



Market Manual 5: Settlements

**Part 5.10: Transitional
Demand Response
Program**

Issue 4.0

This procedure describes the process to be followed by the *IESO* and *market participants* in applying to participate in and requesting payment for the Transitional Demand Response Program.

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Table of Changes

Reference (Section and Paragraph)	Description of Change
Section 1.1	Removed the notification step in the TDRP process.
Section 1.4	Revised this section to inform TDRP participants that they no longer need to submit an intent to participate in TDRP.
Section 1.5	Added information for the relevant <i>charge types</i> for this program.
Section 2.2	Removed Section 2.2 TDRP Notice of Intent to Provide Demand Response as this is no longer a requirement. Re-numbering in subsequent sections.
Section 3.2	Removed Section 3.2 TDRP Notice of Intent to Provide Demand Response to correspond to the removal of Section 2.2. Re-numbering in subsequent sections.
Appendix A	Removed IMO-FORM-1566.

Market Manuals

The *market manuals* consolidate the market procedures and associated forms, standards, and policies that define certain elements relating to the operation of the *IESO-administered markets*. Market procedures provide more detailed descriptions of the requirements for various activities than is specified in the "Market Rules". Where there is a discrepancy between the requirements in a document within a *market manual* and the "Market Rules", the "Market Rules" shall prevail. Standards and policies appended to, or referenced in, these procedures provide a supporting framework.

Market Procedures

The "Settlements Manual" is Volume 5 of the *market manuals*, where this document forms "Part 5.10: Transitional Demand Response Program".

A list of the other component part of the "Settlements Manual" is provided in "Part 5.0: Settlements Overview", in Section 2, 'About This Manual'.

Structure of Market Procedures

Each market procedure is composed of the following sections:

1. **'Introduction'**, which contains general information about the procedure, including an overview, a description of the purpose and scope of the procedure, and information about roles and responsibilities of the parties involved in the procedure.
2. **'Work Flow'**, which contains a graphical representation of the steps and flow of information within the procedure.
3. **'Procedural Steps'**, which contains a table that describes each step and provides other detail related to each step.
4. **'Appendices'**, which may include such items as forms, standards, policies, and agreements.

Conventions

The *market manual* standard conventions are defined in the "Market Manual Overview" document.

– End of Section –

1. Introduction

1.1 Purpose

This procedure describes the processes related to the Transitional Demand Response Program (TDRP) including:

- Application to participate, and
- Request for payment.

1.2 Scope

This procedure is intended to provide *market participants* and interested potential program participants with a summary of the steps and interfaces involved in the Transitional Demand Response Program. The procedural workflows and steps described in this document serve as a roadmap for *market participants* and interested potential program participants, and reflect the requirements set out in the "Market Rules" and applicable *IESO* policies and standards.

The overview information in Section 1.3, below, is provided for context purposes only, highlighting the main actions that comprise the procedure as illustrated in Section 2 and described in Section 3.

1.3 Overview

The objectives of the Transitional Demand Response Program (TDRP) are to help *market participants* overcome specific barriers to demand response (DR) in the short-term and increase the level of demand responsiveness in the Ontario electricity market over the medium and long term.

1.3.1 Application to Participate in the TDRP

The *IESO* will provide date(s) for deadlines to submit applications to participate in the TDRP.

Selection of participants for the program will be based on a two-stage process. In the first stage, the *IESO* will identify those applications that satisfy the program eligibility criteria based on the applications submitted by potential program participants. In the second stage, the *IESO* will score the eligible applications according to evaluation factors reflective of the *IESO*'s program objectives. Participants within a particular tranche (e.g. industrial applicants in the first round) will then be selected from the highest scoring eligible applicants within the tranche. The *IESO* will seek to select participants representing total DR capacity up to nominal targets established for each tranche.

1.3.2 Participant Eligibility Criteria

To be eligible to apply to participate in the TDRP an applicant must be an authorized *market participant* or be prepared to become an authorized *market participant* as a condition of acceptance in the TDRP. It is the responsibility of the applicant to ensure that they hold any applicable *licences* required by the *Ontario Energy Board*.

1.3.3 Project Eligibility Criteria

Applications must meet the following criteria in order to be eligible to participate in the program.

1. Participation in the program must overcome a barrier
2. The proposed demand response activities must be incremental to any current price response activities
3. The demand response provided must be measurable
4. Participants must provide assurance that the proposed demand response will endure beyond the program period
5. Projects (single *facility* or aggregation of *facilities*) must be not less than 250 kW and not more than 5 MW.

Details on these eligibility criteria are provided in Appendix B.

1.3.4 Ranking of Eligible Applicants and Apportionment of Program Target

Up to 100 MW of demand response will be accepted in the TDRP. The *IESO* will solicit applications for the TDRP in two rounds. The first round will close four to six weeks after the initial request for applications and the second round will close approximately three months after the initial request for applications. The *IESO* will *publish* the request for applications and provide the actual closing dates at that time. The *IESO* reserves the right at its sole discretion to modify and refine the program rules between rounds.

Projects accepted in the first round of applications must be commissioned and ready to participate within six months of acceptance by the *IESO*. Projects accepted in the second round must be commissioned and ready to participate within three months of acceptance by the *IESO*. Commissioning timelines may be altered at the discretion of the *IESO*.

The *IESO* has established goals for overall participation in the TDRP and desires a mix of applicants in all customer classes and segments. The provisional goals for each of the industrial, commercial and residential sectors are: Industrial - 40%; Commercial - 30%; Residential - 30%. These goals are 'soft' targets and the actual apportionment may differ from these goals.

For each of the three sectors in the first round, the *IESO* will seek to select the lesser of 50% of the provisional sectorial goal or the total DR capacity represented by eligible applicants in a given sector. For example, if the total capacity of eligible applicants from the commercial sector were only 35% of the provisional commercial goal, all of these applicants would be selected in the first round. If a particular sector is significantly under-represented in the first round of applications, the *IESO* may

choose to select more DR from other sectors in that round (with a corresponding reduction in the provisional sectorial goals in the second round in order to achieve the overall target for the sector).

In the event that the total DR capacity represented by eligible applicants in a given sector and in a given round exceeds the provisional sectorial goal for that sector, the *IESO* will choose from among the eligible applicants according to their overall ranking based on the evaluation factors as listed in Table 1-1 below. The selected participants will be chosen from the highest ranked eligible applicants to achieve total DR capacity roughly equal to the provisional sectorial goal. The ranking and selection of eligible applicants will be at the *IESO*'s sole discretion.

