Manitoba Hydro's TREE/RCM Rebuttal

1. NEED FOR WUSKWATIM

As required by the Terms of Reference for the CEC, MH/NCN has consistently demonstrated the need for Wuskwatim both to serve domestic load and to deliver power into the export market. The attractiveness of Wuskwatim as a resource to serve the Manitoba domestic load was first established through a screening analysis in comparison to a range of alternative options. Subsequently the attractiveness of Wuskwatim in comparison to the short list of most attractive options was illustrated in the long term economics analysis where options are compared one against another on an individual basis.

The attractiveness of Wuskwatim for export was demonstrated by the analysis of advancement from 2019 to 2010, where 2019 is the date for which the system requires new resources. It should be noted that, initially only a portion of Wuskwatim is required in 2019 to serve domestic load even under a drought of record. Subsequent to Wuskwatim, at the time when the further resources are developed to protect domestic needs under extreme potential droughts, under normal flow conditions the incremental energy from Wuskwatim will be delivered into the export market. This point illustrates that serving the domestic market and providing export power are inextricably linked and that any demonstration of need must consider both of these aspects. It is also of interest to note that the export market is, in effect, a hedge with respect to uncertainty in the precise determination of the need for Wuskwatim to serve domestic load, i.e. even under a load forecast which delays the need of Wuskwatim to serve domestic load until 2035, there is very little reduction in the economic attractiveness of this option.

Benefits from the advancement of Wuskwatim include:

a) improvement in the economic and financial health of Manitoba's only electrical utility allowing continuation of one of the lowest utility rates in all of North America,

b) increasing the reliability of the hydro system with the additional source of supply and in the event of higher than predicted load growth in Manitoba,

c) economic stimulation, especially with respect to northern communities; and

d) reducing greenhouse gas emissions with the displacement of natural gas and coal development that would otherwise occur in the export marketplace. This is achieved from the addition of an energy source that is clean and renewable and with a manageable degree of risk.

In determining project need before the CEC, it is important to note that there is a commitment by Manitoba Hydro to proceed with other attractive options. Further it is important that in making this commitment, it has been shown that the adoption of such potentially attractive options, such as a significantly enhanced DSM program, does not render Wuskwatim unattractive. Conversely it has also been shown that these options would not subsequently become unattractive by the development of Wuskwatim. MH/NCN has amply demonstrated both of these considerations.

This examination yields a conclusion that Wuskwatim is economic compared to expanding DSM or developing wind power beyond that level which is economic.

Analysis of the Attractiveness of Wuskwatim in Comparison to Other Options

In response CEC/TREE/RCM NFAAT – 1, TREE/RCM state that "Manitoba Hydro has not demonstrated that Wuskwatim needs to be developed for a 2009/10 in-service date in order to fulfill its mandate to export power. Advancing Wuskwatim to 2009/10 is not the only way … to take full advantage of the export market." Contrary to this assertion, in Chapter 4 "Resource Options" and Attachment 2 "Generation Technology Review" of the CEC NFAAT submission as well as in analyses and previous reports submitted as part of the CEC interrogatory process, there is considerable examination of a number of various ways that power could be delivered to the export market.

In this same response TREE/RCM further state in regard to Wuskwatim "Whether it is the best way has not been seriously addressed by the proponent". While acknowledging that Manitoba Hydro is in the process of evaluating an expanded and promising DSM program, additional DSM would be a complement to the development of Wuskwatim. As stated previously neither consideration of the expanded DSM program nor the Wuskwatim project has any significant effect of one project on the other. They are complementary in terms of economics, rates and the environment.

Attractiveness of Wuskwatim in Comparison to Distributed Generation

TREE/RCM's economic argument as discussed in MH/NCN/TREE/RCM NFAAT III – 1 appears to hinge on the possibility of whether a package of DSM/DG (Distributed Generation) could be put together such that it would be economically more attractive than Wuskwatim. Although this argument lacks economic soundness as discussed below, it has been demonstrated (in the medium low-load growth sensitivity) that even if a DSM/DG option significantly larger than Wuskwatim were to be adopted first it would have a very small effect on the economics of Wuskwatim.

The argument of creating a package of DSM/DG to compare to Wuskwatim lacks economic soundness as DSM, DG and Wuskwatim are all independent projects. This means that DG can be compared directly to Wuskwatim. There is no more rationale to create a package of DSM and DG than there is to create an equivalent package of DSM and Wuskwatim.

In CEC/TREE/RCM NFAAT – 1, TREE/RCM considers 250 MW of wind as an example of DG. Besides DSM, the only option that TREE hints can compete with Wuskwatim is wind (as an example of DG). Despite TREE's contention that "Manitoba Hydro has not demonstrated that Wuskwatim needs to be developed for a 2009/10 in-service date in order to fulfill its mandate to export power" because "Advancing Wuskwatim to 2009/10 is not the only way ... to take full advantage of the export market.", Manitoba Hydro/NCN has submitted considerable evidence (e.g. Manitoba Hydro/NCN rebuttal February 27, 2004) that wind, although somewhat economic, is significantly less attractive than Wuskwatim.

It should be noted that contained in CNF/TREE/RCM I – NFAAT – 5, there are a number of advantages attributed to examples of DG that are applicable neither to DSM nor to wind.

Additionally, in CNF/TREE/RCM I – NFAAT – 5, TREE/RCM state that one of the benefits of DSM and distributed generation is shorter lead times which can improve cash flow by starting to earn revenue sooner – through operational revenue earning or regulatory rate-basing as soon as each module is built - rather than waiting for the entire total capacity to be completed. We recognize this is true for some DSM opportunities such as energy efficient commercial lighting upgrades. However, it is widely acknowledged that scaling up the manpower, institutional and financial capacity to create energy efficiency savings within other technology markets such as residential building retrofits, can take a considerable amount of time (12 to 20 years) even with aggressive implementation rates[1].

Further in the discussion of DSM/DG packages discussed in CEC/TREE/RCM NFAAT – 1, TREE uses 250 MW of wind as an example of DG. Generally the smaller, distributed generation referred to in the advantages cited by Amory Lovins are in the size of kilowatts to tens of megawatts. A 100 MW wind farm sized to achieve the economies of scale as contained in Manitoba Hydro's economic analyses, would not be considered by industry experts as the type of distributed generation which would yield those benefits often associated with DG.

[1] Source: "Kyoto and Beyond: The low-emission path to innovation and efficiency", prepared by David Suzuki Foundation, Climate Action Network (CANet) Canada, and Torrie Smith and Associates, October 2002, page 43.

2. DEMAND SIDE MANAGEMENT

2.1 Rebuttal to TREE/RCM Assessment of Manitoba Hydro's DSM Program

In response to interrogatories CEC/TREE/RCM NFAAT – 9 & 11 and CNF/TREE/RCM NFAAT – 10 & 11, TREE/RCM is critical of Manitoba Hydro's DSM Program.

Supplementing Manitoba Hydro's rebuttal to TREE/RCM's evidence filed on February 19, 2004, Manitoba Hydro offers the following additional information supporting the Corporation's position that its Power Smart initiative is one of the most aggressive DSM initiatives in North America, and exhibits exemplary design and best practices for energy efficiency programs in today's markets.

TREE/RCM comments that "the history of Power Smart is one of plans made but not implemented" (CNF/TREE/RCM NFAAT – 11 page 4). In addition, TREE/RCM makes references to Manitoba Hydro's 1991 DSM targets set for 2001, which were not realized. TREE/RCM goes on to point out in Figure TREE/RCM CNF 11.1 that Manitoba Hydro's DSM program lacks continuity and characterizes the program as "on-again, off-again".

In making these statements, TREE/RCM is assessing Manitoba Hydro's DSM by taking a narrow view of a component of Manitoba Hydro's business, without regard to the Corporation's whole business. As with most comprehensive utilities, DSM is an integrated component of the Corporation's business and decisions are based on considerations for the whole business. For example, in late 1989, Manitoba Hydro entered into a large 1000 MW sale with Ontario with delivery of power scheduled to start in 2000. Manitoba Hydro's resource plans to meet this contractual obligation involved a combination of constructing a new generating station and undertaking an aggressive DSM program. Targets were established for reduced energy consumption in 2001 and an aggressive budget was established to support the DSM program. A few years later, when Ontario Hydro cancelled the sale, Manitoba Hydro revised its plans by canceling the construction of the new generating station and reducing the aggressiveness of its DSM efforts.

Manitoba Hydro's revised DSM plans remained as such throughout the balance of the late 1990s. Even with the changes noted, Manitoba Hydro continued to maintain a strong presence and commitment to Power Smart in the marketplace throughout the 1990's. This commitment even continued throughout the electricity restructuring process that resulted in most utilities either terminating their DSM efforts or severely cutting back on their energy conservation efforts.

As 2000 approached, the economic conditions in the export market changed favourably and Manitoba Hydro revised its DSM efforts and adopted a more aggressive strategy to take advantage of new opportunities. As presented in Manitoba Hydro's rebuttal to

TREE/RCM's evidence filed on February 19, 2004, Manitoba Hydro has been aggressively pursuing its DSM objectives since 2001 and the Corporation's efforts exhibit exemplary design and best practices for energy conservation programs in today's markets.

One of the fundamental benefits of DSM as a resource is its flexibility because its intensity can be increased or decreased according to a region's/utility's business needs in balancing electricity supply and demand.

Although TREE/RCM characterizes Manitoba Hydro's DSM program as "on-again, off-again", in reality, Manitoba Hydro was simply exercising sound business practices and being a leader in promoting energy conservation. It is interesting to note that during this fourteen year period, Manitoba Hydro exercised the same strategy twice (during the early 1990s and early 2000s); both times to pursue export opportunities through a combined resource strategy involving both the construction of new hydraulic generation and pursuing energy conservation in an aggressive manner. This strategy realizes benefits to its domestic customers through lower rates and lower bills and also contributes to meeting the Corporation's environmental goals.

In comparing Manitoba Hydro's DSM activity to leading North American efforts, TREE/RCM focused upon activity in the United States and Manitoba Hydro's efforts during 2000/01 only (reference CEC/TREE/RCM NFAAT-9).

Manitoba Hydro's position is that a more appropriate assessment would involve looking at the Corporation's efforts over a period of time. For example, since 2001, Manitoba Hydro has undertaken a number of aggressive initiatives to pursue its DSM strategy. Details of these initiatives were provided in Manitoba Hydro's rebuttal to TREE/RCM's evidence filed on February 19, 2004.

TREE/RCM state that the average dollars spent in the U.S. is US$3.88 per capita and that the top ten states spend from US$8.43 to US$19.48 per capita. In comparison, Manitoba Hydro's spending is as follows:

Year	Spending
2000/01	$5.13 Cdn (US $3.48)
2001/02	$7.06 Cdn (US $4.55)
2002/03	$10.51 Cdn (US $6.77)
2003/04	$14.14 Cdn (US $10.44)
2004/05	$19.44 Cdn (US $14.35) (projected)

Based on this measure alone, clearly Manitoba Hydro's DSM efforts are one of the most aggressive in North America.

TREE/RCM also state that the leaders in DSM spend from 0.9% to 2.3% of electricity revenues on DSM initiatives. In comparison, Manitoba Hydro spending is as follows:

Year	Spending
2001/02	1.02% of electric revenues
2002/03	1.36% of electric revenues
2003/04	1.83% of electric revenues
2004/05	2.50 % of electric revenues (projected)

Again, based on this measure, clearly Manitoba Hydro's DSM efforts are one of the most aggressive in North America.

