



**Demand Side Management (DSM) in the
Manitoba Public Utility Board's
(PUB's) Needs-For and Alternatives-To
(NFAT) Review of Manitoba Hydro's
(MH's) Development Plan**

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Overview

- Purpose of evidence
 - To address the issues in the MPUB Scope of Work (SOW) on DSM
- General issues
 - Key messages
- Scope of Work (SOW) responses

Key Messages

- MH's approach to DSM is reasonable
 - Comparable to other North American utilities
- DSM on its own has minimal impact on the timing of Keeyask
- MH's approach could be improved
 - Move back to full Integrated Resource Planning (IRP)
 - Change delivery model (government decision)
 - Conduct studies to check assumptions
 - Model uncertainty explicitly
 - Multiple accounts evaluation could be made more complete
- The suggested improvements could affect Conawapa In-Service Date (ISD)
 - An opportunity for MH to keep up with the evolution of the incorporation of EE into system planning

Energy Efficiency Lexicon

- Energy Efficiency (EE) – use of technologies that use energy more efficiently
- Conservation – education to change consumer behaviour
- Soft path – combination of EE and renewables
- Conservation and Demand Management (CDM) – programs that combine EE and conservation
- DSM – programs that deliver estimated customer savings through EE measures
- END-USE – the energy used by energy services
- Energy services- the services that energy performs (heating, cooling, lighting, mechanical action, process-specific, electricity specific)
- MEASURE - a component of a CDM or DSM program
- IRP – a method of treating supply and demand-side measures equivalently

Conceptual Framework

DSM SAVINGS AT TIME T * = SUM OVER ALL END-USE MEASURES OF:
(REFERENCE END-USE MEASURE TERTIARY ENERGY MINUS
EFFICIENT END-USE MEASURE TERTIARY ENERGY)*
(NUMBER OF END-USE MEASURES)

*E.G. 2014

TERM IN THIS BRACKET CANNOT BE MEASURED DIRECTLY; INFERRED FROM EITHER,
BASELINE DATA OR ENGINEERING ASSUMPTIONS OR BOTH

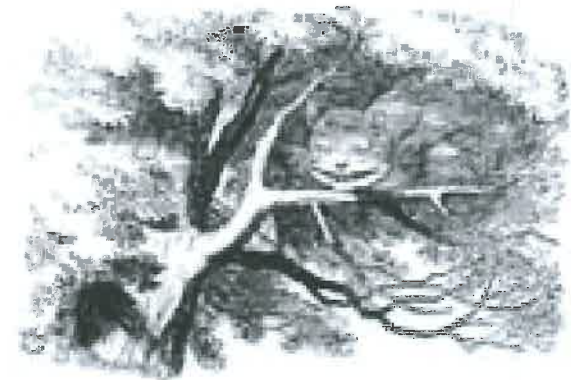
NUMBER OF END-USE MEASURES IS USUALLY DECOMPOSED AS:
NUMBER OF END-USE MEASURES = POPULATION OF SERVICES
PROVIDED BY END-USE MEASURE * SATURATION LIMIT (%) * PENETRATION (%)

THESE TERMS REQUIRE ASSUMPTIONS ABOUT MARKET BEHAVIOUR

DSM SAVINGS AT T+1 = DSM SAVINGS AT TIME T * DECAY RATE (%)