Table 1–1: Evaluation Factors Used to Rank Eligible Applications

Evaluation Factor	Weighting in Overall Ranking
Significance of barriers to be overcome	25
Overall fit with <i>IESO</i> TDRP objectives including but not limited to: <ul style="list-style-type: none"> • Permanence • Preference for load control vs. backup generation type projects 	25
Expected ability to leverage to other customers and segments	20
Degree to which the proposed DR addresses an “under-served” market segment or opportunity	15
Innovative approach	15
Total	100 points

1.4 Participation in TDRP

Once an applicant has satisfied all eligibility criteria and has been accepted to participate in the TDRP, it is eligible to provide demand response in any trading hour for which the three-hour ahead pre-dispatch price¹ reaches \$120/MWh.

It is not necessary for the TDRP participant to notify the *IESO* in advance of their intention to provide demand response.

¹ The current hour counts as the first of the three hours – for example, if the current time is 11:45 EST (HE 12), then the three-hour ahead pre-dispatch price will be for 14:00-15:00 EST (HE 15).

1.5 Settlement of TDRP

The payment for the demand response provided through the TDRP is the product of the three hour ahead pre-dispatch price to a maximum of \$500/MWh and the calculated demand reduction (the customer's actual consumption minus the customer's baseline consumption).

This credit will be applied as *charge type* 134, Demand Response Credit. Payment is applied at month-end on the *preliminary settlement statement* for the last *trading day* of the month following the month in which the demand response occurred.

Transitional Demand Response Program participants must download and complete IMO-FORM-1567 "Request for Payment for the Transitional Demand Response Program". Completed forms must be uploaded to the MPI no later than 17:00 EST, four *business days* after the last *trading day* of the month following the month in which the demand response was provided. The *IESO* will download the payment data to a database and process the *settlement amounts* on the *settlement statement* for the last *trading day* of the month following the month the demand response was provided.

Payment will be made for demand response provided in a trading hour up to a maximum of 5 MW and \$500/MWh. Payments will be based on data provided by the program participant subject to audit and recovery of any overpayment as enabled by section 4.7C.3 of Chapter 9 in the *market rules* (see: MR-00256-R00-R02). Transitional Demand Response Program participants are responsible for retaining all supporting data and documentation for each request for payment. The *IESO* or its agent may audit the supporting materials at any time.

Payment for demand response that cannot be verified through the audit, and that is determined to be an overpayment, will be recovered by the *IESO* and the TDRP participant may, at the *IESO*'s discretion, be disqualified from further participation in the program.

The corresponding setoff amount will be applied, using *charge type* 184 Demand Response Debit, as a non-hourly uplift to loads in the *IESO-administered market* in the *billing period* in which the *market participant* was paid.

1.5.1 IESO Public Appeals for Power

Participants with generation facilities approved for demand response under TDRP that responded to IESO public appeals for power by operating their generator may exclude this data from their baseline calculations when claiming payment for demand response provided.

1.6 Roles and Responsibilities

The roles and responsibilities for the Transitional Demand Response Program are shared between TDRP applicants/participants and the *IESO* and are set out in detail in sections 2 and 3 below.

1.7 Contact Information

Unless otherwise specified in a notice to the applicant, if the applicant wishes to contact the *IESO*, the applicant can contact the *IESO* via email at helpcentre@ieso.ca or via telephone, mail or courier to the numbers and addresses given on the *IESO*'s Web site (www.ieso.ca) - or click on 'Have a

question?’ to go to the ‘Contacting the IESO’ page). Normal business hours are weekdays 8:00 AM to 5:00 PM. Telephone messages or emails may be left in relevant voice or electronic *IESO* mail boxes, which will be answered on the next *business day*.

If a specific alternative contact is specified in the notices or communication with the applicant, the applicant should contact such *IESO* staff directly.

– End of Section –

2. Procedural Work Flow

The following diagrams, Figures 2-1 through 2-3, represent the flow of work and information requirements relating to the Transitional Demand Response Program for the *IESO*, the primary external participant involved in the program, and any other parties.

The steps illustrated in the diagram are described in detail in Section 3.

Table 2–1: Legend for Work Flow Diagrams

Legend	Description
Oval	An event that triggers a task or that completes a task. Trigger events and completion events are numbered sequentially within the procedure (01 to 99).
Task Box	Shows reference number, party responsible for performing the task (if “other party”), and the task name or a brief summary of the task. Reference number (e.g., 1A.02) indicates the procedure number within the current <i>market manual</i> (1), sub-procedure identifier (if applicable) (A), and task number (02).
Solid horizontal line	Shows information flow between the <i>IESO</i> and external parties.
Solid vertical line	Shows linkage between tasks.
Broken line	Links trigger events and completion events to preceding or succeeding task.

2.1 TDRP Application Process

Market participants and other potential program participants must apply to participate in the TDRP. The steps in the following diagram describe the process to apply and to be accepted in the program.

Figure 2-1 is described in detail in Section 3.1, Table 3-1.