In CEC/TREE/RCM NFAAT-9, TREE/RCM outlines the characteristics and benefits of "third generation" DSM initiatives as being comprehensive, customized, customer-oriented, technology-focused with supporting services and training, and working in partnership to create a significant market impact.

Manitoba Hydro has pointed out in its rebuttal to TREE/RCM's evidence filed on February 19, 2004, that the Corporation's programs exhibit those characteristics. For example, Manitoba Hydro's new Power Smart New Home Program promotes and encourages residential customers to build new homes to Power Smart Standards. The standards were designed looking at the whole house as a system and includes electricity, natural gas, and water conservation technologies along with addressing air quality. In pursuing energy efficiency improvements, Manitoba Hydro's Power Smart programs and initiatives are developed in consultation with industry advisory teams. For example, the Power Smart New Home program was designed in cooperation and extensive involvement with industry and government representatives. Further, Manitoba Hydro's Power Smart New Home Program is integrated with the Federal Government's EnerGuide for New Houses program and delivered as a package to Manitobans.

TREE/RCM also suggest that Manitoba Hydro "form collaboratives with industry, NGO, government and community groups to achieve common objectives" (CEC/TREE/RCM NFAAT-11b).

Manitoba Hydro's Power Smart efforts do involve both sponsoring and partnering with community groups such as the Manitoba Climate Change Connection where Manitoba Hydro sponsored and actively participated in providing workshops throughout the province. TREE/RCM also state that Manitoba Hydro could enhance its conservation efforts by working with the Winnipeg Housing & Homelessness Initiative (WHHI) where R2000 homes have been constructed in the core area of Winnipeg. Again, Manitoba Hydro is already doing this. In fact, Manitoba Hydro has been working with the Winnipeg Housing & Homelessness Initiative and two non-profit neighborhood groups in Winnipeg (North End Housing Project and Spence Street Neighborhood Group) over the last three years. Manitoba Hydro's involvement has resulted in all 20 new infill homes being constructed to R-2000 standards during this time period. For these initiatives, Manitoba Hydro provided technical guidance and expertise along with a combination of grants and/or low interest loans (as low as 2%) to cover the additional construction costs of building to R-2000 standards. Manitoba Hydro also worked with Habitat for Humanity

in 2003 to build all nine (9) Habitat housing units to R-2000 standards. For this project, in addition to a $10 000 grant, one technical staff person was assigned full time to the construction sites to train volunteers in the proper methods for installing energy related housing components.

TREE/RCM statethat targeting programs for client groups such as low income, first nations, municipalities, etc., are preferable when designing programs and this practice represents one of the common traits of third generation DSM initiatives. In looking at different sectors of the existing housing market, Manitoba Hydro also recognizes the unique needs of the low-income residential sector. In addition to the initiatives already mentioned, Manitoba Hydro has sponsored a research initiative on Healthy Housing in West Broadway, which addresses energy use and efficiency in the low-income residential sector and Manitoba Hydro has partnered with the Winnipeg Housing and Rehabilitation Corporation (WHRC), WHHI, and the West Broadway Corporation to develop a Power Smart Rehabilitation Standard. The purpose of Manitoba Hydro's involvement is to assist non-profit housing rehabilitation agencies such as the West Broadway Corporation in maximizing the resource savings achievable within existing budgets and through accessing available grant funding such as that available through the EnerGuide for Houses Federal Grant Program. Manitoba Hydro is also participating in discussions with Tribal Council Representatives of Northern communities in off-grid locations to determine ways of reducing electricity use (appliances and water heating) and diesel consumption (space heating). This program is a customized version of the Power Smart Program that Manitoba Hydro is developing to address the needs of all First Nations communities.

TREE/RCM state that implementing less than the full set of cost effective measures with each customer increases the cost of DSM by having to re-engage the customer, adding to the marketing and promotion costs of DSM. Manitoba Hydro recognizes this in their programming design and delivery. For example, Manitoba Hydro's marketing strategy under "Power Smart for Business" is to promote all components of the Commercial Construction and Commercial Lighting Programs concurrently. When speaking with customers, Manitoba Hydro's sales force pursues all opportunities available. Although Manitoba Hydro does not currently provide free energy audits and interest free financing as provided by Massachusetts Electric, the dedicated Power Smart sales staff do conduct free facility site inspections that will highlight areas where MH programs can assist the customer with retrofit opportunities resulting in energy savings. In more technical applications, engineering support will also attend the site assessment at no cost to the customer. In addition, Manitoba Hydro financially supports a number of technologies not currently included by Massachusetts Electric, such as: windows, air barrier systems, parking lot controllers, chillers and rooftop or split system air conditioners. Manitoba Hydro's custom option under the Commercial Construction and Renovation Program also serves as a "catch all" providing incentives for energy saving technologies not currently offered under prescriptive options. In the residential sector, Manitoba Hydro also targets all components of the home. This is exemplified in both the Power Smart Home Audit program and the Power Smart New Home program.

The Power Smart Energy Manager Program (PSEM) is another example of how Manitoba Hydro's DSM initiatives evolve to meet customer needs. PSEM was originally intended to address no-cost and low-cost changes in schools given that this particular customer segment often has capital constraints. However, within the first few months of the pilot with Pembina Trails School Division (PTSD), the focus was expanded to include major energy efficient retrofit projects. The catalyst for this expanded scope was largely a result of the Power Smart incentives and their ability to reduce capital costs, creating acceptable payback periods. The trained PSEM in the school division now also holds training sessions, in conjunction with Manitoba Hydro engineers (at no cost to the customer), to educate custodial staff on how to identify energy saving opportunities. This initiative has already realized energy savings from numerous opportunities, beyond the initial low-cost and no-cost initiative. To date, the division has achieved utility bill savings of $36 925 in year one and $113 215 in year two.

Manitoba Hydro continues to explore opportunities for partnerships with community groups, government, and other agencies which will result in resource efficiencies in Manitoba. This includes discussions with other utilities, such as BC Hydro, and building upon their experiences and lessons learned to develop programs to be delivered in Manitoba.

In developing Manitoba Hydro's portfolio of DSM offerings, Manitoba Hydro has taken the approach that a "mix" of different initiatives is required in order to create an overall change in the marketplace. Under this approach, initiatives such as consumer workshops, energy experts, and information services, defined by TREE/RCM as "first generation" programs, create the foundation for more aggressive incentive based programs such as the Power Smart New Home Program and the Commercial Construction and Lighting Programs. Manitoba Hydro is of the opinion that any third generation energy conservation utility would not be "third generation" if its programs excluded "Supporting Programs and Services" or "first generation" programs as outlined under the American Council for an Energy Efficient Economy (ACEEE) in its March 2003 report "America's Best: Profiles of America's Leading Energy Efficiency Programs" by Dan York and Martin Kushler.

TREE/RCM state in CEC/TREE/RCM NFAAT - 11 that increasing incentive levels leads to increased participation in energy efficient technologies.

Manitoba Hydro recognizes the influence incentives have on participation rates; this is exemplified in the Commercial Lighting program, the Chiller Program and the Home Insulation Program. While Manitoba Hydro agrees with the statement in general, it is not the only market barrier to be addressed. In developing DSM programs, Manitoba Hydro looks to all potential barriers, such as customer awareness, product availability, product accessibility, product affordability and market acceptance. Manitoba Hydro seeks to influence the market working through and developing existing market channels without becoming the market (i.e. without directly competing with private industry) in order to create a sustainable market change. In addressing the affordability barrier, Manitoba Hydro does currently offer incentives for a variety of energy efficient technologies. Manitoba Hydro is also currently reviewing the possibility of offering Power Smart financing services for commercial customers in addition to the financing services currently being provided to residential customers. Other utilities, such as Xcel Energy of Minnesota, offer financing at "competitive interest rates" in addition to rebates for energy efficient technologies.

The table below outlines a few of Manitoba Hydro's new and current offerings and presents the incentives offered as a percentage of the measure's cost.

SECTOR	PROGRAM	INCENTIVE LEVEL (%)
Residential	Power Smart New Home Program	Approximately 30%.
Residential	Home Insulation Program (HIP) for Electrically Heated Homes	Incentives range from 75% to 100% of material cost of insulation. Program encourages participation in both HIP and EnerGuide for Houses Federal Grant Program.
Residential	Power Smart R-2000 Program (R-2000 homes qualify under PS New Home Program)	Manitoba Hydro shares approximately 50% of the cost of operating the R-2000 program in Manitoba, including administration, testing, and certification. Customer is eligible for same incentive as under the PS New Home Program (approximately 30%).
Commercial	Energy Efficient Lighting Program	For Renovation Applications = avg. of 76% of total capital cost. For New Construction = average of 87% of incremental product cost.
Commercial	Commercial Construction – Air Barrier	Average of 78% of Incremental Product Cost; Average of 9% of total capital cost.
Commercial	Commercial Construction – High Efficiency Windows	Average of 78% of Incremental Product Cost; Average of 18% of total capital cost.
Commercial	Commercial Construction – HVAC	Average of 81% of Incremental Product Cost; Average of 11% of total capital cost.
Commercial	Commercial Construction – Parking Lot Controllers	Average of 33% of total capital cost.
Commercial	Power Smart Design Standards	Building to Power Smart Design Standards ensures that the customer is eligible for Power Smart incentives in addition to Federal incentives under CBIP.
Commercial	Religious Buildings Initiative	Fixed 6.5% loan for a max of $15 000 to $30 000 for a max of 10 years.
Commercial	Power Smart Energy	Coordinated with all Commercial Construction and Lighting

	Manager	incentive offerings.
Commercial	Agricultural Heat Pads	For Renovation Applications = average of 31% of total capital cost. For New Construction = average of 24% of incremental product cost.
Industrial	Performance Optimization	Typically provides 30% to 40% of incremental project cost. Incentive formula with "cap" is similar to programs offered by BC Hydro, Hydro Quebec, and Government of Canada.
Industrial	Eco-Efficiency	Provided with comprehensive technical assessment addressing efficiency opportunities for all resources. Coordinated to be eligible for incentives under Federal Industrial Energy Audit Incentive Program and the Performance Optimization Program

The Federal Government's C-2000 standard is targeted to new commercial facilities and sets building performance targets at 50% better than the Model National Energy Code for Buildings. Manitoba Hydro's new head office building to be constructed in downtown Winnipeg will not only meet C-2000 standards, but is targeted to achieve Gold Level Leadership in Energy and Environmental Design (LEED) certification.

