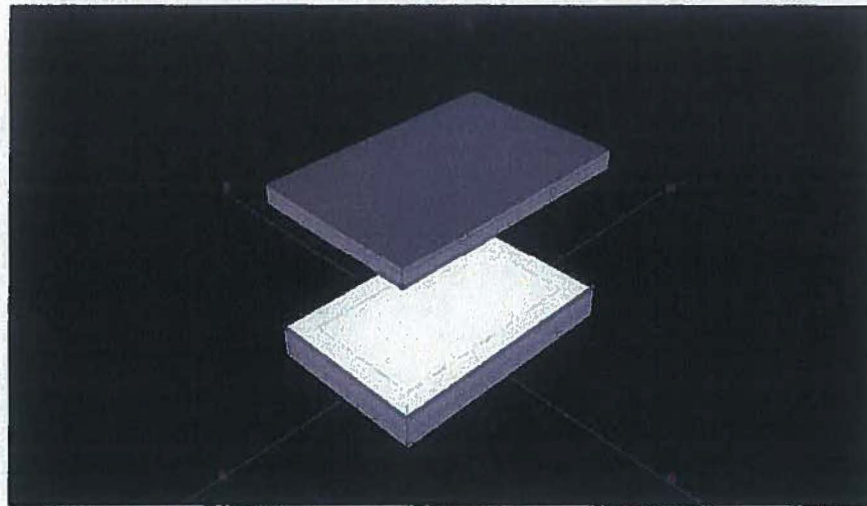


Figure 7. Large Office Building Rendering

Light Industrial

A prototypical building energy simulation model for a light industrial building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table 17.

Table 17. Light Industrial Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	100,000 square feet total 80,000 SF factory 20,000 SF warehouse
Number of floors	1
Wall construction and R-value	Concrete block with Brick, no insulation, R-5
Roof construction and R-value	Concrete deck with built-up roof, R-12
Glazing type	Multipane; Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Factory – 2.25 W/SF Warehouse – 0.7 W/SF
Plug load density	Factory – 1.2 W/SF Warehouse – 0.2 W/SF
Operating hours	Mon-Fri: 6am – 6pm Sat Sun: Unoccupied
HVAC system type	Packaged single zone, no economizer
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

A computer-generated sketch of the prototype is shown in Figure 8.

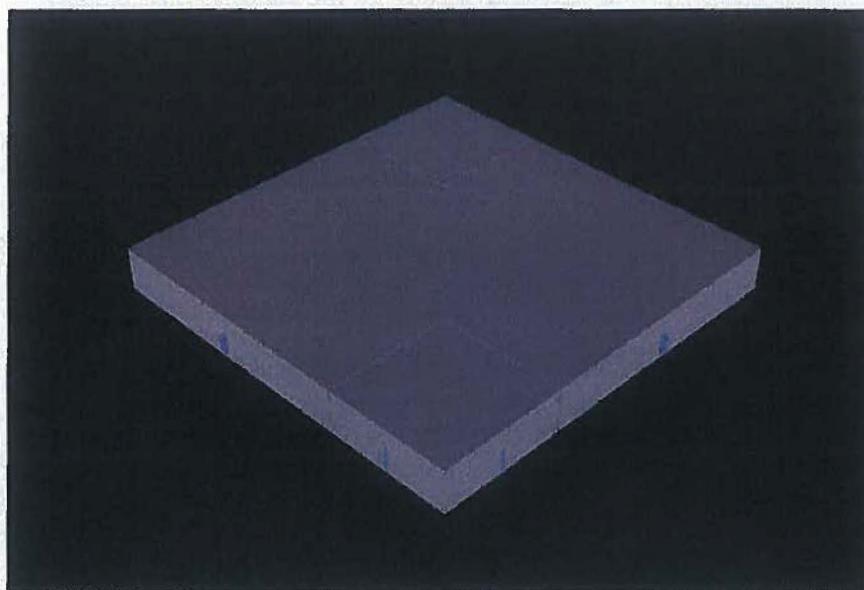


Figure 8. Light Industrial Building Rendering

Primary School

A prototypical building energy simulation model for an elementary school was developed using the DOE-2.2 building energy simulation program. The model is really of two identical buildings oriented in two different directions. The characteristics of the prototype are summarized in Table 18.