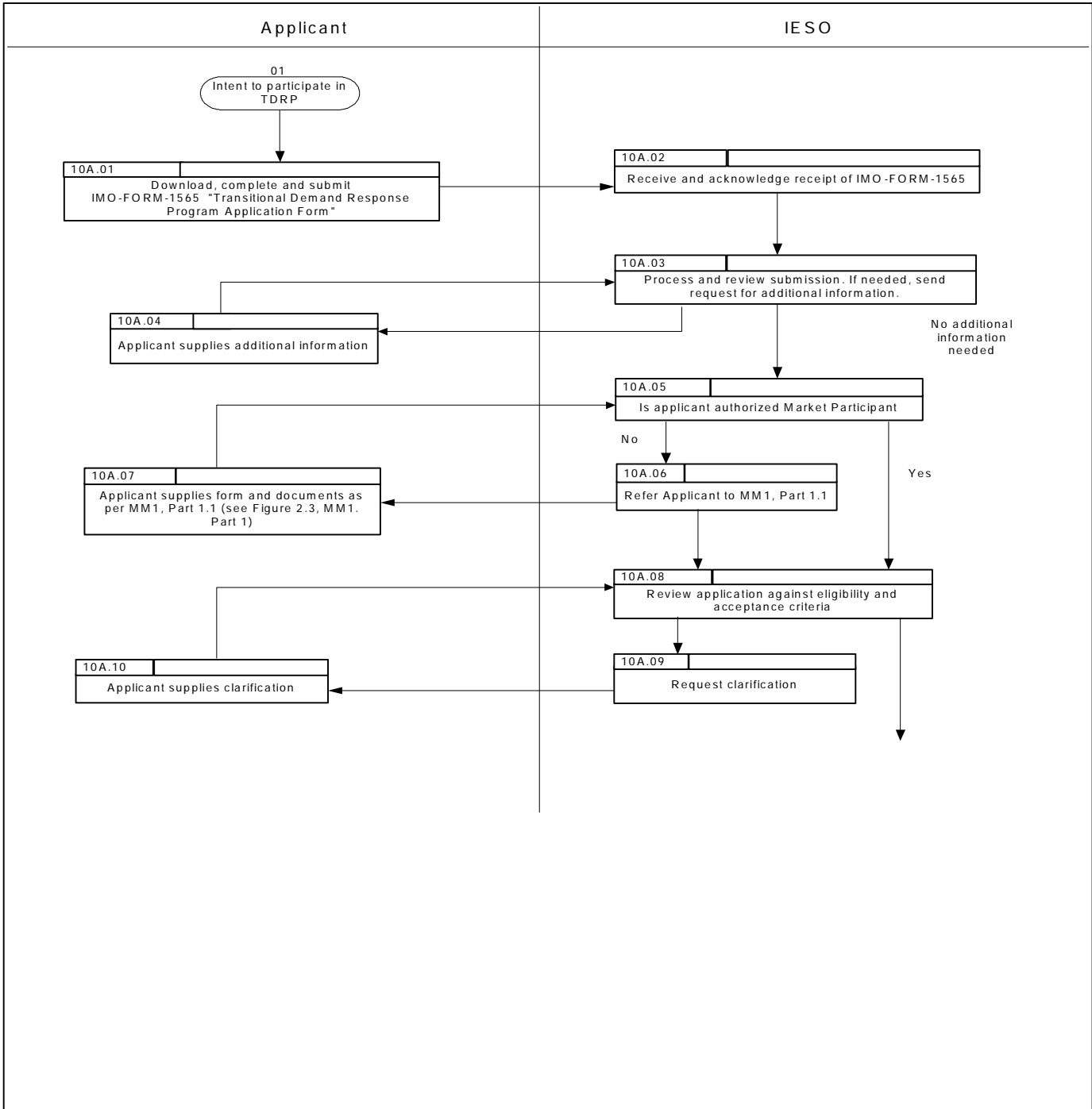


Figure 2–1: Work Flow for TDRP Application Process

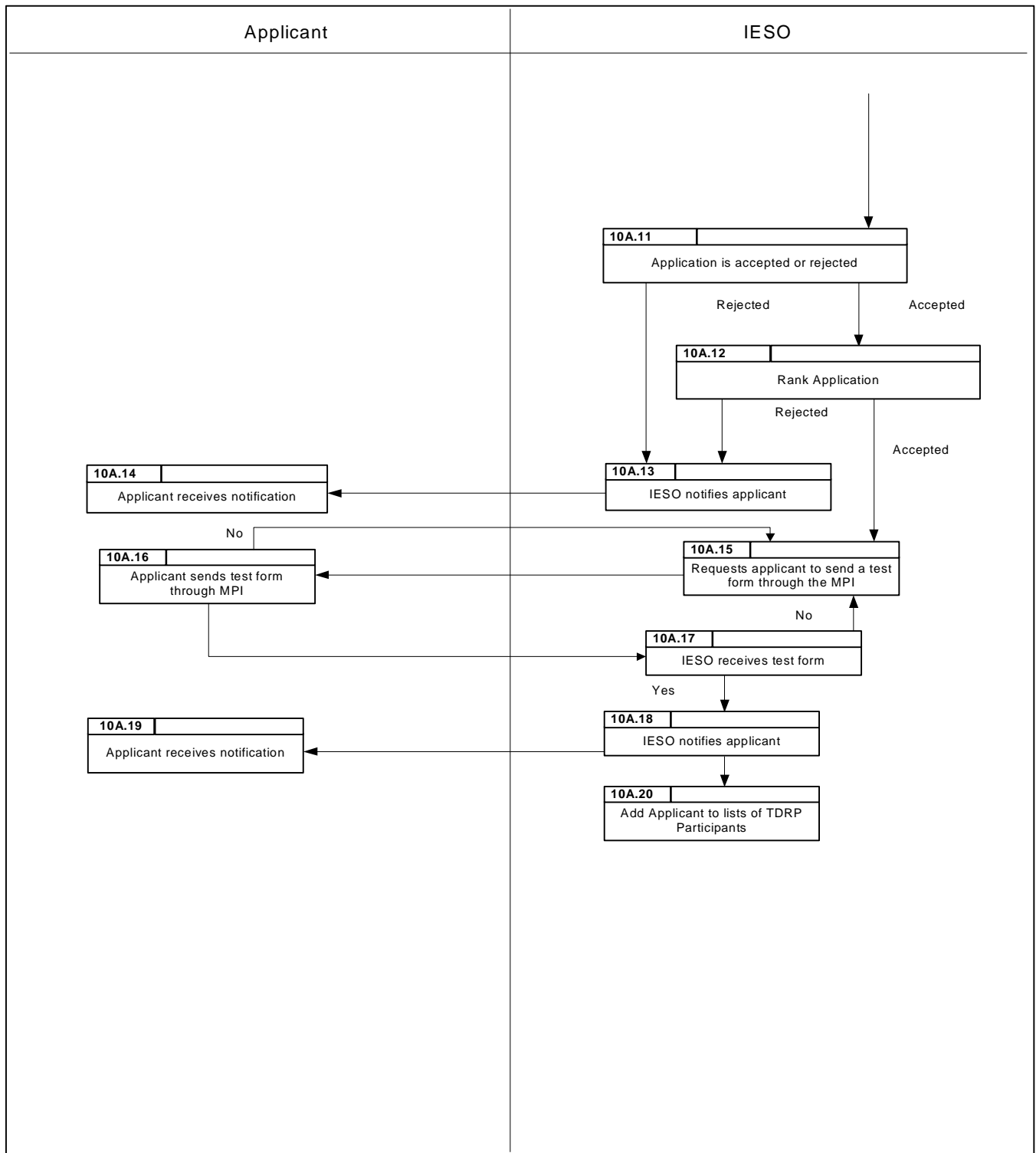


Figure 2–2: Work Flow for TDRP Application Process (continued)

2.2 TDRP Settlement Process

Within four *business days* after the last *trading day* of the month following the month in which the demand response was provided, TDRP participants must submit *settlement* data to the *IESO* in order to receive a payment. The steps in the following diagram describe the process to submit *settlement* data to the *IESO*. Figure 2–3 is described in detail in Section 3.2, Table 3–2.