It is interesting to note that if one takes a retrospective look at some of Manitoba Hydro's previous DSM programs, it would appear that Manitoba Hydro offered third generation programming in the early 1990s. TREE/RCM state that "third generation" electricity efficiency programs are also organized around points of market intervention such as a decision to replace failed or old equipment. Retailers may be offered money for every high efficiency appliance they sell and customers will be rebated the difference between the average cost of the appliance and the more efficient model". TREE/RCM also state that successful third generation programs are ones with industry, government, and other utility partners (collaborations) and have a continued commitment to the customer. In 1991, Manitoba Hydro launched their High Efficiency Motor program to encourage customers to choose high efficiency motors at the point of replacement. This program was the result of a collaboration across Canada called the Coordinated Utilities Approach to Motors, which included Manitoba Hydro, BC Hydro, Ontario Hydro, and Hydro Quebec. Manitoba Hydro's program was structured so that incentives were based upon the efficiency improvement of the high efficiency motor compared to the standard unit, which maximized the efficiency improvement at the time of the opportunity. The incentive package included both rebates for the customer and the vendor. During the course of the program, Manitoba Hydro worked with key customers to establish internal purchasing policies to ensure high efficiency motors were part of standard specifications. The incentive component of this program concluded in 1996 with national efficiency legislation being passed which covered all 1 hp to 200 hp motors purchased in Canada. In continuing the relationship with these customers, Manitoba Hydro is supporting additional research into efficient motor re-wind practices to ensure the efficiencies gained are maintained.

2.2 Rebuttal to TREE/RCM Assessment of Economic Potential

In response to MH/NCN/TREE/RCM – NFAAT III – 10, TREE/RCM state that the Rate Impact Measures (RIM) test is used to define the upper limit to measures that

are admitted to Manitoba Hydro's Power Smart DSM programs and that the RIM test is a more restrictive test than whether or not a measure is economic.

While it is true that the RIM test is a more restrictive test than the Total Resource Cost test, it is not true that Manitoba Hydro uses the RIM test to determine which technologies or measures are included or not included within an individual Power Smart Program.

When determining whether or not to include a technology within a proposed DSM program, the determining factor is whether or not the cost of the installed technology or measure (incremental opportunity cost or full retrofit cost) is less than the present value of the electricity savings' marginal cost benefits.

Marginal Resource Cost Technology Screen = (Present Value of the Marginal Cost Benefit of the energy and demand savings)/(Present Value of the installed technology cost)

If an energy efficient technology is cost effective under the Marginal Resource Cost (MRC) screen with a benefit/cost ratio greater than 1:1, the technology is included within the proposed program design. It is after this point that the details of the Power Smart program design are determined. Power Smart programs are designed to address market barriers to adoption such as: customer awareness of energy efficient measures and their benefits and co-benefits; local or national product/service availability; vendor and trade ally awareness, understanding and acceptance; price premiums compared to standard technologies; payback and return on investment requirements; perceived risks of "new" energy efficiency measures; and, splits between the purchasing agent and the person(s) benefiting from the energy efficiency measure (e.g. landlord/tenant relationships). It is during the design that program and incentive costs are outlined and a full Total Resource Cost (TRC) benefit/cost ratio and RIM benefit/cost ratio is calculated.

The TRC benefit/cost test is the primary economic evaluator used by Manitoba Hydro in determining whether or not to pursue a DSM initiative. Manitoba Hydro uses the RIM test as a guide. Individual programs do not have to pass the RIM test to be included within Manitoba Hydro's Power Smart Plan.

In response to interrogatory, CNF/TREE/RCM I NFAAT – 6, TREE/RCM state that there are more DSM savings achievable in the Manitoba marketplace than identified under the recently completed DSM Market Potential Study. In making this statement, TREE/RCM maintains that Manitoba Hydro's consultants have failed to identify DSM technologies that are economic given the 6.15 cents/kwh threshold and to include technologies that were identified as economic by the consultants in the roll-up analysis of the total amount of economic DSM.

Manitoba Hydro offers the following information supporting the estimate for economic and market achievable potential presented in the DSM Market Potential Study, in response to the observations provided by TREE/RCM in CNF/TREE/RCM I NFAAT –6.

Observation #1: TREE/RCM state that the overall whole building energy performance improvement presented in the DSM Market Potential Study is very modest, for both new and existing buildings. TREE/RCM state while the study refers to "whole building energy use intensities" (EUI's), the "whole building EUI'S" referred to are actually whole segment electricity EUl's computed by dividing total segment electricity use by total segment floor area, not the total fuel and electricity per sq.m of building floor area. As such, they are not reflections of the improvement that is occurring at the whole building level, and their rate of improvement should be much higher than presented.

Response: The intent of the DSM Market Potential Study was to examine the potential for electricity conservation in Manitoba. Therefore for the purpose of this report, the values used for EUI were based on actual Manitoba electricity use by segment. A review of other fuel use and the savings potential associated with these fuels, such as natural gas, was outside the scope of this study.

Observation #2: TREE/RCM state that: "The overall building energy performance improvements are well below the 25-35% whole building improvements that are generally found to be economic for existing buildings. For new buildings, the absolute whole building intensities are relatively high compared with the performance of new, advanced buildings, suggesting the full potential for improvement in these buildings has been missed by the scope and method of the study. Of course the focus of the study was on electricity, but the total potential for electricity improvement cannot be determined out of context. Basic air sealing and weatherization are not included in the analysis, let alone comprehensive, whole building analysis that fully captures the gas and electricity savings potential, and the synergies between them. A few space heating measures were analyzed for electrically heated buildings, but most commercial and institutional buildings in Manitoba are gas heated, and the DSM Market Potential Study has not included a comprehensive and integrated analysis of the opportunities for energy savings in these buildings."

Response: Air sealing was included in DSM Market Potential Study analysis of the commercial sector; it was addressed through infiltration calculations in all new construction scenarios. It was bundled with other technologies such as high performance walls and windows to achieve an integrated approach and not a piecemeal approach to

designing new buildings. Also, in assessing the economic potential for existing commercial buildings, the study included the baseline saturation levels of technologies, such as T-8 lighting. This baseline analysis was incorporated to account for the penetration of energy efficient technologies that already exists in the building stock and not to "double count" measures that have been installed. The economic potential forecast must be sensitive to stock penetration in order to present a reasonable reflection of the market potential available for the DSM initiatives.

Observation #3: TREE/RCM state that: "In the specific case of new buildings, the potential for 'cost tunneling' does not appear to have been explored in the Market Potential Study".

Response: Integrated design was an integral part of the DSM Market Potential study and was used in the evaluation of all new buildings. Integrated Design achieves the same results as "Cost Tunneling" as the improvements in the envelope allow a reduction of equipment size and cost savings in the heating or cooling system.

Observation #4: TREE/RCM comments that end users will adopt new technologies for their amenity value and a host of other factors, economic and otherwise. TREE/RCM comment that technologies get adopted in spite of the fact that they cannot be justified on the basis of a CCE calculation. These technological trends could be identified and anticipated in the load forecasting or future demand scenario analysis.

Response: Manitoba Hydro agrees with TREE/RCM's observation that end users will adopt new technologies based on a "customers' perceived" value, both energy related and non-energy related. In the industry, the latter is generally referred to as NE (non-energy) benefits. As general practice, all leading edge companies including Manitoba Hydro, take these benefits into account during the detailed design phase of the energy conservation process and in their promotional marketing material. For example, in the industrial sector Manitoba Hydro NE benefits include promoting the reliability and process improvements associated with undertaking energy conservation measures. In the commercial sector, Manitoba Hydro aggressively promotes NE benefits in its promotional material as exemplified in the following excerpts from billboard and other advertising media:

- "Save Your Energy for More Important Things Like Making Money"

- "Save Your Energy for More Important Things Like Increasing Sales"

- "When you install Power Smart measures, your building is:

  - less expensive to operate
  - more productive to work in
  - less impact on the environment
  - more attractive
  - healthier, and more comfortable for staff and customers"

Likewise, Manitoba Hydro promotes NE benefits in its residential program including using phrases such as "Feel Good About The Choices You Make", "Home Comfort" and "Air Quality".

As part of Manitoba Hydro's load forecasting activities, trends in the market are taken into account and incorporated into the forecasts as these market events become evident, however, these impacts are restricted to those resultant from changes to codes and standards and general consumer activity unrelated to the Corporation's Power Smart activities. This is to ensure Manitoba Hydro is not double counting for energy reductions through its energy conservation measure and its load forecasting efforts.

Observation #5: TREE/RCM imply that the assumptions for savings potential in "small commercial" and "other commercial" categories is understated as the electricity use for these sectors was not modeled.

Response: Although there are some large facilities contained in "Other", the majority of the buildings contained in "Small Commercial" and "Other" are small buildings such as barber shops, plumbers shops, rural hairdressing salons and many others that have relatively small electrical energy consumption. The "Other" buildings category include a diverse range of buildings that do not fit well into any of the selected building segments, nor do they exhibit sufficient energy use commonality to form a distinct building segment. As the majority of the customers in the Small Commercial segment have less than 50 kW of connected load of which represents primarily "heat and light" end-uses, the focus of the study modeling was large and medium sized facilities. The electricity savings potential in the "Small Commercial" and "Other" building segments was analyzed separately and based on the results determined in the detailed analyses of the medium and large commercial segments.

Observations #6 & #7: TREE/RCM state that the omission of air sealing as a measure in small, medium and large commercial buildings is questionable.

Response: As stated above, air sealing was included in DSM Market Potential Study analysis for the commercial sector; it was addressed through infiltration calculations in all new construction scenarios. Air sealing was also taken into account in the analysis of the residential sector.

Observation #8: TREE/RCM observed that integrated lighting systems, which appear economic, are included only in the "roll-up" of the general lighting component of the office building sector, rather than all sectors.

Response: Integrated lighting systems provide personal control of the lighting and space temperature of a single office or work station. It was decided that this type of technology was most applicable in offices due to the fact that the occupancy of most offices and work stations are fixed and do not change at regular intervals which happens in hospitals, schools and universities. Continuity in occupancy leads to continuity and consistency in savings.

Observation #9: TREE/RCM state that the savings that could be achieved from more efficient computers, office equipment and other types of plug loads in the commercial buildings sector are very conservative in light of the technology advances being made in this area.

Response: Computer monitors were considered in the study as they have higher energy consumption and are upgraded regularly. Offices, universities, and hospitals were originally considered to be the largest users of computers and therefore offer the greatest potential. Expanding the savings for energy efficient computers to the other segments would generate additional savings of 0.026 GW.h by 2017/18 which represents less than 1% of the 2.8 GW.h of the 2017/18 achievable potential identified for computers in offices, universities and hospitals.

While there have been vast improvements in the standby losses of other plug loads such a printers and copiers it is also true that this type of equipment has also increased in function. Although the units are more energy efficient, this increase in function has resulted in a corresponding overall increase in energy consumption.

Observation #10: TREE/RCM state that the integrated design approach was not applied to new apartment buildings in the residential sector. TREE/RCM also states that a number of other measures have been excluded from the assessment for apartment buildings, including basic air sealing and weatherization, window upgrades, car plugs, and water heater insulation.

Response: As explained previously, the integrated design approach, which includes high performance windows and air sealing, was applied to all new buildings but not broken out as a separate technology.

For the purpose of the study, apartment buildings were recognized as unique buildings and were divided into residential units and common areas (commercial). The residential units are included in the residential study. Water heater/pipe insulation and hot water savings for multi-family and apartments were based on reductions at point of use (efficient washing machines/dishwashers) and were included in the residential unit assessment. Car plugs (block heaters and car warmers) were considered a component of the common area and were included in the commercial study.

In response to CNF/TREE/RCM I NFAAT-9, TREE/RCM produces an estimate of the DSM potential in Manitoba.

Response: TREE's estimate of the DSM potential in Manitoba should be viewed in consideration of the following issues:

- TREE/RCM state that this is only a rough estimate and that a full scale analysis of the economic potential for DSM was not undertaken.