The Cheshire Cat: Central Concern with DSM

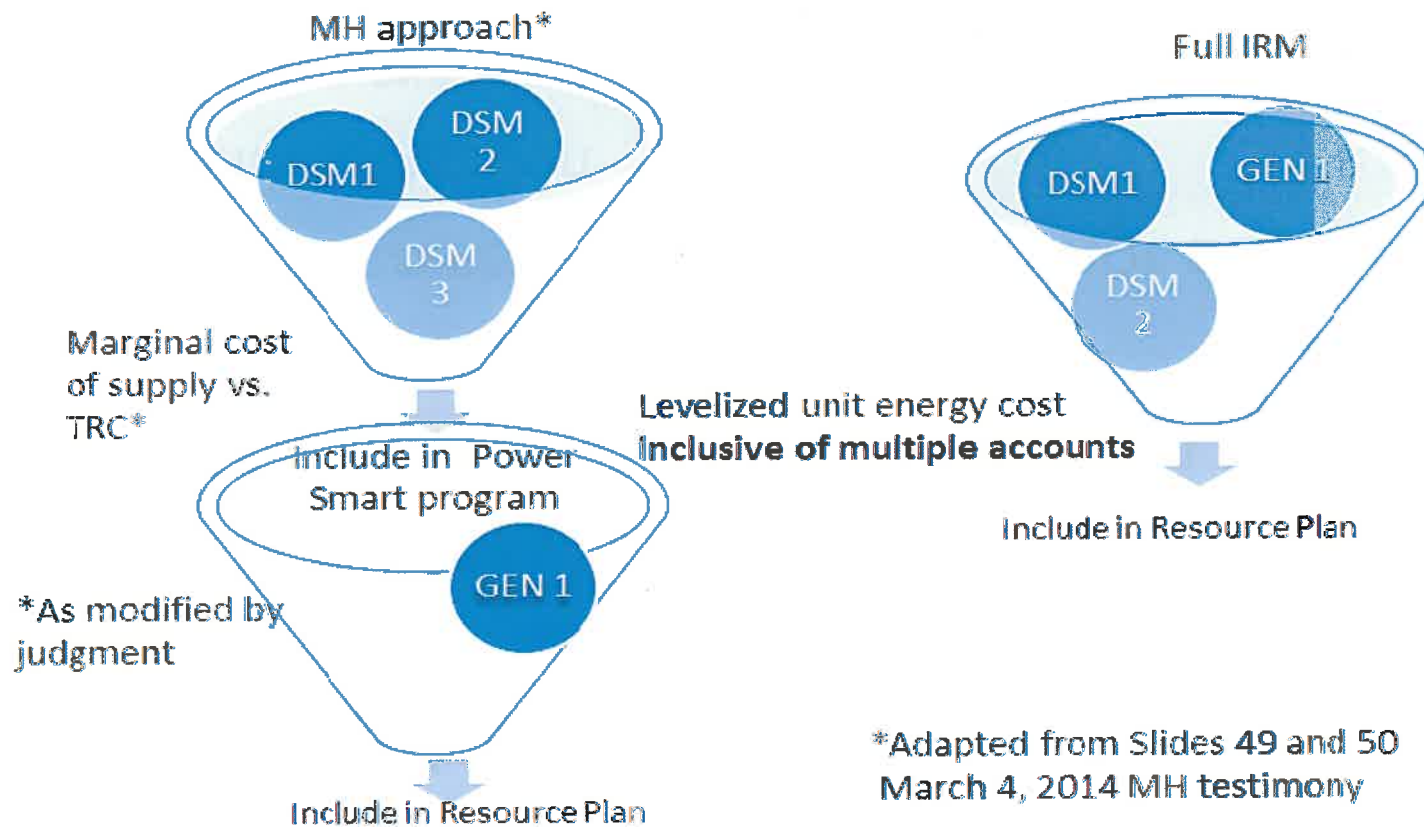
- DSM is the preferred institutional form of Energy Efficiency
 - Other forms; Energy Service Companies (ESCOs), pure incentive programs, education, codes and standards
- DSM savings cannot be measured
 - We cannot observe what might have happened
- Using baseline or engineering estimates has an inherent uncertainty
 - Underlying tertiary energy use
 - Assumptions about market response



DSM and System Planning

- A fundamental asymmetry between DSM savings estimates and supply estimates
- If DSM is underestimated capacity is not dispatched
 - Cost: underutilization
 - For MH firm export opportunities may be foregone
- If DSM is overestimated and capacity is not built this may increase the risks of brownouts and-or blackouts

How Does MH's DSM Approach Differ From "Full" IRP ?



Coherence and Load factors

- Load factor suggested as a qualitative diagnostic tool for NFAT
 - Not “DSM demand and energy savings must be in the same proportions as system load”(MH Rebuttal p42|36)
 - Do the bottom-up DSM savings projections from Power Smart “hang together” with system planning and with ‘top down’ stress testing?
 - MH’s system load factor is coherent
 - The system load factor and DSM load factors are coherent
 - Other than Curtailable Rates program, load factor differences are plausible