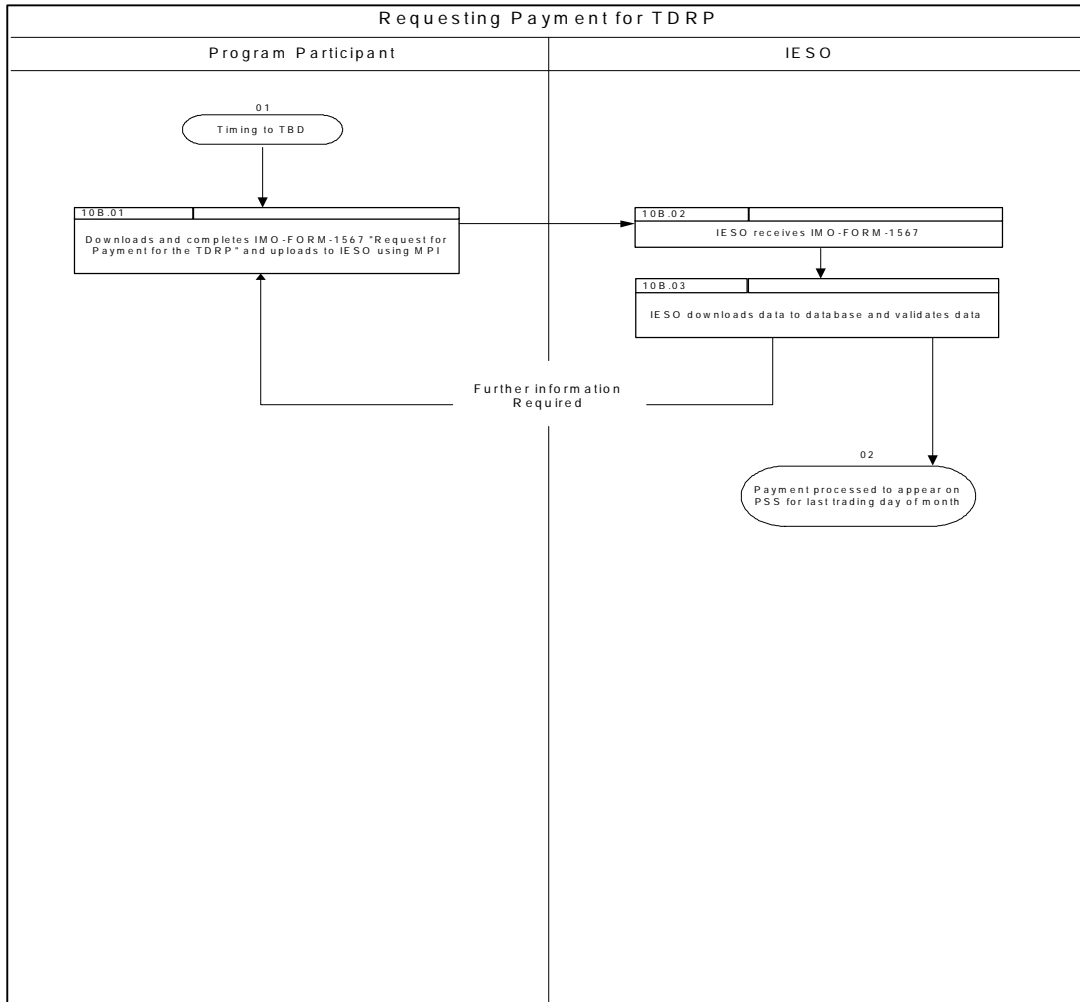


Figure 2–3: Work Flow for TDRP Settlement Process

– End of Section –

3. Procedural Steps

This section contains detail on the tasks (steps) that comprise the Transitional Demand Response Program. The steps in the following table are illustrated in Section 2.

The table contains seven columns, as follows:

Ref.

The numerical reference to the task.

Task Name

The task name as identified in Section 2.

Task Detail

Detail about the task.

When

A list of all the events that can trigger commencement of the task.

Resulting Information

A list of the information flows that may or must result from the task.

Method

The format and method for each information flow are specified.

Completion Events

A list of all the circumstances in which the task should be deemed finished.

3.1 TDRP Application Process

Market participants and other potential program participants must apply to participate in the TDRP. The steps shown in the following table are illustrated in Section 2.1, Figures 2-1 and 2-2.

Table 3–1: Procedural Steps for TDRP Application Process

Ref.	Task Name	Task Detail	When	Resulting Information	Method	Completion Events
10A.01	Download, complete and submit IMO-Form-1565.	Applicant downloads “Transitional Demand Response Program Application Form” (IMO-FORM-1565) from <i>IESO</i> Web site. The applicant completes the form and assembles any required supporting documents and submits it to the <i>IESO</i> .	Prior to deadline for applications.	Applicant has applied to participate in the TDRP.	Mail, courier, fax.	Application form submitted.
10A.02	Receive and acknowledge receipt of application form.	<i>IESO</i> receives application and supporting documents and sends an email acknowledging receipt.	After Step 10A.01.	Acknowledgement of receipt of application.	Email.	Applicant receives acknowledgement.
10A.03	Process and review application.	<i>IESO</i> reviews application. If additional information is required participant is notified.	After Step 10A.02.	Application to participate in the TDRP.	Email.	Request for information received.
10A.04	Applicant supplies additional information.	Applicant supplies additional information.	After Step 10A.03 if required.	Additional information to complete application.	Email, fax or mail.	Information received.