- The estimate is of economic potential and not "achievable" potential, the latter being the relevant estimate in assessing the issues associated with constructing Wuskwatim.

- TREE/RCM adjusts the CCE from Manitoba Hydro's avoided cost number of 6.15 cents to 8 cents – a 30% percent increase to account for NE (non energy) benefits. As provided in Manitoba Hydro's response to "Observation #4" in the previous section, Manitoba Hydro already takes these benefits into account in determining the achievable potential in the market. These NE benefits are reflected in the estimate of participation rates for each program in the detailed design phase for both technologies that have CCE's below and above 6.15 cents. In the latter case, examples include residential customers that replace existing windows and install high efficiency windows. As previously mentioned, Manitoba Hydro is fully aware that consumers will implement technologies based on the combined energy and NE benefits. For technologies not captured by specific Power Smart programs, Manitoba Hydro captures the resultant energy reduction in its Load Forecast, recognizing that a forecast will not predict the future precisely due to the very nature of forecasting.

- TREE/RCM added in measures that were assumed to be missed in Manitoba Hydro DSM Market Potential Study. As provided in Manitoba Hydro's response to the previous section (CNF/TREE/RCM I NFAAT -6), Manitoba Hydro did take into account virtually all of the measures that TREE/RCM identified. As with all long range forecasting exercises, Manitoba Hydro recognizes that the DSM Market Potential Study does not encompass all possible current and future energy efficient upgrades, however, it is a reasonable and appropriate assessment of the Manitoba market. The study was intended to provide an estimate of the economic and, more importantly, the achievable potential in Manitoba. These studies, by nature are not expected to capture the economic potential with 100 percent accuracy. These limitations are recognized and taken into account during the detailed program design phase.

3. LOAD FORECAST

Load Forecasting Rebuttal to TREE

In responses to interrogatories, CEC/TREE/RCM NFAAT -1 and CNF/TREE/RCM NFAAT-2, 3, & 4, TREE/RCM state that Manitoba Hydro's load forecast over estimates the electricity demand in Manitoba. TREE/RCM further develops an adjusted Basic Forecast for Manitoba which TREE/RCM claim shows that there are plausible, reasonable, and even probable scenarios in which the forecast electricity demand will come out lower than Manitoba Hydro's forecast.

Manitoba Hydro's position is that its Load Forecast is reasonable and that TREE/RCM's adjusted Load Forecast is unreasonable and produces an unrealistic scenario for the electricity demand in Manitoba. To support Manitoba Hydro's position, a detailed discussion and analysis are provided along the following topics:

1. Manitoba Hydro's Forecasting Methodology;
2. Accuracy of Manitoba Hydro's Forecast Results;
3. Assessment of Manitoba Hydro's 2002 Load Forecast by Building Types;
4. Comparison of Historical and 2002 Load Forecast Growth by Building Type;
5. Comparison of Historical and TREE/RCM Reference Projection; and
6. Productivity Improvements in Manitoba Hydro's 2002 Load Forecast.

The following summary points highlight the rationale for Manitoba Hydro's position:

- Manitoba Hydro has been improving its load forecasting methodologies since the late 1970's and now has a set of methodologies that are providing forecasts with accurate results. This is supported by the forecast accuracy realized over the past decade.

- Manitoba Hydro's forecast is based on an overall approach that uses methodologies best suited for forecasting load growth in three specific market sectors. The forecast incorporates a balanced consideration for reasonable productivity improvements, historical trends, anticipated future changes in electricity intensities, customer specific information, national economic activity as it impacts Manitoba's economic activity and the relative provincial advantage for attracting industry.

- Manitoba Hydro is not forecasting the future based solely on the past.
  - The 2002 Load Forecast projects a low growth rate of 0.3% per year for residential electricity sales. As a benchmark, historical residential electricity sales increased 1.7% per year. TREE/RCM concurs with Manitoba Hydro's

forecasting approach in the residential sector and infers that the residential end use model used by Manitoba Hydro produces a reasonable forecast.

- Manitoba Hydro's 2002 Load Forecast projects a reasonable growth rate of 0.8% per year for commercial electricity sales, whereas TREE/RCM forecasts commercial electricity sales to decline 0.4% per year. As a benchmark, historical commercial electricity sales increased 1.9% per year. The TREE/RCM commercial sales forecast is intuitively low, considering that future DSM energy savings from commercial DSM activities are not included in the forecast. TREE/RCM's forecast is radically different than historical information and is unsupported by any detailed analysis.

- The 2002 Load Forecast projects a growth rate of 1.6% per year for industrial electricity sales, whereas TREE/RCM forecasts industrial sales to increase only 0.8% per year. As a benchmark, historical industrial electricity sales increased 3.4% per year. The TREE/RCM industrial sales forecast is intuitively low considering that electricity intensive industries are continuing to expand in Manitoba and there is no supporting evidence to suggest that this trend is going to radically change.

- The 2002 Load Forecast projects a overall growth rate of 1.0% per year for electricity demand in Manitoba, whereas TREE/RCM forecasts total sales to increase only 0.2% per year. As a benchmark, historical total electricity sales increased 2.4% per year.

- The 2002 Load Forecast contains significant electricity productivity improvements. The residential sector is forecast to improve 2.0% per year, which is significantly higher than the 0.5% annual improvement experienced in the past. The commercial sector is forecast to improve 1.4% per year, which is significantly different than the 0.2% annual improvement experienced in the past. The industrial sector is forecast to improve 0.7% per year, which is significantly higher than the 1.2% annual decrease in productivity experienced in the past.

- As a reasonableness check, changes occurring in a number of other indicators, including electricity sales per capita, productivity of the Manitoba economy, productivity of the general service sector and residential sales per household suggest that Manitoba Hydro's underlying forecast is realistic.

- TREE/RCM's adjusted forecast predicts that future growth will be only 13% of the growth experienced in the past – a future that is radically and inexplicitly different than the past. The unrealistic nature of TREE/RCM's adjusted forecast is evident by undertaking a basic reasonableness check of the forecast, as follows:

  - The TREE/RCM Reference Projection forecasts total provincial sales to be only 19 830 GW.h by 2017/18. Billing records indicate that actual sales have already reached a level of 19 206 GW.h for the 2003 calendar year. Therefore,

TREE/RCM's adjusted Load Forecast has only 624 GW.h of sales growth, for the entire province, over the next fourteen years. Any load reductions due to Manitoba Hydro's incentive based DSM initiatives are over and above TREE/RCM's load forecast.

- The most current, customer-specific information indicates that 925 GW.h of additional industrial sales will be required by 2007/08, which would result in the 2017/18 reference projection being exceeded by 300 GW.h, ten years earlier than forecast by TREE/RCM, and this will occur with no growth in the residential and commercial sectors.

- The 2017/18 reference projection will be exceeded by 2005/06, twelve years earlier than forecast, if historical growth patterns are sustained just over the next two years.

- TREE/RCM's forecast assumes that the commercial sales will decrease over the next fourteen years without any further DSM activity and that the industrial load will grow at a much slower rate than it has historically, despite the fact that electricity intensive industries are continuing to expand in Manitoba.

1. Manitoba Hydro's Forecasting Methodology

The 2002 Load Forecast consists of three major sub-components: the residential end use forecast, the general service mass market forecast; and general service top customers forecast. The residential end use forecast is prepared using a detailed, multi-step approach. The residential customer forecast is separated into primary electric space heat (all-electric) and non-primary electric space heat (standard) classifications using a Market Share Model. The Residential End Use Model factors in appliance saturation forecasts, appliance lifetimes, appliance replacement rates, the usage or unit energy consumption (UEC) for the existing appliance stock and the usage for new and replacement appliances, incorporating efficiency improvements over time. TREE/RCM concurs with this approach and on page 5 of CNF/TREE/RCM I NFAAT-4, infers that the residential end use model produces a reasonable forecast that is in line with demographic and economic projections.

The general service mass market forecast is prepared using a top-down forecasting methodology rather than a bottom-up forecasting methodology. Specifically, the mass market forecast is prepared using an econometric regression that relates electricity sales to previous electricity sales, the real price of electricity and the real gross domestic product of Manitoba. The general service mass market forecast represents all general service customers, excluding only the largest electricity consumers in the province. In total, the general service mass market represents approximately 48 000 commercial and industrial accounts. Manitoba Hydro is of the opinion that the top-down method produces reasonable results and the methodology is based on more reliable, timely and accurate information than a bottom-up methodology would employ.

The general service top customer forecast is prepared using an intensive, customer-specific process involving Key and Major account staff visiting each customer to review their future business plans and to obtain detailed information on the customers' future electricity demands. Forecasting large industrial growth in the longer term is a difficult task. Although historical sales clearly suggest that the top customer category will continue to grow in the future, it is uncertain which sectors of the economy will expand and to what degree these expansions will occur. To accommodate a reasonable estimate of growth in this market sector, Manitoba Hydro's forecast takes into account a balance of information based on historical information, changes occurring within the various industries (both regional and outside Manitoba) and also, the relative attractiveness of conducting business in Manitoba for electricity intensive industries. Manitoba Hydro's load forecast assumes that future load growth will range from 60 to 90 GW.h per year. Analysis of historical sales indicates that this is the fastest growing market in Manitoba and since 1992/93, the top customer category has grown 150 GW.h per year. The load growth included in Manitoba Hydro's load forecast is substantially below historical growth rates and is entirely consistent with the assumption that industrial productivity will improve in the future.

TREE/RCM suggests that using GDP and productivity by industrial sector is a more accurate method of forecasting load growth in this sector. This claim is not supported nor is it accurate. Predicting the future levels of industry GDP and productivity is just as difficult, or even more difficult, than predicting electricity consumption directly. For example, forecasting industry GDP and productivity for the Manitoba mining sector in 2020 is subject to considerable uncertainty. Manitoba Hydro contends that TREE/RCM's method of preparing industrial forecasts based on GDP and productivity by industrial sectors would produce unreliable results based on assumptions that can not be forecast with any degree of certainty.

2. *Accuracy of Manitoba Hydro's Forecast Results*

Manitoba Hydro has been improving its load forecasting methodologies since the late 1970's and now has a set of methodologies that are providing forecasts with accurate results. For example, Table 1.1 shows the accuracy of each forecast prepared since 1992. The rows indicate the year that the forecast was prepared and the columns indicate the number of years into the future that the forecast accuracy comparison is being made. For example, row "1994" and column "Year 10" indicates that ten years after the 1994 forecast was prepared, the forecast under-predicted actual, weather-adjusted net firm energy by 6.7%. Table 1.1 also shows that Manitoba Hydro's forecasts prepared since May, 1992, has under-predicted the electricity requirements of Manitoba. Using the data provided in Table 1.1, the average five year forecast is low by 0.9% and the average ten year forecast low by 4.7%.

TABLE 1.1 FORECAST ACCURACY COMPARISONS						
Forecast Preparation Year	Forecast Accuracy by Year into the Future					
	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
1992	1.2%	0.8%	0.9%	2.9%	1.3%	-1.0%
1993	0.1%	-0.6%	1.0%	-0.8%	-3.2%	-6.3%
1994	-0.8%	0.9%	-1.1%	-3.8%	-7.0%	-6.7%
1995	0.1%	-1.5%	-3.9%	-7.1%	-6.9%	N/A
1996	-0.7%	-3.4%	-7.0%	-7.0%	N/A	N/A
1997	-0.7%	-4.5%	-4.7%	N/A	N/A	N/A
1998	-1.9%	-1.2%	N/A	N/A	N/A	N/A
1999	-4.3%	N/A	N/A	N/A	N/A	N/A
Average	-0.9%	-1.4%	-2.5%	-3.1%	-3.9%	-4.7%

3. *Assessing Manitoba Hydro's 2002 Load Forecast by Building Types*

To undertake a "reasonableness" check on Manitoba Hydro's forecast, the 2002 forecast is disaggregated into residential, commercial and industrial sectors on an end use basis. This is similar to the exercise undertaken by TREE/RCM.