Projected & Historical Load & Capacity Factors & Capacity Reserve

Manitoba Hydro Load and Capacity Factors and Capacity Reserve

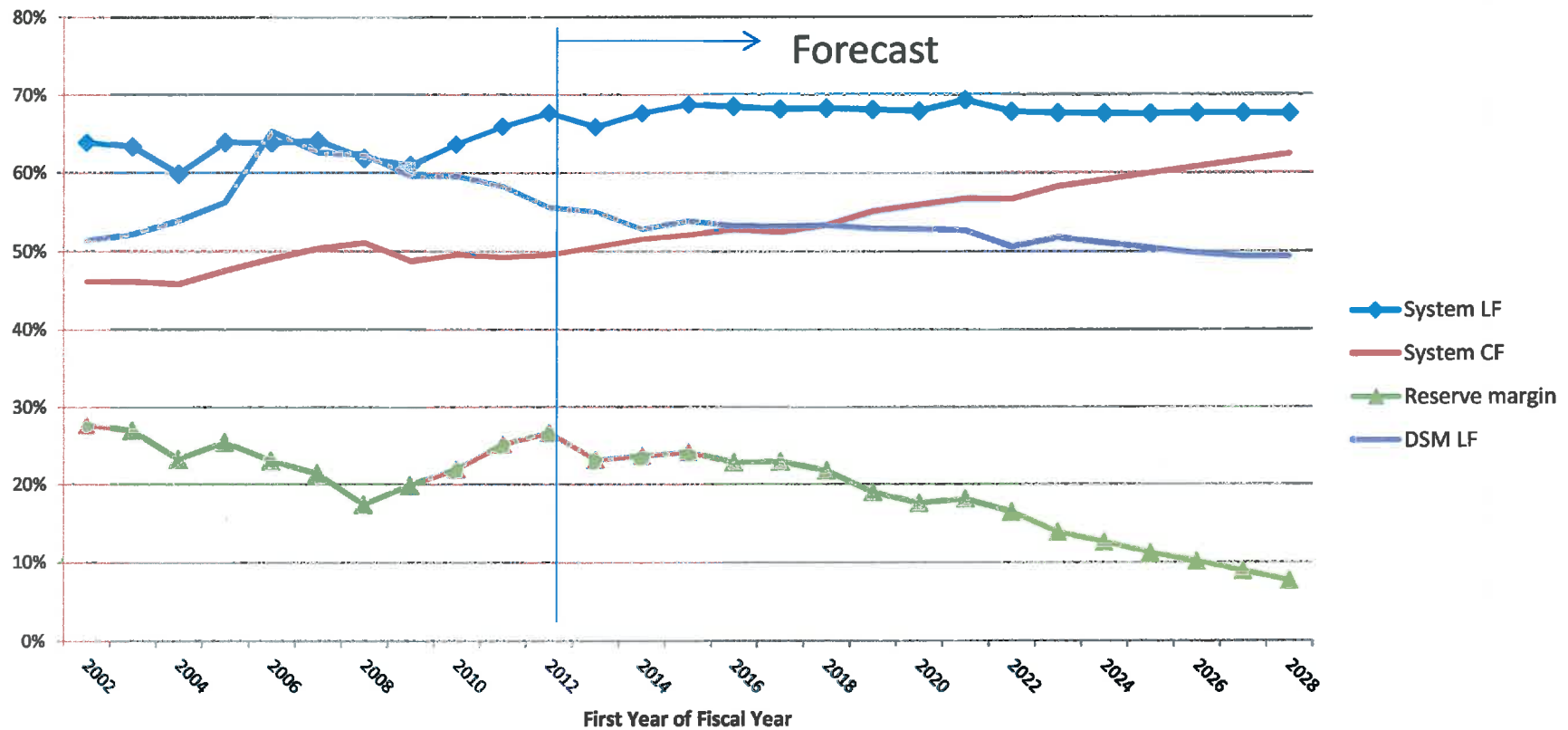


Figure 2 Elenchus DSM Report p 4

What Are the Uncertainties of DSM Savings Estimates?

- While there is no doubt that rates of load growth have declined from the 1950-70 rates, there is no consensus on the relative contributions of:
 - Price effects (including substitution);
 - Income effects (including the rebound effect);
 - Autonomous technological change ;
 - Customer preferences;
 - Impact of 'conservation' messages;
 - Codes and standards; and
 - DSM and other EE programs.

How Can DSM Uncertainties Be Handled?

- Need to acknowledge explicitly the uncertainties and the asymmetry problem
- Treat DSM estimates similarly to wind power
 - System operators are building up knowledge of the statistical distributions of wind output and use this to establish **expected values** for wind output that are equivalent to generation
 - Use methods from experimental theory
 - Improve knowledge of tertiary end use energy by retrospective statistical studies of DSM participants and non-participants

Why then, Should you Accept Dunsky and ENERNOC`s Evidence?