10A.05 to 10A.07	Determine if applicant is an authorized <i>market participant</i> .	<i>IESO</i> determines if applicant is an authorized <i>market participant</i> . If applicant is not a <i>market participant</i> , the <i>IESO</i> will refer them to the applicable process documents to become authorized. ²	After Step 10A.03.			Authorized <i>market participant</i> .
10A.08 to 10A.11	Review applications.	The <i>IESO</i> will review the application against the eligibility criteria. If additional information is required, the <i>IESO</i> may request that the applicant provide additional information.	After Step 10A.05.	Any additional information requested has been received.	Telephone, fax, email.	Complete application for review.
				Applications not meeting the eligibility requirements will be rejected and the applicant notified.		Applicants to be notified that application has been rejected.
				Those meeting the requirements will be ranked.		Application ready for ranking.
10A.12	Rank applications.	The <i>IESO</i> will rank applications meeting the eligibility requirements.	After Step 10A.08.	Applications to be accepted for the TDRP. ¹		Applications to be accepted.
				Applications not accepted for the TDRP.		Applications to be rejected.
10A.13	Notify applicant.	The <i>IESO</i> will notify applicants whose applications have not been accepted.	After Step 10A.08 or 10A.12.	Notification that application has not been accepted for the TDRP.	Fax and mail.	Applicant receives notification.
10A.14	Applicant receives notification.	The applicant receives notification that application to participate in TDRP has not been accepted.			Fax and mail.	
10A.15	Test form submission using	The <i>IESO</i> will notify the applicant that pending	After Step 10A.12 and when applicant	Applicant notified that application has been accepted	Fax.	

² An Application to Participate in the TDRP can be conditionally accepted by the *IESO* pending the authorization of the Applicant to participate in the *IESO*-administered markets.

	MPI.	successful upload of test form using MPI application for TDRP has been accepted.	is authorized to participate in the <i>IESO-administered markets</i> .	pending successful upload of test form.		
10A.16	Applicant performs test to upload test form using MPI.	Applicant uploads test form using MPI and <i>IESO</i> receives form.	After Step 10A.15.	Participant can upload forms using MPI.	Uploaded to the MPI.	Test to upload test form using MPI was successfully completed.
10A.17	<i>IESO</i> receives test form.					Test to upload test form using MPI was successfully completed.
10A.18	Notify applicant.	<i>IESO</i> notifies participant that application has been accepted and can now participate in TDRP.	After Step 10A.16.	Participant accepted in TDRP.	Fax and mail.	Participant receives notification. Ready to participate in the TDRP.
10A.19	Applicant receives notification.					Participant receives notification. Ready to participate in the TDRP.
10A.20	Participant added to list of TDRP participants.	<i>IESO</i> adds participant to list of accepted participants for the TDRP and files updated list.	After Step 10A.18.	Updated list of TDRP participants: http://www.ieso.ca/imoweb/market/content_center/participants_center.asp		

3.2 TDRP Settlement Process

TDRP participants must submit *settlement* data to the *IESO* in order to receive a payment. The steps shown in the following table are illustrated in Section 2.2, Figure 2–3.

Simulation of uploading procedure can be found at: <http://www.ieso.ca/iesoweb/marketplaceTraining/systemSims.asp>.

Table 3–2: Procedural Steps for Settlement of the TDRP

Ref.	Task Name	Task Detail	When	Resulting Information	Method	Completion Events
10B.01	Download, and submit form.	Program participant downloads IMO-FORM-1567, “Request for Payment for the TDRP”.	No later than 4 <i>business days</i> after the last <i>trading day</i> of the month following the month in which the demand response was provided.	<i>Settlement</i> information.	Excel spreadsheet uploaded to the MPI.	<i>IESO</i> receives form.
10B.02	<i>IESO</i> receives IMO-FORM-1567.					

Table 3–2: Procedural Steps for Settlement of the TDRP

10B.03	<i>IESO</i> downloads and validates <i>settlement</i> data.	<p><i>IESO</i> downloads <i>settlement</i> data provided in IMO-FORM-1567, “Request for Payment for the TDRP”.</p> <p><i>IESO</i> will validate 3-hour ahead pre-dispatch price, review claimed demand response quantity based on baseline data submitted on form.</p> <p>If information is missing or additional information required <i>IESO</i> will request participant submit information and provide date by which information is required.</p>	After Step 10B.01.	<p>Validated <i>settlement</i> data.</p> <p><i>Settlement amount</i> will appear as a manual line entry (<i>Charge Type 134 – Demand Response Credit</i>) on the <i>settlement statement</i> for the month following the month in which the demand response was provided</p>	Telephone, email and MPI.	<i>Settlement</i> ready data.
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– End of Section –

Appendix A: Forms

This appendix contains a list of the forms associated with the Transitional Demand Response Program. These are available on the *IESO* public Web site in the same location as this procedure. The forms included are as follows:

Form Name	Form Number
Transitional Demand Response Program Application Form	IMO-FORM-1565
Request for Payment for Transitional Demand Response Program	IMO-FORM-1567

– End of Section –

Appendix B: Project Eligibility Criteria

1. Participation Must Overcome a Barrier to DR

Participation in the TDRP must help participants to overcome one or more barriers to becoming more demand responsive. The primary barriers are:

- DR is not economic or the benefits are too uncertain
- Existing *market rules* or regulations impede provision of DR
- There is a lack of infrastructure to enable DR
- Lack of awareness of potential to provide DR

Each of these barriers and the specific information sought from applicants related to these barriers are discussed below.

Proposed DR is not economic without the expected payments from the TDRP

Applicants should substantiate any claim that the proposed DR is not economic without participating in the TDRP. Submissions should include details of the applicant's economic analysis related to the proposed DR, including:

- The capital investment (if any) required for provision of DR.
- The internal costs (if any) incurred for the provision of DR (e.g. one-time upfront costs or ongoing per-dispatch costs).
- The expected benefits accruing from the proposed DR under current market conditions and rules (including avoidance of high *energy* costs). These benefits should also reflect the applicant's assumptions regarding the number and duration of high *energy* cost events and the number of these events that could be captured through the proposed DR.
- The applicant's required financial criteria (e.g. target payback, hurdle rate, etc.) that must be satisfied.

Existing *market rules* or regulations are an impediment to the provision of DR

Applicants should substantiate any claim that *market rules* or regulations represent a barrier that participation in the TDRP would help overcome. This should include the following at a minimum:

- Reference to specific *market rules* and / or clauses in a code or regulatory instrument.
- A discussion as to how these rules and / or clauses are an impediment to the provision of DR.
- How participation in the TDRP helps to overcome this impediment.

Applicant does not currently have the necessary infrastructure to provide the proposed DR

Applicants should substantiate any claim that lack of infrastructure is a barrier that participation in the TDRP would help overcome. This would likely include the following at a minimum:

- Identification of the required infrastructure needed to allow provision of the proposed DR (this could include control equipment, storage capacity to allow certain processes to be temporarily shut down, integration of automation / control equipment with *market price* information, etc.).
- inventory of any existing infrastructure available to support the provision of the proposed DR.
- how the required infrastructure would complement and augment the existing infrastructure.