Historical Sales by Building Type

Manitoba Hydro has an extensive database with a detailed classification system that can identify general service sales growth to four digit Standard Industrial Classification (S.I.C.) code accuracy. Manitoba Hydro also assigns a Physical Structure Index (P.S.I.) code to all residential and general service accounts. The S.I.C. code identifies the type of business and the P.S.I. code identifies the type of building.

Residential sales are grouped into nine building types: single detached, duplex, cottage, town/row, mobile, apartment, non-dwelling, farm and farm non-dwelling. Commercial sales are grouped into seventeen different building types: office, restaurant, retail, grocery, warehouse, school, college, hospital, hotel/motel, bulk apartment, apartment common service, personal care home, recreation facility, church, miscellaneous, non-building and Saskatchewan Power Corporation. Industrial sales are categorized into nine different industries: agriculture, mining, food/beverage, pulp/paper, chemicals, petroleum transport, primary metals, miscellaneous and non-buildings.

Manitoba Hydro has accumulated building type information on customers since 1989, creating a fifteen year record of sales growth by building type. This information is only available for Winnipeg Hydro customers since 2002, after the purchase by Manitoba Hydro. Table 1.2 includes historical sales information by building type for the Manitoba Hydro service area during the 1992 to 2002 period.

TABLE 1.2
HISTORICAL ELECTRICITY SALES BY BUILDING TYPE

	Manitoba Hydro Service Area Sales by Building Type (GW.h)										
Building Type	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Single Detached	3,115	3,241	3,278	3,389	3,564	3,462	3,241	3,378	3,503	3,579	3,794
Duplex	107	110	111	113	116	113	107	108	111	113	117
Cottage	29	32	34	36	41	40	37	41	45	47	53
Town/Row	110	115	115	116	121	117	107	110	113	117	124
Mobile	158	169	172	180	196	191	172	185	194	197	210
Apartment	158	166	166	172	180	175	159	166	171	178	186
Non-Dwelling	22	24	23	23	25	24	21	21	20	20	20
Farm	907	932	921	941	1,005	958	845	878	893	902	948
Farm Non-Dwelling	38	35	33	31	31	37	31	30	28	27	27
RESIDENTIAL	**4,644**	**4,824**	**4,853**	**5,001**	**5,280**	**5,116**	**4,718**	**4,916**	**5,078**	**5,180**	**5,479**
Office	281	293	297	303	316	315	297	309	321	325	340
Restaurant	149	153	160	167	168	165	166	168	171	176	179
Retail	372	383	396	406	417	420	422	436	454	470	476
Grocery	210	215	218	221	221	223	231	242	249	255	257
Warehouse	167	173	181	186	195	199	194	202	208	215	226
School	258	269	270	273	287	282	267	277	286	290	305
College	118	117	119	123	124	126	118	114	117	121	124
Hospital	151	154	157	158	161	160	158	159	165	170	176
Hotel/Motel	142	145	145	148	154	154	148	155	162	168	175
Bulk Apartment	383	394	384	395	417	393	358	372	379	388	405
Common Service	96	98	98	99	104	99	87	91	94	98	104
Personal Care Home	84	88	91	94	97	94	87	88	93	96	101
Recreation Facility	172	179	188	196	204	207	202	213	230	231	238
Church	41	44	44	46	48	47	43	45	48	49	52
Miscellaneous	375	376	371	378	395	387	377	388	411	418	437
Non Building	106	112	113	120	128	128	128	137	142	148	159
Sask. Power Corp.	29	29	30	29	31	30	34	37	41	38	43
COMMERCIAL	**3,133**	**3,222**	**3,261**	**3,342**	**3,468**	**3,430**	**3,317**	**3,434**	**3,572**	**3,657**	**3,798**
Agriculture	312	329	335	363	395	399	404	434	467	507	548
Mining	261	257	209	229	293	310	302	304	289	281	223
Food/Beverage	263	273	281	307	311	350	366	396	443	457	461
Pulp/Paper	445	453	465	480	506	526	524	544	564	751	772
Chemicals	771	837	850	893	901	961	964	897	909	997	1,480
Petroleum Transport	460	499	510	565	592	655	1,020	858	773	753	779
Primary Metals	1,994	2,028	1,947	2,017	2,048	2,111	2,115	1,916	2,140	2,122	2,061
Miscellaneous	399	418	430	442	448	476	490	485	513	537	550
Non-Buildings	54	54	55	57	60	60	61	61	68	74	84
INDUSTRIAL	**4,960**	**5,150**	**5,082**	**5,353**	**5,552**	**5,849**	**6,246**	**5,896**	**6,165**	**6,479**	**6,957**
GS Diesel FC	11	12	13	15	16	15	9	6	4	5	4
GS Diesel	1	1	1	1	1	1	0	0	0	0	0
GS Seasonal	7	6	6	5	5	5	5	5	4	4	4
GS FR Water Heat	15	13	11	10	10	9	8	8	8	8	7
Sentinels FR	14	14	10	8	9	9	9	9	10	10	10
Street Lighting	86	76	62	57	56	56	56	57	58	58	66
Res Diesel	12	13	13	14	15	14	11	7	5	5	6
Res Seasonal	52	51	47	48	48	46	44	46	49	49	54
Res FR Water Heat	28	25	23	21	21	19	18	17	16	15	14
OTHER	**226**	**210**	**186**	**180**	**179**	**174**	**161**	**155**	**154**	**155**	**166**
TOTAL	**12,963**	**13,406**	**13,381**	**13,876**	**14,479**	**14,569**	**14,442**	**14,401**	**14,969**	**15,470**	**16,400**

Historical Sales Growth by Building Type

Table 1.3 analyzes the sales growth by building type that occurred in the Manitoba Hydro service area over the 1992 to 2002 period and provides insight to load growth experienced within the various building sectors. Total sales have grown from 12,963 GW.h in 1992 to 16 400 GW.h in 2002. Over this period of time, total sales have grown an average of 343.7 GW.h per year, representing an average annual growth rate of 2.4% per year. This growth is occurring in the Manitoba Hydro service area only and does not include any growth from the Winnipeg Hydro service area.

In the residential sector, a majority of the load growth is occurring in the single detached buildings, with growth averaging 67.9 GW.h from 1992 to 2002. High growth rates are also experienced in the cottage and mobile home sectors, however, these sectors are much smaller in magnitude.

Commercial sales increased from 3 133 GW.h in 1992 to 3 798 GW.h in 2002. Over this period, commercial sales have grown an average of 66.5 GW.h per year, representing an average annual growth rate of 1.9% per year. Commercial sales are growing due to increased activity in the retail, recreation, miscellaneous commercial, office and warehouse sectors.

Industrial sales increased from 4 960 GW.h in 1992 to 6 957 GW.h in 2002. Over this period of time, industrial sales have grown 199.7 GW.h per year, representing an average annual growth rate of 3.4% per year. The high growth is due to electricity intensive industries expanding within Manitoba.

TABLE 1.3
HISTORICAL ELECTRICITY GROWTH RATES BY BUILDING TYPE

	Manitoba Hydro Sales (GW.h)		Ten Year Growth Rate	
Building Type	**1992**	**2002**	**(GW.h/Yr)**	**(%/Yr)**
Single Detached	3,115	3,794	67.9	2.0%
Duplex	107	117	1.0	0.9%
Cottage	29	53	2.4	6.3%
Town/Row	110	124	1.4	1.2%
Mobile	158	210	5.2	2.9%
Apartment	158	186	2.8	1.7%
Non-Dwelling	22	20	-0.3	-1.2%
Farm	907	948	4.1	0.4%
Farm Non-Dwelling	38	27	-1.0	-3.1%
RESIDENTIAL	**4,644**	**5,479**	**83.6**	**1.7%**
Office	281	340	6.0	2.0%
Restaurant	149	179	3.0	1.8%
Retail	372	476	10.4	2.5%
Grocery	210	257	4.7	2.0%
Warehouse	167	226	5.9	3.1%
School	258	305	4.7	1.7%
College	118	124	0.6	0.5%
Hospital	151	176	2.5	1.6%
Hotel/Motel	142	175	3.4	2.2%
Bulk Apartment	383	405	2.2	0.6%
Common Service	96	104	0.7	0.7%
Personal Care Home	84	101	1.7	1.9%
Recreation Facility	172	238	6.6	3.3%
Church	41	52	1.1	2.5%
Miscellaneous	375	437	6.2	1.5%
Non-Building	106	159	5.3	4.1%
Sask. Power Corp.	29	43	1.5	4.2%
COMMERCIAL	**3,133**	**3,798**	**66.5**	**1.9%**
Agriculture	312	548	23.6	5.8%
Mining	261	223	-3.9	-1.6%
Food/Beverage	263	461	19.8	5.8%
Pulp/Paper	445	772	32.7	5.7%
Chemicals	771	1,480	70.9	6.7%
Petroleum Transport	460	779	31.9	5.4%
Primary Metals	1,994	2,061	6.7	0.3%
Miscellaneous	399	550	15.0	3.2%
Non Buildings	54	84	3.0	4.5%
INDUSTRIAL	**4,960**	**6,957**	**199.7**	**3.4%**
GS Diesel FC	11	4	-0.7	-8.8%
GS Diesel	1	0	-0.1	-100.0%
GS Seasonal	7	4	-0.3	-4.6%
GS FR Water Heat	15	7	-0.8	-6.8%
Sentinels FR	14	10	-0.4	-3.5%
Street Lighting	86	66	-2.0	-2.7%
Res Diesel	12	6	-0.6	-6.4%
Res Seasonal	52	54	0.1	0.2%
Res FR Water Heat	28	14	-1.4	-6.7%
OTHER	**226**	**166**	**-6.1**	**-3.1%**
TOTAL	**12,963**	**16,400**	**343.7**	**2.4%**

Historical Growth Percentages by Building Type

Historical growth percentages were calculated for each residential, commercial and industrial building type (Table 1.4). These percentages identify the building types in which residential and general service mass market growth occurred. These percentages were used to break down residential basic and general service mass market sales forecasts into building type sales forecasts.