- The evidence of Dunsky and ENERNOC are “state of the art” for DSM
- But there are concerns with DSM
 - Measurability problem
 - Assumptions about markets
 - Institutional ambiguity
- This creates inherent uncertainty
- Should not throw out specific EE with the general DSM bathwater

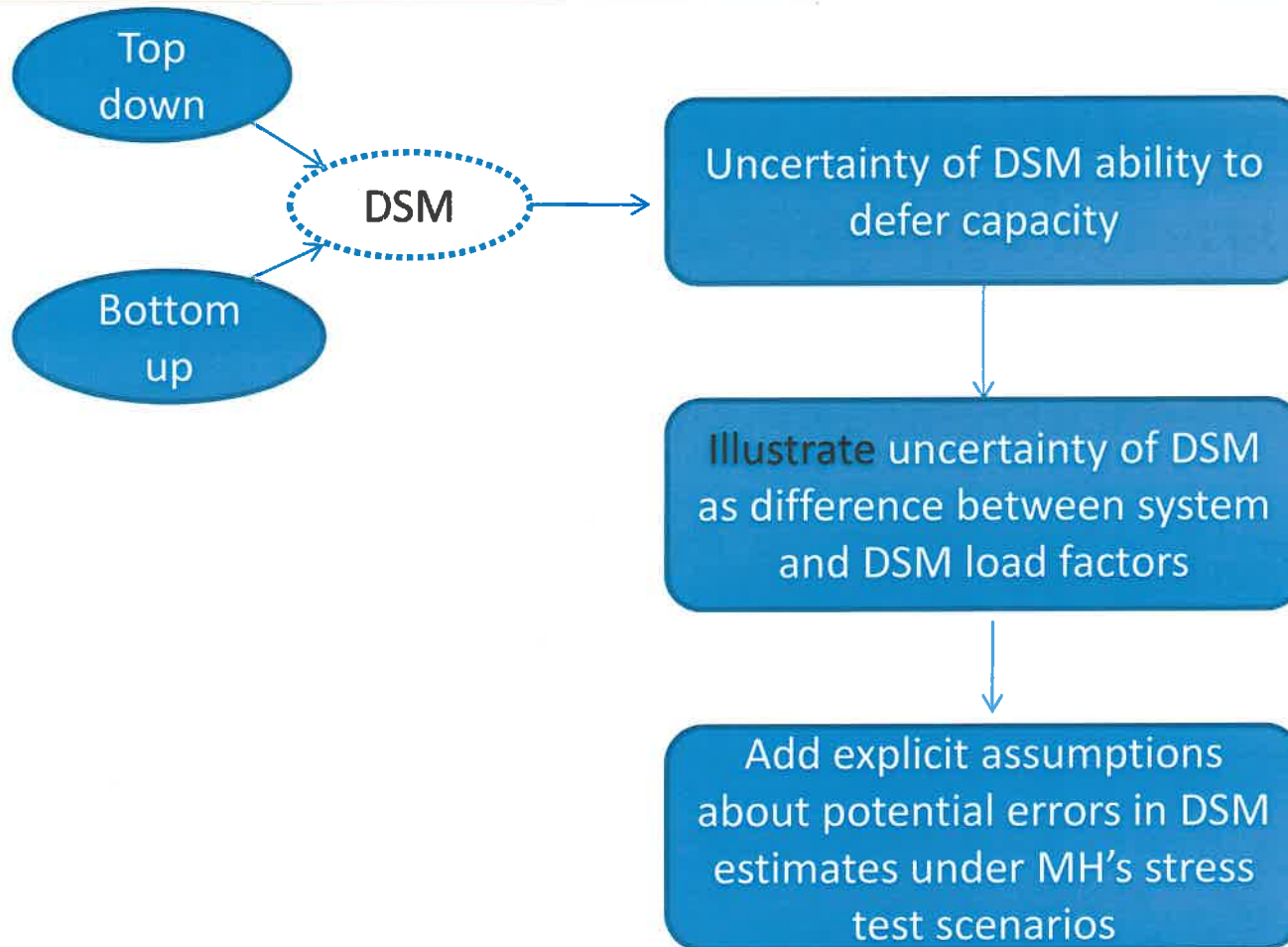
Babies and Bathwater

- The flaws of DSM and its uncertainties should not blind utilities to the value of EE
- There is a large body of evidence that EE can `supply` a substantial amount of electricity services below the cost of new generation
 - While “barriers” to DSM analysis overstates the issues, it is reasonable to provide some degree of public support for EE
- Need simply to apply the best available evidence of DSM savings with an acknowledgement of uncertainties and the asymmetry problem, preferably with IRP