Table 18. Elementary School Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	2 buildings, 25,000 square feet each; oriented 90° from each other Classroom: 15,750 SF Cafeteria: 3,750 SF Gymnasium: 3,750 SF Kitchen: 1,750 SF
Number of floors	1
Wall construction and R-value	Concrete with brick veneer, R-7.5
Roof construction and R-value	Wood frame with built-up roof, R-13.5
Glazing type	Multipane Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Classroom: 1.8 W/SF Cafeteria: 1.3 W/SF Gymnasium: 1.7 W/SF Kitchen: 2.2 W/SF
Plug load density	Classroom: 1.2 W/SF Cafeteria: 0.6 W/SF Gymnasium: 0.6 W/SF Kitchen: 4.2 W/SF
Operating hours	Mon-Fri: 8am – 6pm Sun: 8am – 4pm
HVAC system type	Packaged single zone, no economizer

Characteristic	Value
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

A computer-generated sketch of the prototype is shown in Figure 9.

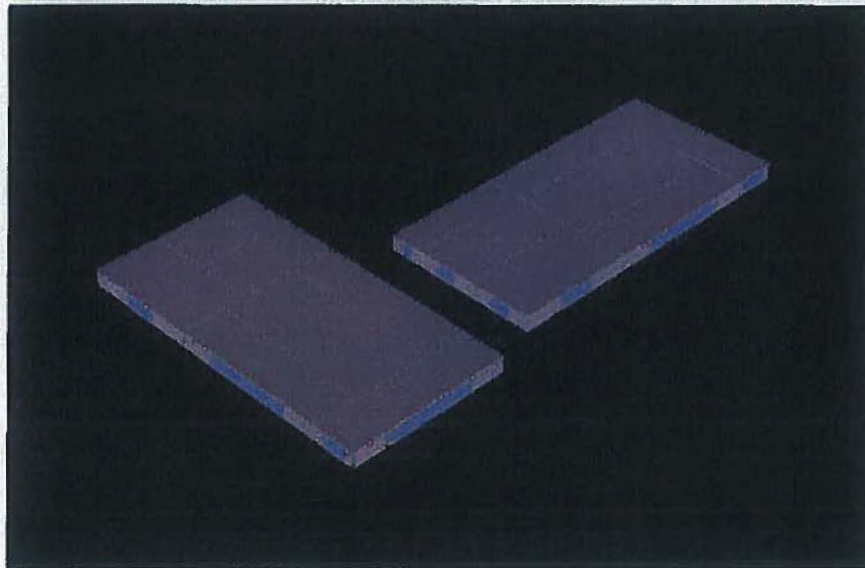


Figure 9. School Building Rendering

Small Office

A prototypical building energy simulation model for a small office was developed using the DOE-2.2 building energy simulation program. The characteristics of the small office prototype are summarized in Table 19.

Table 19. Small Office Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	10,000 square feet
Number of floors	2
Wall construction and R-value	Wood frame with brick veneer, R-7.5
Roof construction and R-value	Wood frame with built-up roof, R-13.5
Glazing type	Multipane; Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Perimeter offices: 1.55 W/SF Core offices: 1.45 W/SF
Plug load density	Perimeter offices: 1.6 W/SF Core offices: 0.7 W/SF
Operating hours	Mon-Sat: 9am – 6pm Sun: Unoccupied
HVAC system type	Packaged single zone, no economizer
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.

Characteristic	Value
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

A computer-generated sketch of the small office prototype is shown in Figure 10.