Almost half (46.1%) of the growth in the general service mass market occurred in the industrial sector, with agriculture (19%) and miscellaneous industrial (12.1%) accounting for a large portion of the growth. Although the General Service Mass Market was forecast to grow at an annual rate of 1.6%, only a little more than half (53.9%) of this growth should be allocated to the commercial sector. Therefore, the 2002 Load Forecast assumes that commercial electricity consumption will grow about 0.8% per year (Table 1.6). The DSM market potential study assumed a growth rate of 1.6% which has been recognized and will be addressed in the next phase (i.e. detailed design phase) of Manitoba Hydro's efforts to revise its DSM targets. This will have the effect of lowering

TABLE 1.4
GROWTH PERCENTAGES BY BUILDING TYPE

Building Type	Percentage of Residential Sales	Building Type	Percentage of GS Mass Sales
Single Detached	81.3%	Office	4.8%
Duplex	1.2%	Restaurant	2.4%
Cottage	2.9%	Retail	8.4%
Town/Row	1.6%	Grocery	3.8%
Mobile	6.2%	Warehouse	4.8%
Apartment	3.4%	School	3.8%
Non Dwelling	-0.3%	College	0.9%
Farm	4.9%	Hospital	2.0%
Farm Non Dwelling	-1.2%	Hotel/Motel	2.7%
RESIDENTIAL	**100.0%**	Bulk Apartment	1.8%
		Common Service	0.6%
		Personal Care Home	1.4%
		Recreation Facility	5.3%
		Church	0.9%
		Miscellaneous	5.0%
		Non Building	4.2%
		Sask. Power Corp.	1.2%
		COMMERCIAL	**53.9%**
		Agriculture	19.0%
		Mining	-3.3%
		Food/Beverage	6.3%
		Pulp/Paper	3.0%
		Chemicals	5.1%
		Petroleum Transport	-0.3%
		Primary Metals	1.8%
		Miscellaneous	12.1%
		Non Buildings	2.4%
		INDUSTRIAL	**46.1%**
		GENERAL SERVICE MASS	**100.0%**

economic and achievable DSM potential identified in the DSM market potential study. The impact is mitigated by the fact that approximately 20% of the DSM potential actually comes from new buildings. This effect on the economic and achievable DSM potential is in a direction opposite to that proposed by TREE/RCM (i.e. that there is more DSM potential in Manitoba than the DSM market potential study indicates).

2002 Load Forecast by Building Type

The 2002 Load Forecast was broken into the various building type components. The first step of this process is to allocate the forecast of Winnipeg Hydro at common bus to the various sales sectors on the following basis: residential basic (23%), general service mass market (72%), street lighting (1%) and distribution losses (4%). These allocation percentages were derived by comparing actual Winnipeg Hydro sales over the past two years as a percentage of the Winnipeg Hydro load at common bus.

The residential basic sales forecast was allocated to residential building types using the historical residential growth percentages contained on Table 1.4. For example, 81.3% of the residential basic sales forecast, including Winnipeg Hydro, was allocated to the residential single detached building type.

The general service mass market sales forecast was allocated to commercial and industrial building types using the historical general service mass market growth percentages contained on Table 1.4. For example, 4.8% of the general service mass market sales forecast, including Winnipeg Hydro, was allocated to the commercial office building type.

The general service top customer forecasts was allocated to the proper building types on a customer by customer basis. The results are contained in Table 1.5.

TABLE 1.5
2002 Load Forecast By Building Type

	Forecast Sales By Building Type (Province of Manitoba)															
Building Type	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Single Detached	4,032	4,070	4,104	4,130	4,155	4,180	4,206	4,233	4,261	4,291	4,322	4,353	4,386	4,415	4,444	4,475
Duplex	166	166	167	167	168	168	168	169	169	170	170	171	171	172	172	173
Cottage	48	49	50	51	52	53	54	55	56	57	58	59	60	61	63	64
Town/Row	131	132	132	133	133	134	134	135	135	136	137	137	138	138	139	140
Mobile	198	201	203	205	207	209	211	213	215	217	220	222	225	227	229	231
Apartment	283	284	286	287	288	289	290	291	292	294	295	296	298	299	300	301
Non Dwelling	31	31	31	31	30	30	30	30	30	30	30	30	30	29	29	29
Farm	938	941	943	944	946	947	949	950	952	954	956	958	960	962	963	965
Farm Non Dwelling	30	29	29	28	28	28	27	27	26	26	25	25	24	24	24	23
RESIDENTIAL	**5,856**	**5,903**	**5,945**	**5,976**	**6,008**	**6,039**	**6,070**	**6,103**	**6,138**	**6,174**	**6,212**	**6,251**	**6,291**	**6,327**	**6,363**	**6,400**
Office	750	755	759	764	768	772	775	779	783	789	794	799	804	809	814	819
Restaurant	231	234	235	238	240	242	243	245	247	250	253	255	258	260	262	265
Retail	698	707	714	722	729	736	742	748	756	766	775	784	793	801	809	818
Grocery	319	323	326	330	333	336	339	342	345	349	354	358	362	365	369	373
Warehouse	258	264	267	272	276	280	284	287	292	297	303	308	313	317	322	327
School	344	348	351	355	359	361	364	367	371	375	379	383	387	391	395	398
College	163	164	164	165	166	167	168	168	169	170	171	172	173	174	175	176
Hospital	261	263	264	266	268	270	271	273	275	277	279	282	284	286	288	290
Hotel/Motel	229	232	234	237	240	242	244	246	248	251	255	257	260	263	266	268
Bulk Apartment	566	568	569	571	572	574	575	576	578	580	582	584	586	587	589	591
Common Service	166	166	167	168	168	169	169	169	170	171	171	172	173	173	174	174
Personal Care Home	119	120	121	123	124	125	126	127	129	130	132	133	134	136	137	139
Recreation Facility	316	322	326	331	336	340	344	347	353	358	365	370	376	381	386	391
Church	66	67	68	69	70	71	71	72	73	74	75	76	77	78	79	79
Miscellaneous	603	609	613	618	622	626	630	633	638	644	649	655	660	665	670	674
Non Building	168	172	176	180	184	187	190	193	197	202	207	211	216	220	224	228
Sask. Power Corp.	42	43	44	45	46	47	48	49	50	52	53	54	55	57	58	59
COMMERCIAL	**5,297**	**5,359**	**5,399**	**5,453**	**5,501**	**5,544**	**5,583**	**5,622**	**5,675**	**5,735**	**5,797**	**5,855**	**5,909**	**5,962**	**6,016**	**6,069**
Agriculture	526	548	562	582	598	613	627	641	659	680	702	723	742	760	779	798
Mining	193	149	146	143	146	149	153	157	159	162	167	172	178	184	190	195
Food/Beverage	483	510	515	521	532	543	554	564	577	590	606	622	637	652	667	683
Pulp/Paper	784	777	780	783	794	806	817	828	840	853	870	886	903	919	936	952
Chemicals	1,584	1,599	1,643	1,688	1,757	1,825	1,893	1,960	2,029	2,099	2,141	2,182	2,223	2,264	2,305	2,346
Petroleum Transport	762	786	811	836	867	897	928	959	990	1,020	1,049	1,078	1,087	1,095	1,104	1,113
Primary Metals	2,103	2,140	2,176	2,213	2,219	2,224	2,229	2,235	2,240	2,246	2,252	2,257	2,253	2,248	2,243	2,238
Miscellaneous	686	700	709	721	732	741	750	759	771	784	798	811	823	835	847	859
Non Buildings	81	84	86	88	90	92	94	96	98	101	103	106	108	111	113	116
INDUSTRIAL	**7,201**	**7,293**	**7,428**	**7,574**	**7,735**	**7,892**	**8,046**	**8,198**	**8,363**	**8,535**	**8,688**	**8,837**	**8,954**	**9,069**	**9,185**	**9,300**
GS Diesel FC	6	6	7	8	8	9	9	10	11	11	12	12	13	14	14	15
GS Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GS Seasonal	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
GS FR Water Heat	7	7	7	6	6	6	5	5	5	5	4	4	4	4	4	3
Sentinels FR	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13
Street Lighting	83	83	83	84	84	85	85	86	86	87	87	88	88	89	89	90
Res Diesel	6	7	7	8	9	9	10	10	11	11	12	12	13	13	14	14
Res Seasonal	49	51	52	53	55	56	57	59	60	61	63	64	65	67	68	69
Res FR Water Heat	14	13	12	11	11	10	9	9	8	8	7	7	6	6	6	5
OTHER	**179**	**181**	**183**	**185**	**187**	**189**	**191**	**194**	**196**	**199**	**201**	**203**	**206**	**208**	**211**	**213**
TOTAL	**18,533**	**18,735**	**18,955**	**19,189**	**19,431**	**19,663**	**19,890**	**20,116**	**20,372**	**20,642**	**20,899**	**21,147**	**21,360**	**21,567**	**21,775**	**21,983**

4. Comparison of Historical and 2002 Load Forecast Growth by Building Type

To undertake a reasonableness check of Manitoba Hydro's 2002 Load Forecast, historical growth by building type is compared between that experienced over the 1992 to 2002 period to the growth inherent in the 2002 Load Forecast. The results of this comparison are provided in Table 1.6. To incorporate the most current information, the forecast growth is calculated from the actual calendar year 2003 sales. The forecast and actual 2003 sales include Winnipeg Hydro; whereas the historical growth excludes Winnipeg Hydro from the analysis because the data is unavailable.

Residential sales increased 83.6 GW.h per year over the historical period and the 2002 Load Forecast increased only 16.7 GW.h per year. The annual residential growth rate was 1.7% over the historical period and is forecast to be only 0.3% per year in the future. The residential load increased significantly in 2002/03, due to increased saturation and usage of computers, increased saturations of electric water heating and increased saturations of large screen televisions. The higher load growth in the residential sector was reflected into the 2003 Load Forecast.

Commercial sales increased 66.5 GW.h per year over the historical period and the 2002 Load Forecast increased only 48.3 GW.h per year. The annual commercial growth rate was 1.9% over the historical period and is forecast to be only 0.8% per year in the future.

Industrial sales increased 199.7 GW.h per year over the historical period and the 2002 Load Forecast increased only 133.1 GW.h per year. The annual industrial growth rate was 3.4% over the historical period and is forecast to be only 1.6% per year in the future. Major expansions in the chemical, pulp/paper, petroleum transport and agricultural sectors were the primary reasons for the growth. The 2002 Load Forecast assumes continued industrial growth, primarily in the chemical and petroleum transport sectors, but at a much lower rate than the past.

Overall, total sales increased 343.7 GW.h per year over the historical period and the 2002 Load Forecast increases only 198.4 GW.h per year. The annual total sales growth rate was 2.4% over the historical period and is forecast to be only 1.0% per year in the future.

These growth figures are well below the historical growth experienced in Manitoba and provide supporting documentation that Manitoba Hydro is not forecasting the future based solely on historical trends. Manitoba Hydro's forecast incorporates a balanced consideration of reasonable productivity improvements, historical trends, anticipated future changes in electricity intensities, customer specific information, national economic activity as it impacts Manitoba's economic activity and the relative provincial advantage for attracting industry. Another important point to note is that the 2002 Load Forecast excludes any load reduction due to Manitoba Hydro's incentive based DSM initiatives.