Customers are not aware of opportunities to provide DR or do not understand how to do so

Applicants should substantiate any claim that lack of awareness is a barrier that participation in the TDRP would help overcome.

Applicants proposing to aggregate DR from a group of customers should comment on the current level of awareness among the target customer group and discuss how they will overcome any lack of awareness among these customers. This should include the following at a minimum:

- Description of the specific customers being targeted.
- The specific DR these customers could provide.
- Steps the applicant will take to increase DR awareness among this customer group.

Other Barriers

Applicants may face other barriers to becoming more demand responsive, such as insufficient advance notice of high-priced periods. If so, applicants should provide a description of these other barriers and how participation in the TDRP will help to overcome them in their application.

2. Demand Response Activities Must Be Incremental To Any Current Price Response Activities

Applicants should provide evidence that the proposed DR will be incremental to any current price response activities. For applicants with interval metering, this evidence should include the following at a minimum:

- Derivation of a baseline for each of five days (see IMO_FORM_1565) in which the three-hour ahead pre-dispatch price exceeded \$120/MWh during periods in the one year period prior to April 16, 2004. This baseline should be developed consistent with the methodology described elsewhere in this document.
- Estimation of current price response activities for each of the five days (derived by subtracting the actual load from the baseline).

Applicants representing customers without interval *meters* should describe the target customer's current behaviour and current price response activities, if any.

3. Demand Response Provided Must be Measurable

A participant's DR will be determined based on the baseline less the actual load during a DR event. The baseline for a *trading hour* on a *business day* will be based on the high ten of past eleven same *trading hours* on *business days* immediately preceding the provision of the DR, excluding any hours in which the three hour-ahead pre-dispatch price was equal to or greater than \$120/MWh. If the source of demand response is separately metered local generation and the generator is the only source of DR at that meter, the generation baseline values are calculated based on the low ten of the past eleven same trading hours on business days immediately preceding the provision of the DR, excluding any hours in which the three hour-ahead pre-dispatch price was equal to or greater than \$120/MWh or the generator was run in response to Public Appeals for Power from the IESO.

For Saturdays or Sundays the baseline will be based on the same *trading hour* in the last five Saturdays or Sundays, respectively, excluding any days in which the three hour-ahead pre-dispatch price was equal to or greater than \$120/MWh. A variation to the baseline may be proposed by the applicant in the application to participate and will be evaluated by the IESO on a case by case basis. Acceptance of the variation will be solely at the discretion of the IESO. An example of an acceptable variation might include but not be limited to vacation or maintenance shut downs.

The IESO will allow applicants to propose the use of a weather correction adjustment to their baseline calculation methodology. Applicants proposing the use of a weather correction adjustment in their baseline calculation in situations where the inclusion of such an adjustment would materially improve the accuracy of the baseline should provide the rationale for and details of their proposed adjustment in their application. The IESO expects that the number of cooling (or heating) degree days and possibly the relative humidity at a nearby weather station for which data is publicly available would be appropriate input(s) for any weather correction adjustment, but applicants are free to propose alternative weather correction adjustments. Note that it is the IESO's intention that any weather correction adjustment should yield unique adjustment factors for each hour of the day even if the weather data upon which the adjustment is based is a daily average (such as cooling degree days). Hence, for any given day the weather correction adjustment for the hour starting at 10 am (EST) would be different than the weather correction adjustment for the hour starting at 3 pm (EST). Applicants wishing to include a weather correction adjustment in the baseline calculation methodology should compare and contrast 1) the estimated baseline (without weather correction) versus actual load against 2) the adjusted baseline (with weather correction adjustment) versus actual load. Allowance for a weather correction adjustment and selection of the adjustment mechanism will be at the IESO's sole discretion.

Measurement and Verification Protocol for Non-Interval Metered Load

Applicants proposing to include DR from non-interval metered loads must provide a proposed measurement and verification (M&V) protocol with their application. Guidelines for development of the M&V protocol are provided in Appendix C. The guidelines were developed by ISO-NE and adapted from its Load Response Manual with ISO-NE's permission.

4. Must Provide Assurance that Proposed DR Will Endure Beyond the Program Period

Applicants must provide assurance that 1) the supporting infrastructure and equipment will remain in place and 2) the proposed DR will extend beyond the duration of the TDRP. Applicants should:

- discuss whether or not the proposed DR capacity would continue following the expiration of the TDRP absent any other changes in *market rules*, regulatory codes or rate structures

- Estimate the amount and availability, if any, of DR capacity that would be available after the TDRP ends (and absent any changes in *market rules*, regulatory codes or rates structures) relative to that which would be provided under the TDRP.
- Identify the specific changes in *market rules*, regulatory codes or rate structures under which the DR would be permanent.

– End of Section –

Appendix C: Measurement and Verification Protocol Development³

The following materials were developed by ISO-NE and adapted from its Load Response Program Manual, with ISO-NE's permission.

The guidelines in this Appendix provide an opportunity for Applicants with customers without *facility*-wide interval metering to participate in the TDRP. Applicants must have the ability to cause their customers' electrical loads to be curtailed during a TDRP event and report back their customers' aggregated DR. Examples of potential DR strategies could include:

- Traditional direct load control, such as air-conditioner and electric hot water heater cycling and pool pump reductions
- Permission-based control of thermostat set-points
- Control of lighting circuits and dimmable ballasts
- Compressor controls on vending machines and refrigeration

Applicants have several options for measuring and submitting *energy* usage or load reduction data.

Developing an Acceptable Measurement and Verification (M&V) Plan

The objective of the Applicant's M&V Plan is to describe both the data acquisition procedure and the analysis methodology that will be used by the Applicant to determine their customers' aggregate DR. While unique issues may require attention on a case-by-case basis, all M&V Plans should address the following general issues.

Description of the load reduction measures

The M&V Plan should describe the nature of the load reduction measures, including the type of end-use equipment involved and the manner in which load will be controlled by the Applicant. It should also characterize the nature of the loads under control, with respect to factors such as whether the loads are constant, staged, or continuously variable; are weather or time-dependent; or have interactive effects on other loads. To verify the nature of load characteristics, some short-term monitoring may be necessary and the data included with the submittal of the M&V Plan.