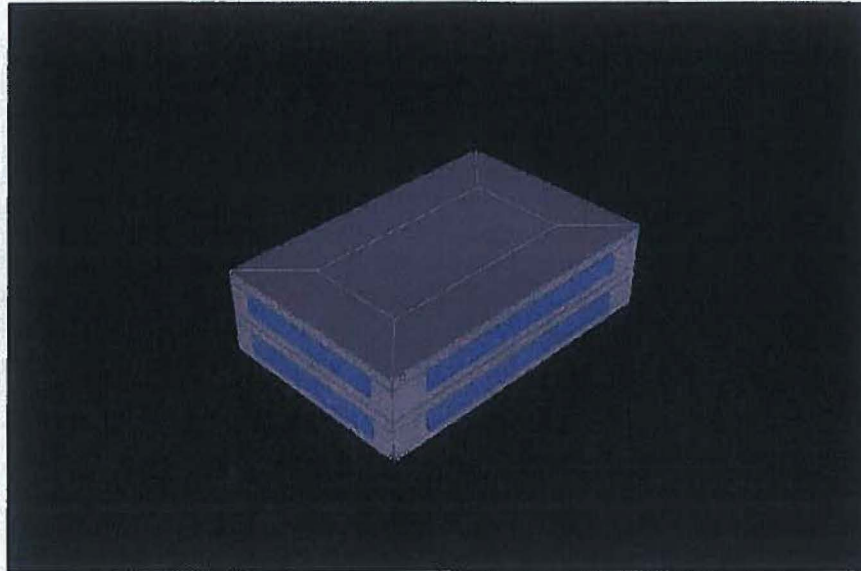


Figure 10. Small Office Prototype Building Rendering

Small Retail

A prototypical building energy simulation model for a small retail building was developed using the DOE-2.2 building energy simulation program. The characteristics of the small retail building prototype are summarized in Table 20.

Table 20. Small Retail Prototype Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	6400 square foot sales area 1600 square foot storage area 8000 square feet total
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer, R-7.5
Roof construction and R-value	Wood frame with built-up roof, R-13.5
Glazing type	Multipane; Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Sales area: 2.15 W/SF Storage area: 0.85 W/SF (Active) 0.45 W/SF (Inactive)
Plug load density	Sales area: 1.2 W/SF Storage area: 0.2 W/SF
Operating hours	10 – 10 Monday-Saturday 10 – 8 Sunday
HVAC system type	Packaged single zone, no economizer
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing assumed.

Characteristic	Value
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

A computer-generated sketch of the small retail building prototype is shown in Figure 11.

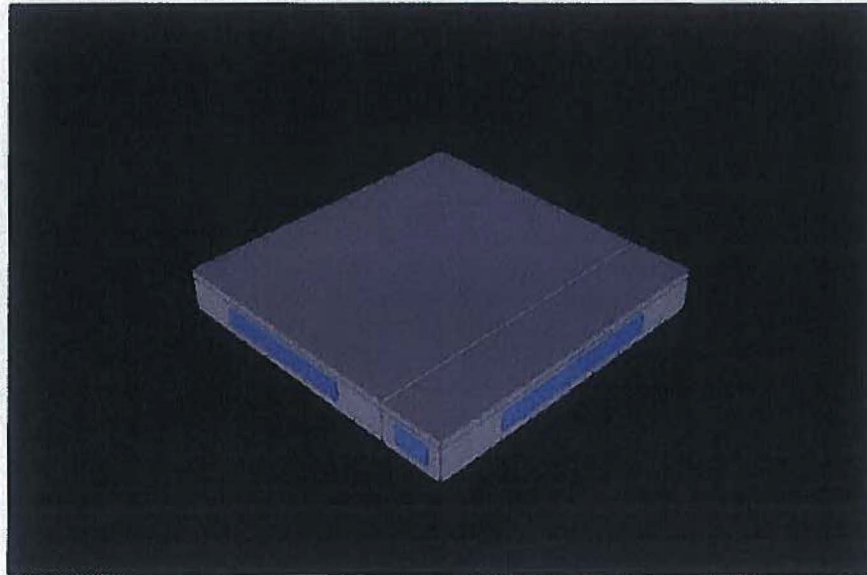


Figure 11. Small Retail Prototype Building Rendering

Weighting of Results

The simulation models provide results at a level of detail that sometimes surpass the normal data collection procedures from customer incentive applications and other EDC data collection. Thus, weights were assigned to individual simulation results, and the weighted averages were reported in the TRM sections where the added complexity of using building type-specific factors was unwarranted. The weights used for analysis were derived from Duke Energy data.

For the commercial building analysis, the weights assigned to each of the building types are shown below:

Table 21. Commercial Building Type Weights

Building Type	Weight
Assembly	0.118
Big Box	0.017
Fast food	0.017
Full Service	0.042
Light industrial	0.008
Primary school	0.059
Small office	0.176
Small retail	0.563

Note, the large office and grocery store models were used to analyze specific measures unique to the HVAC system and equipment types used in these buildings. Results relevant to these building types were reported separately and not included in the weighted averages.