TABLE 1.6
HISTORICAL AND 2002 LOAD FORECAST COMPARISON

	Manitoba Hydro Sales History (1992-2002)				Provincial Sales (2003-2017/18)			
	Sales (GW.h)		Growth Rate		Sales (GW.h)		Growth Rate	
Building Type	Actual 1992	Actual 2002	(GW.h/Yr)	(%/Yr)	Actual 2003	Forecast 2017/18	(GW.h/Yr)	(%/Yr)
Single Detached	3,115	3,794	67.9	2.0%	4,285	4,475	13.6	0.3%
Duplex	107	117	1.0	0.9%	171	173	0.1	0.1%
Cottage	29	53	2.4	6.3%	60	64	0.2	0.4%
Town/Row	110	124	1.4	1.2%	135	140	0.4	0.3%
Mobile	158	210	5.2	2.9%	209	231	1.6	0.7%
Apartment	158	186	2.8	1.7%	294	301	0.5	0.2%
Non Dwelling	22	20	-0.3	-1.2%	30	29	-0.1	-0.2%
Farm	907	948	4.1	0.4%	955	965	0.7	0.1%
Farm Non Dwelling	38	27	-1.0	-3.1%	28	23	-0.4	-1.4%
RESIDENTIAL	**4,644**	**5,479**	**83.6**	**1.7%**	**6,167**	**6,400**	**16.7**	**0.3%**
Office	281	340	6.0	2.0%	755	819	4.6	0.6%
Restaurant	149	179	3.0	1.8%	236	265	2.1	0.8%
Retail	372	476	10.4	2.5%	699	818	8.5	1.1%
Grocery	210	257	4.7	2.0%	325	373	3.4	1.0%
Warehouse	167	226	5.9	3.1%	265	327	4.4	1.5%
School	258	305	4.7	1.7%	345	398	3.8	1.0%
College	118	124	0.6	0.5%	171	176	0.3	0.2%
Hospital	151	176	2.5	1.6%	265	290	1.7	0.6%
Hotel/Motel	142	175	3.4	2.2%	232	268	2.6	1.0%
Bulk Apartment	383	405	2.2	0.6%	562	591	2.1	0.4%
Common Service	96	104	0.7	0.7%	169	174	0.4	0.2%
Personal Care Home	84	101	1.7	1.9%	119	139	1.4	1.1%
Recreation Facility	172	238	6.6	3.3%	320	391	5.1	1.4%
Church	41	52	1.1	2.5%	71	79	0.6	0.8%
Miscellaneous	375	437	6.2	1.5%	637	674	2.7	0.4%
Non Building	106	159	5.3	4.1%	177	228	3.7	1.8%
Sask. Power Corp.	29	43	1.5	4.2%	45	59	1.0	1.9%
COMMERCIAL	**3,133**	**3,798**	**66.5**	**1.9%**	**5,393**	**6,069**	**48.3**	**0.8%**
Agriculture	312	548	23.6	5.8%	580	798	15.6	2.3%
Mining	261	223	-3.9	-1.6%	154	195	3.0	1.7%
Food/Beverage	263	461	19.8	5.8%	517	683	11.9	2.0%
Pulp/Paper	445	772	32.7	5.7%	814	952	9.9	1.1%
Chemicals	771	1,480	70.9	6.7%	1,654	2,346	49.4	2.5%
Petroleum Transport	460	779	31.9	5.4%	753	1,113	25.7	2.8%
Primary Metals	1,994	2,061	6.7	0.3%	2,195	2,238	3.1	0.1%
Miscellaneous	399	550	15.0	3.2%	680	859	12.8	1.7%
Non Buildings	54	84	3.0	4.5%	91	116	1.8	1.7%
INDUSTRIAL	**4,960**	**6,957**	**199.7**	**3.4%**	**7,437**	**9,300**	**133.1**	**1.6%**
GS Diesel FC	11	4	-0.7	-8.8%	5	15	0.7	8.8%
GS Diesel	1	0	-0.1	-100.0%	0	0	0.0	0.0%
GS Seasonal	7	4	-0.3	-4.6%	5	4	-0.1	-1.8%
GS FR Water Heat	15	7	-0.8	-6.8%	13	3	-0.7	-9.3%
Sentinels FR	14	10	-0.4	-3.5%	10	13	0.2	1.7%
Street Lighting	86	66	-2.0	-2.7%	80	90	0.7	0.8%
Res Diesel	12	6	-0.6	-6.4%	6	14	0.6	6.4%
Res Seasonal	52	54	0.1	0.2%	56	69	0.9	1.5%
Res FR Water Heat	28	14	-1.4	-6.7%	34	5	-2.0	-12.3%
OTHER	**226**	**166**	**-6.1**	**-3.1%**	**209**	**213**	**0.3**	**0.1%**
TOTAL	**12,963**	**16,400**	**343.7**	**2.4%**	**19,206**	**21,983**	**198.4**	**1.0%**

The forecast growth rates for residential (0.3%) and commercial (0.8%) are significantly below the forecast of GDP growth (1.9%), implying substantial efficiency improvement. The forecast growth rate for industrial (1.6%) is also below the GDP growth rate, implying productivity improvement, even though electricity intensive industries are forecast to continue to expand in Manitoba.

5. *Comparison of Historical and TREE/RCM's Reference Projection*

To undertake a reasonableness check of TREE/RCM's Adjusted Forecast, historical growth by building type is compared between that experienced over the 1992 to 2002 period to the growth inherent in TREE/RCM's Adjusted Forecast. The results of this comparison are provided in Table 1.7.

TABLE 1.7
HISTORICAL AND TREE/RCM REFERENCE PROJECTION COMPARISON

	History			
	1992	2002	Annual Growth	
Sector	Sales (GW.h)	Sales (GW.h)	Sales (GW.h)	Sales (%)
Residential	4,644	5,479	83.6	1.7%
Commercial	3,133	3,798	66.5	1.9%
Industrial	4,960	6,957	199.7	3.4%
Total	12,963	16,400	343.7	2.4%
	Actual	TREE/RCM Reference Projection		
	2003	2017/18	Annual Growth	
Sector	Sales (GW.h)	Sales (GW.h)	Sales (GW.h)	Sales (%)
Residential	6,167	6,360	13.8	0.2%
Commercial	5,393	5,131	-18.7	-0.4%
Industrial	7,437	8,338	64.4	0.8%
Total	19,206	19,830	44.6	0.2%

The residential sales are forecast by TREE/RCM to be similar to that forecast by Manitoba Hydro's forecast.

Commercial sales increased 66.5 GW.h per year over the historical period and the TREE/RCM Reference Projection has a decrease of 18.7 GW.h per year. The annual commercial growth rate was 1.9% over the historical period and is forecast to decrease 0.4% per year in the future. The TREE/RCM commercial sales forecast is intuitively low, considering that future DSM energy savings from commercial DSM activities are not included in this forecast. TREE/RCM's forecast is radically different than historical information and is unsupported by any detailed analysis.

Industrial sales increased 199.7 GW.h per year over the historical period and the TREE/RCM Reference Projection has an increase of 64.4 GW.h per year. The annual industrial growth rate was 3.4% over the historical period and is forecast to be only 0.8% per year in the future. The TREE/RCM industrial sales forecast is intuitively low, considering that electricity intensive industries are continuing to expand in Manitoba and there is no supporting evidence to suggest that this trend is going to radically change.

Table 1.7 clearly reveals the degree to which the TREE/RCM Reference Projection underestimates electricity consumption in Manitoba. The TREE/RCM Reference Projection forecasts total provincial sales to be only 19,830 GW.h by 2017/18. Doing a simple check, billing records indicate that actual sales have already reached a level of 19,206 GW.h for the 2003 calendar year. Therefore, TREE/RCM's adjusted Load Forecast has only 624 GW.h of sales growth, for the entire province, over the next fourteen years. TREE/RCM projects an annual sales increase of 44.6 GW.h, which is only 13% of the historical growth. In Manitoba Hydro's option, the TREE/RCM Reference Projection is based on an unrealistic future that is radically different than the past.

Since the 2003 calendar sales are already at a level of 19,206 GW.h and sales growth averages 343.7 GW.h per year, the 2017/18 reference projection would be surpassed in just two years of historical load growth. Manitoba electricity sales could easily exceed TREE/RCM's 2017/18 prediction of 19 830 GW.h by 2005/06 – a full twelve years before TREE/RCM's forecast predicts.

What makes TREE/RCM's projection even more unrealistic is that the forecast covers a period when large industrial customers will likely continue to locate and expand within the province. The latest discussions with Manitoba's top customers indicate that construction commitments will add an additional 475 GW.h of load growth by mid 2005 and a further 450 GW.h by 2007/08. These commitments alone will bring the Manitoba load to 20 131 (19 206 + 450 + 475) GW.h by 2007/08, which suggests that the 2017/18 TREE/RCM Reference Projection will underestimate electricity demand by 300 GW.h in 2007/08, without the addition of any load growth in the residential and General Service Mass Market segments.

6. *Productivity Improvements in the 2002 Load Forecast*

Productivity Improvements by Sector

Since commercial and industrial sales breakdown of Winnipeg Hydro data is not available, the historical productivity improvements are calculated using Manitoba Hydro data only. Winnipeg Hydro sales data is available for 2003 and was factored into the calculation of forecast productivity improvements.

Historically, the residential sector showed an annual productivity improvement of 0.5% and the 2002 Load Forecast predicts an annual 2.0% improvement. The commercial

sector showed an annual productivity improvement of 0.2% and the 2002 Load Forecast predicts an annual 1.4% improvement. The industrial sector showed an annual productivity decrease of 1.2% and the 2002 Load Forecast predicts an annual 0.7% improvement.

Table 1.8 compares the historical productivity improvements by sector to the productivity improvements that are implicit in the 2002 Load Forecast. These results clearly show that the 2002 Load Forecast is based on assumptions and model relationships that implicitly incorporate productivity improvements into the forecast.

TABLE 1.8
PRODUCTIVITY IMPROVEMENTS BY SECTOR

	History						
	1992			2002			Annual
Sector	GDP$	Sales	Productivity	GDP$	Sales	Productivity	Growth
Residential	$26,629	4,644	$5.73	$33,095	5,479	$6.04	0.5%
Commercial	$26,629	3,133	$8.50	$33,095	3,798	$8.71	0.2%
Industrial	$26,629	4,960	$5.37	$33,095	6,957	$4.76	-1.2%
	Forecast						
	2003			2017/18			Annual
Sector	GDP$	Sales	Productivity	GDP$	Sales	Productivity	Growth
Residential	$33,095	6,167	$5.37	$45,416	6,400	$7.10	2.0%
Commercial	$33,095	5,393	$6.14	$45,416	6,069	$7.48	1.4%
Industrial	$33,095	7,437	$4.45	$45,416	9,300	$4.88	0.7%

In TREE/RCM's adjusted load forecast for the industrial sector (page 2 of CNF/RCM/TREE I NFAAT -4), a productivity improvement of 14.4% by 2017/18 is inherent in the forecast. TREE/RCM suggests that this is reasonable in light of the 10% productivity improvement experienced in Canada from 1996-2001. As shown in Table 1.8, Manitoba experienced an annual productivity decrease of 1.2% per year since 1992 which indicates that a judgment based on national activities can be, and in this case, are inappropriate. Manitoba Hydro is of the opinion that it is more accurate to forecast economic activity in Manitoba based on regional information and customer specific information, supplemented with national information. In the latter case, incorporating national information is appropriate to the degree that the economic activity impacts regional economic activity.

Electricity Sales Per Capita

Graph CNF 2.1 of CNF/TREE/RCM I NFAAT–2 has been reproduced to include the 2002 Load Forecast results. Table 1.9 compares the twenty year history of electricity sales per capita to the twenty year forecast of electricity sales per capita. The 2002 provincial sales forecast was created by adding 96% of the Winnipeg Hydro load at common bus to the sales reported in the 2002 Load Forecast, assuming that 4% of the common bus load would end up as distribution losses.