- A constant load device is one that operates at the same demand (kW) whenever it is on, such as a bank of fluorescent lights controlled by a single switch or a single-speed compressor in a packaged air conditioner unit. Since demand is rarely perfectly constant, a load can be considered as constant if it varies by no more than 5-10% from its average value during operation.

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- A staged load is one that can operate at several fixed demand levels, such as a two-speed compressor in a packaged air conditioning unit.
- A continuously variable load can operate at any demand within some range – for example, a fan or pump motor with flow controls or a variable speed drive.

The M&V Plan should identify the specifications for each piece of end-use equipment affected by the load reduction strategy at each customer site. Relevant information may include the equipment capacity (kW, tons, horsepower, full-load amps, power factor, etc.), operating schedule, and customer controls (manual operation, *energy* management system, etc.).

Measurement and Monitoring Strategy

The measurement and monitoring activities proposed for calculating *energy* usage or load reduction are a central component of the M&V Plan, and the following set of issues should be addressed.

1. Monitored Parameter(s). At least three general options can be considered:
 - a. *Facility*-wide metering of demand (kW). This is the traditional approach allowed in load response programs in which load reductions are estimated based on the whole-premise interval *meters*. This approach is preferred if whole-premise interval metering already exists at a *facility*. However, this approach may not be appropriate if the curtailed loads are small relative to the total *facility* load due to the small “signal-to-noise ratio” or if installing whole-premise interval metering is not economic relative to other monitoring methods.
 - b. End-use interval metering of demand (kW). This approach may be more appropriate than Option (a) if curtailed loads are small relative to the building load, a *facility* does not currently have whole-premise interval metering or end-use demand (kW) data can be readily obtained from a building *energy* management or control’s system. However, consideration must be given to the possibility of interactive effects that may significantly alter loads on other end-use equipment. For example, control of dimmable ballasts may lead to higher use of task lighting. Therefore, M&V plans that propose end-use metering must describe why whole-premise interval metering is either not cost-effective or inappropriate.
 - c. End-use interval metering of a proxy variable for demand. This method may include measuring something other than demand (kW) such as current (amperage) and voltage or equipment status (on/off, operating time). This approach is characterized by similar attributes as Option (b), but also requires that a correlation be established between the monitored proxy variable and demand (kW). These correlations may be established by conducting short-term monitoring or a series of spot measurements of both parameters, and correlating the data sets (e.g., by performing a regression analysis) to estimate the functional relationship between the two parameters. Alternatively, engineering estimates of this relationship or use of equipment manufacturer’s data may be appropriate in some circumstances. For example, current and voltage measurements together with a power factor estimate an end-use’s demand (kW). Similar to Option (b) above, M&V Plans that propose end-use metering of a proxy variable must describe why whole-premise interval metering is either not cost effective or inappropriate.
2. Monitoring Interval and Period. The M&V Plan should specify the period over which monitoring will be conducted and the interval over which monitored values will be averaged, recorded and reported to *IESO*.

3. **Instrumentation.** The M&V Plan should identify the type of monitoring and data logging equipment (i.e. manufacturer and model number) to be used, and its accuracy, as indicated by calibration or manufacturer's data. All meters specified must be Measurement Canada approved.

If alternative methods of measuring demand are proposed (i.e. proxy variables, voltage, current, etc.) the calculated demand (kW) values from the monitoring data should achieve an accuracy of $\pm 2\%$ on the calculated demand (kW).

If the proposed methods rely on the measured current (amps) and the nominal voltage, the power factor of the end-uses must be included in the demand (kW) calculations. Furthermore, demand measurements for three-phase devices should be conducted on all phases in order to account for any phase imbalance.

If a *facility's energy* management system (EMS) will be used to record pulse output from a power transducer, the processing accuracy of the EMS must be verified.

4. **Sampling.** If sampling will be conducted, the M&V Plan should define each population to be sampled, the sample size, and the target level of precision and confidence. The M&V Plan should include all calculations conducted for determining the sample size and describe how the sample points will be selected. For additional information on sampling, refer to the section below titled "Sampling."

Load Reduction Calculation Methodology

The M&V Plan must describe how the Applicant will calculate its DR from the monitored data of individual end-use devices or customers. The Applicant must use the customer baseline methodology described elsewhere in the TDRP rules.

Calculating load reductions from a sample

If *energy* usage or load reductions will be measured for the entire population of controlled loads or customers, then the Applicant's aggregated *energy* usage or load reduction in each measurement interval and zone will be calculated as the sum of all individual measured *energy* usage or load reductions. However, if sampling will be conducted, the Applicant's aggregated *energy* usage or load reduction in each measurement interval and zone must be calculated from the monitoring data of the sample, and the M&V Plan should describe how this calculation will be performed.

The calculation methodology will take one of two general forms:

1. *Energy* usage or load reductions will be determined for each member of the sample and extrapolated to the population in terms of some average normalized value, such as the average kW reduction per unit, per ton of cooling capacity, per kW of connected load, or some other analogous unit.
2. A proxy variable for *energy* usage or load reduction (e.g., change in duty cycle) is determined for each member of the sample, and the *energy* usage or load reduction for the entire population is calculated based on the average measured value of the proxy variable and additional stipulated or measured input parameters for each member of the population (e.g., connected load).

A variety of other critical issues that relate to calculating *energy* usage or load reductions from a sample may also arise and should be addressed in the M&V Plan, including equipment failure and customer over-rides. For control technologies that allow the Applicant to determine over-ride rates

and signal failures, better accuracy is possible using these known rates and applying them to the savings for those with successful signal and no over-ride. For example, some thermostat control technologies allow the Applicant to know the signal failure and override for all members of the population. In this case, by separating out all members of the sample with signal failures or overrides, the variation in measured load reduction for the remaining sample points will be generally smaller than it would if the load reduction were calculated for the entire sample. The average load reduction for this subset of the sample can then be extrapolated to the portion of the population that had no signal failure or customer override.

Sampling

If sampling will be conducted, the M&V Plan must define each population to be sampled, the sample size, and the target level of precision and confidence. The M&V Plan must include all calculations conducted for determining the sample size and describe how the sample points will be selected.

Applicants using a Sampling Plan are likely to employ load reduction strategies that involve curtailing similar types of small loads dispersed across a large number of customer sites (e.g., cycling of residential air conditioners) or within a single customer *facility* (e.g., lighting circuits or vending machines). In some cases, it may not be feasible for the Applicant to individually monitor each piece of equipment, and it may be appropriate to monitor a representative sample. To do so, the Applicant must first identify the relevant populations and then determine the appropriate sample size for each population. After monitoring has been conducted, the Applicant must evaluate the distribution of its sample in order to recalculate their sample size for the following year.