Appendix B – Custom Analysis Template

A. Project Information⁷⁷⁹

Project Name

Date

Project, measure, metering and analysis information shall reflect the project as installed and operating. Directions to the user of the template are in this font throughout the document. Analysts should use a different font to document the project information. Submit all required utility and/or PUCO documentation, the completed Custom Analysis Template and associated documentation as indicated herein and in the TRM. List project documentation in the Documentation Summary Worksheet (Appendix C).

This template complements the Technical Reference Manual requirements for custom measure analysis. Refer to the appropriate TRM protocol to ensure adequate documentation of the custom analysis. The Sections in this template are labeled A - E as they do not directly correspond to the four sections in the TRM.

Table 22

Program Name	
Customer Name	
Site Name if Different	
Site Address	
Building or Site Type	
NAICS Code	
Customer Business/Product	
Building Size	
Project Start Date	
Start Date of Measure Installation	
Project Completion Date	
Applicable Codes &/or Standards	
Electric Utility & Account Number	
Meter Number	
Annual Electric Energy Use on Affected Meter	Pre-installation Annual kWh: Pre-installation maximum billed kW:

⁷⁷⁹ Section A of this document is based on a Measurement and Verification Template developed by Energy Resource Solutions for NYSERDA in 2010.

Rate	
Gas Utility & Account Number	
Meter Number	
Annual Gas Energy Use on Affected Meter	Pre-installation Annual Consumption Therms:
Rate	

Add rows as needed to provide the necessary information regarding any other energy sources are affected by this project (ie. Fuel oil or renewable energy)

Principal Customer Contact Name	
Title	
Phone	
Email	
Utility Representative Name	
Title	
Phone	
Email	
Custom Energy Analyst Contact Name	Technical lead for this custom analysis.
Title	
Company	
Phone	Office: Cell:
Email	
Mailing Address	
Additional Project Contact	
Role	
Title	
Company	
Phone	
Email	

Add lines as needed

Project Description

Describe the project and how it saves energy. Complete the following Project Savings Summary table based on the results of the savings analysis per Section D below.

Table 23 – Project Savings Summary

Measure Number	Measure Name	Electric Energy Savings (kWh/yr)	Coincident Demand Savings (kW)	Gas Savings (therms/yr)	Other Fuel Impacts
1					
2					

Measure Number	Measure Name	Electric Energy Savings (kWh/yr)	Coincident Demand Savings (kW)	Gas Savings (therms/yr)	Other Fuel Impacts
3					
Total Savings for All Measures					

Add information regarding other fuel impacts if the project impacts unregulated fuels such as fuel oil, renewable, etc. and indicate units in the header. Delete columns that are not applicable to the project, except electric efficiency projects must include Electric Energy and Coincident Demand columns. Add rows as needed to address all measures associated with the project. Show any increases in energy as a result of the project as a negative number (negative savings).

B. Measure Information

Document the following information for each project measure. Duplicate Section B for each unique measure. Include all information necessary to describe the equipment and how it operates, including manufacturer's information. Reference case studies of similar systems wherever possible. Reference supporting documentation in the Documentation Summary Worksheet. Duplicate the following sections as needed.

Measure Number and Name

Measure Description

Describe the new technology, measure, and/or change in operations, and how it saves energy.

Measure Performance in Comparison with Relevant Codes and Standards

Document the relevant efficiency codes or federal/state/local standards that apply to the proposed efficient equipment and the ratings of the measure equipment in comparison with applicable standards.

Additional Benefits

If the efficient measure was the result of a process improvement that provides additional benefits, such as waste reduction, clearly describe all of the ways that the new process saves energy and resources. This can include reductions in areas such as waste heat, O&M costs, labor costs, water consumption, or process waste.

Baseline Description

Describe the baseline condition. Reference the TRM requirements. Complete Documentation Summary Worksheet to document industrial process baselines for retrofit projects.

Relevant Codes and Standards

For New Construction and Equipment Replacement Projects the Baseline is the applicable code and/or standard. Clearly cite the reference code or standard used to