Figure 1.1 clearly shows that future electricity sales per capita are expected to grow, but at a declining rate compared to the past. Table 1.9 shows that electricity sales per capita has increased 5,225 kW.h/person or 47% over the last twenty years. The 2002 Load Forecast indicates that electricity sales per capita will increase only 2,501 kW.h/person or 15% over the next twenty years.

FIGURE 1.1

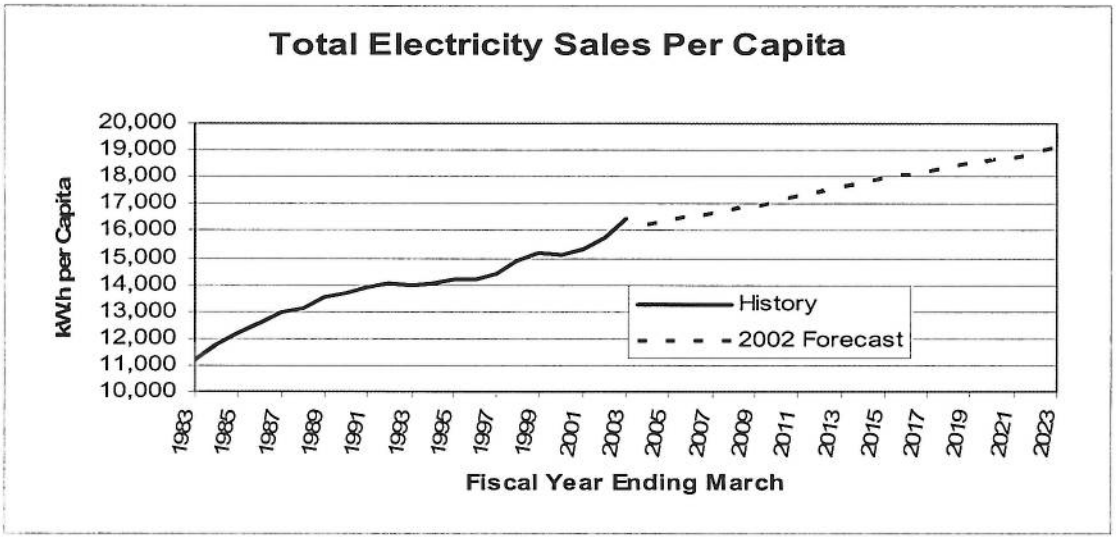

TABLE 1.9

	May 2002 Load Forecast				
Fiscal Year	Sales (GW.h)	Manitoba Population	kW.h Per Capita	kW.h/Capita Growth kW.h	Percent
1982/83	11,783	1,050	11,222	N/A	N/A
2002/03	18,947	1,152	16,447	5,225	47%
2022/23	23,059	1,217	18,948	2,501	15%

Electricity sales per capita have increased in the past and are expected to increase in the future because electricity intensive industries are locating and expanding in the province. In the future, the rate of growth to this index is forecast to decline. The 2002 Load Forecast assumes that the growth in electricity sales per capita will be less than half (2,501/5,225 = 48%) of the growth that this index has exhibited in the past. This further indicates that Manitoba Hydro is not simply forecasting the future based on the past.

Electrical Productivity of the Manitoba Economy

Electrical productivity of the Manitoba economy is measured by dividing the real gross provincial product by the total provincial electricity consumption. In other words, it is a

ratio of $/kW.h that measures the amount of economic output gained from every kW.h produced. A higher ratio means that the province is becoming more productive.

Figure 1.2 clearly shows that the overall electrical productivity of the Manitoba economy has declined since 1982/83. The electrical productivity of the province improved over the 1992 to 2000 period, but has declined again in recent years. Table 1.10 shows that the electrical productivity of Manitoba, as measured in GDP$/kW.h of firm energy, has decreased 0.11 $/kW.h or 7% since 1982/83. The 2002 Load Forecast indicates that electricity productivity will increase 0.26 $/kW.h or 17% over the next twenty years.

Electrical productivity of the Manitoba economy has decreased in the past due to the expansion of electricity intensive industries within the province. The 2002 Load Forecast assumes that the electrical productivity of Manitoba will improve substantially over the next twenty years, even though continued expansion of electricity intensive industries is expected. Manitoba Hydro is predicting that the overall economy of Manitoba will be more productive.

FIGURE 1.2

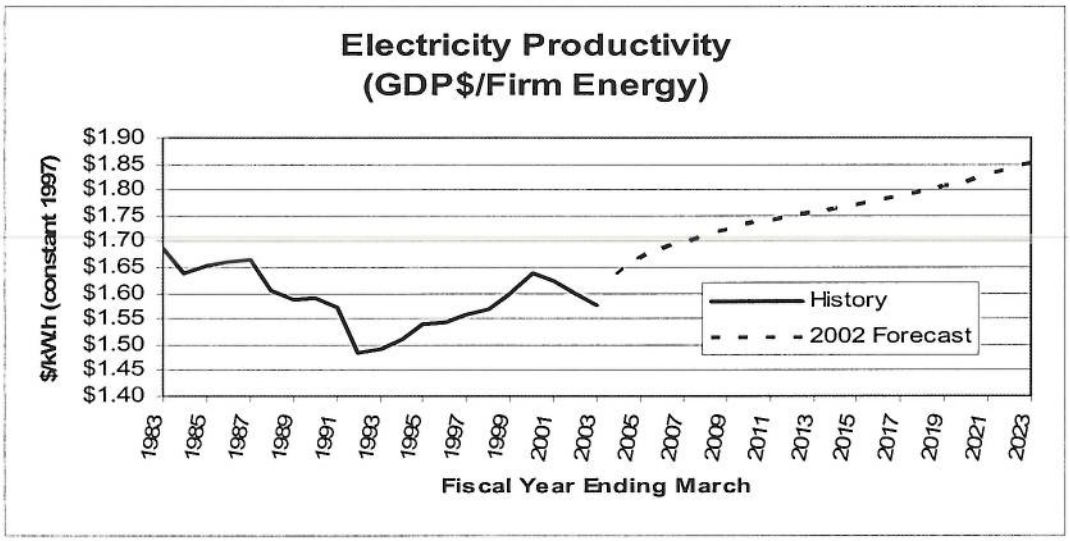

TABLE 1.10

	May 2002 Load Forecast				
Fiscal Year	Manitoba GDP (97$)	Energy (GW.h)	GDP$ per kW.h	Productivity Growth $/kW.h	Productivity Growth Percent
1982/83	22,703	13,472	1.69	N/A	N/A
2002/03	34,127	21,668	1.57	-0.11	-7%
2022/23	48,459	26,381	1.84	0.26	17%

Electrical Productivity of the General Service Sector

Electrical productivity of the General Service sector is measured by dividing the real gross provincial product by general service electricity consumption. It measures the amount of economic output gained from every kW.h produced for the general service sector. A higher ratio means that the general service sector is becoming more productive.

Figure 1.3 clearly shows that the electrical productivity of the general service sector has declined significantly since 1982/83. Table 1.11 shows that the electrical productivity of Manitoba, as measured in GDP$/kW.h of general service electricity sales, has decreased 0.46 $/kW.h or 15% since 1982/83. The 2002 Load Forecast indicates that electricity productivity will increase 0.29 $/kW.h or 11% over the next twenty years.

FIGURE 1.3

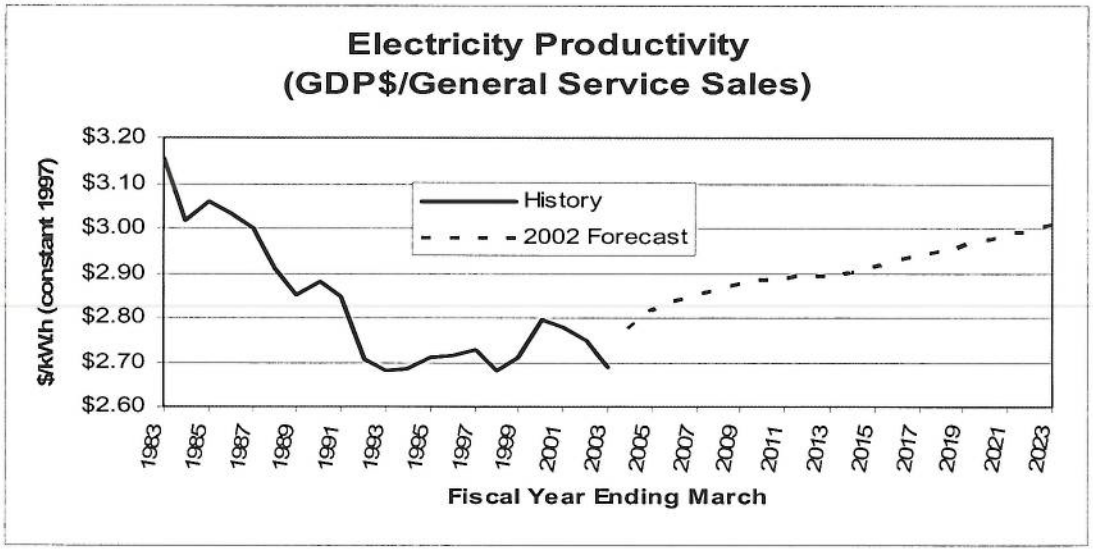

TABLE 1.11

	May 2002 Load Forecast				
Fiscal	**Manitoba**	**GS Sales**	**GDP$** per	**Productivity Growth**	
Year	GDP (97$)	(GW.h)	kW.h	$/kW.h	Percent
1982/83	22,703	7,198	3.15	N/A	N/A
2002/03	34,127	12,686	2.69	-0.46	-15%
2022/23	48,459	16,261	2.98	0.29	11%

Again, electrical productivity of the general service sector has decreased in the past due to the expansion of electricity intensive industries within the province. The 2002 Load Forecast assumes that the electrical productivity of Manitoba will improve substantially over the next twenty years, even though continued expansion of electricity intensive industries is expected. As indicated by this analysis, Manitoba Hydro is predicting that the overall economy of Manitoba will be more productive.

Residential Sales Per Household

Graphs 2.4 and 2.5 of CNF/TREE/RCM I NFAAT correctly show that the electricity usage per household is forecast to increase for non-electric space heat (standard) customers and decrease for electric space heat (all-electric) customers. There are some major differences between standard and all-electric customers beside their choice of space heating fuel. The standard customer tends to live in an urban location where natural gas is available, has natural gas water heat and has more disposable income. The all-electric customer tends to live in rural areas where natural gas is not available, and has electric water heat and less disposable income.

The average use of a standard customer will increase in the future because of increasing appliance and electric water heating saturation rates. The standard customer group has more income to purchase discretionary electricity consuming appliances such as computers and large screen TV's. This sector is also characterized by having a low saturation (19%) of electric water tanks. This is forecast to increase in the future due to changing building code requirements and the associated cost of installing natural gas water tanks. The increase in appliance and electric water heating saturation rates is forecast to cause the standard average use to increase over time. The increase in average use is well supported by the historical data from 1991/92 to 2002/03.

The average use of an all-electric customer will decrease because these customers have less income to purchase electricity-consuming appliances. The vast majority of all-electric customers (88%) already has electric water tanks. The combination of lower appliance saturation growth rates, negligible electric water heating growth rates and a decreasing space heating requirement due to improvements in insulation levels and building code standards will cause the average use to decrease over time. The decrease in average use is well supported by the historical data from 1991/92 to 2002/03.