Identifying the Relevant Populations

To monitor a sample of end points, the Applicant must first identify populations whose members (e.g., end-use devices, customers, lighting circuits) would be expected to have similar values for the monitored parameter. If the populations are defined too broadly, the sample will be unlikely to provide statistically significant results. Populations should consist of members that are similar with respect to:

1. Type and size of equipment affected by the load reduction strategy.
2. Usage patterns (e.g., residential vs. commercial).
3. Load control strategy (e.g., duty cycle control vs. thermostat set point control).

Determining the Appropriate Sample Size

The appropriate sample size depends on the target level of precision at some specified confidence interval. For all programs, the default statistical target is 90/10 (10% precision at a one-tailed 90% confidence level) in the load reduction (kW) amount.

A generally accepted methodology for calculating the appropriate sample size is to conduct simple random sampling for each population. To follow this approach, first calculate the sample size corresponding to an infinite population (n'), according to Equation (1):

$$n' = \left(\frac{z \times c.v.}{p} \right)^2 \quad (1)$$

Where z is the z -factor for a given confidence interval ($z = 1.282$ for a one-tailed 90% confidence interval); p is the precision ($p = 0.1$ for 10% precision); and $c.v.$ is the coefficient of variation, which is equal to the ratio of the standard deviation of the sampled variable to its average value. In general, the greater the expected variation in the variable from one device to the next – e.g., due to operational patterns or equipment size – the greater the value of $c.v.$ that should be used to calculate the sample size. If monitoring has already been conducted, the $c.v.$ should be based on the monitored data. Otherwise, a default initial value of $c.v. = 0.5$ should be used. For load reductions that are likely to have significant variations from one device to the next, a larger $c.v.$ may be necessary.

The sample size (n) for the finite population (N) can then be calculated according to Equation (2):

$$n = \frac{n'}{1 + n'/N} \quad (2)$$

Where n is rounded up to the nearest integer.

If an Applicant has multiple populations, as an alternative they may calculate sample sizes based on a stratified sampling approach, applied across all of the populations. This technique involves more complex sample size calculations, but will generally yield a smaller total number of sample points.

If the Applicant believes that the sample sizes corresponding to a 90/10 statistical target would result in onerous M&V costs relative to project benefits, they may propose a reduction in sample sizes. However, the IESO will then de-rate the Applicant's DR. To determine the level of de-rating, first calculate the precision at 90% confidence associated with the reduced sample size, according to Equation (3):

$$p = z \times c.v. \times \sqrt{\frac{N/n - 1}{N}} \quad (3)$$

The de-rating of load reductions is based on the difference between this precision and the target level of 10%. For example, if the precision associated with a reduced sample size is 15%, load reductions will be de-rated by $15\% - 10\% = 5\%$.

For any sample calculation methodology, it is advisable that the Applicants over-sample (e.g., by 10%) to compensate for potential data loss due to failures in monitoring equipment or other factors.

Evaluating the Sample Distribution Based on Monitoring Data

During the first year of participation a default value for the coefficient of variation (c.v.) will be set to 0.5. However, after some TDRP events, the Applicant can more accurately estimate the c.v. of the population, based on the monitoring data for these events. For simple random sampling, the procedure for evaluating the c.v. of each population is as follows:

1. For each hour of each load reduction event, calculate the mean value and standard deviation of the sampling variable (e.g., kW reduction per unit).
2. Based on the hourly standard deviation and mean values, calculate hourly values for the c.v., equal to the ratio of the standard deviation to the mean.
3. Calculate the average of the hourly c.v. values for all reduction events during the calendar year.

Based on these calculated c.v. values, the Applicant can re-calculate the appropriate sample size for the following program year, using Equations (1) and (2). If the calculated c.v. values are significantly larger than 0.5, this could indicate either that the population has a wide distribution with respect to the sampling variable, or that the population is composed of two or more distinct groups that should be disaggregated into separate populations. In the latter case, the Applicant should re-calculate the c.v. values for each separate population, based on the existing sample data from each of these groups.

M&V Plan Checklist

Applicants may wish to consult the following checklist to ensure that their M&V Plan addresses the necessary issues and contains adequate detail.

1. The M&V Plan describes the load reduction strategy and related end-use devices, identifying:
 - The type, quantity, and location of end-use devices that will be controlled
 - The manner in which end-use devices will be controlled
 - The general characteristics of the end-use devices, with respect to factors such as load variability, time- or weather-dependence, and interactive effects on other end-use equipment
 - Detailed specifications, to the extent possible, for each end-use device to be controlled, including nameplate capacity, operating schedule, and customer controls
2. The M&V Plan describes the measurements that will be conducted to calculate DR during TDRP events, identifying:
 - The parameters that will be measured
 - The duration over which monitoring will be conducted
 - The interval over which monitoring data will be averaged and recorded
 - The type of monitoring and data logging equipment to be used and their accuracy (include calibration data and/or manufacturer's spec sheets to verify instrumentation accuracy)
 - If applicable, the populations to be sampled, the target level of precision and confidence, and the sample sizes (include all calculations used to determine sample size)

3. The M&V Plan describes the methodology by which aggregate DR for each hour will be calculated from the monitoring data, identifying:
 - How the actual load will be calculated, for M&V strategies that involves the measurement of proxy variables
 - How the baseline load will be calculated, including the period used to calculate baseline loads and adjustments that will be made to account for weather or time of day
 - If sampling will be conducted, the calculation method by which monitored results from the sample will be applied to the entire population, including (if applicable) the effect of customer over-rides and signal or equipment failure

The following is a sample M&V Plan template for your consideration. Completion of a submission using the following (or similar) headings would provide the required information for a complete M&V Plan.

Template – TDRP Monitoring & Verification Plan

1.0 Measurement and Monitoring Strategy

1.1 Monitoring Parameters and Variables

1.2 Monitoring Interval and Period

1.3 Measurement Equipment Specifications

1.4 Measurement Data Collection and Management Plan

1.4.1 Measurement Data Validation, Editing and Estimating Plan

2.0 Statistical Sampling Plan

2.1 Description of Population(s)

2.2 Sample Size Calculations

2.3 Method of Sampling

3.0 Demand Reduction Calculation Methodology

– End of Section –

References

Document Name	Document ID

– End of Document –