Stress Testing

- Elenchus' stress-testing builds on MH's top-down analysis
 - 1.5, 2, 3 and 4 times DSM (not multiples of spending on DSM*)
 - No imports or exports
- Under the assumption that the difference between system and DSM load factors results in overestimate of capacity (versus energy) as an illustration of uncertainty
- Illustrative examples of introducing arbitrary uncertainty assumptions – impact on capacity reserve
 - Manitoba only, no credit for load curtailment

Logic of Stress Test



Heuristic Stress Test of MH's DSM Analysis (Updated)

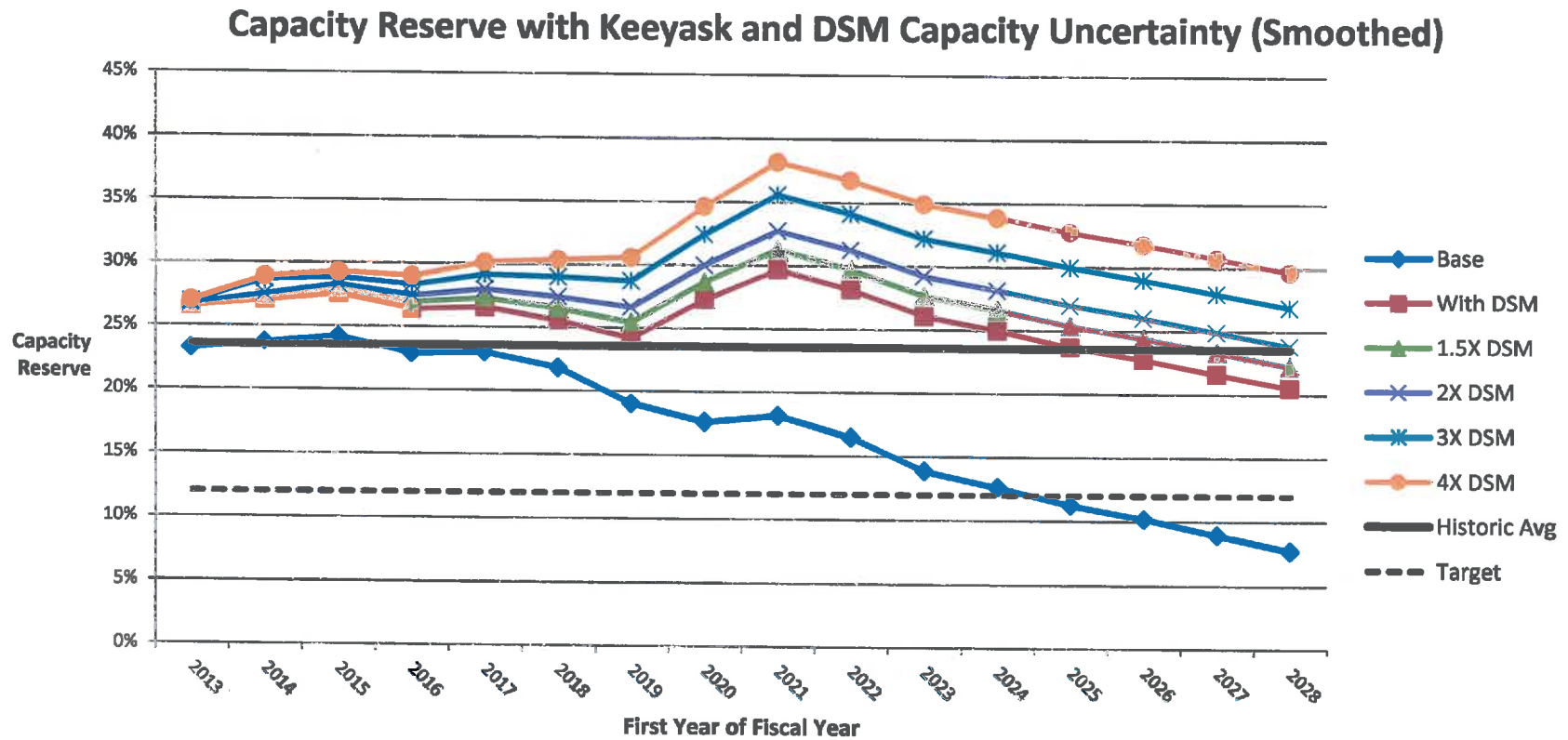
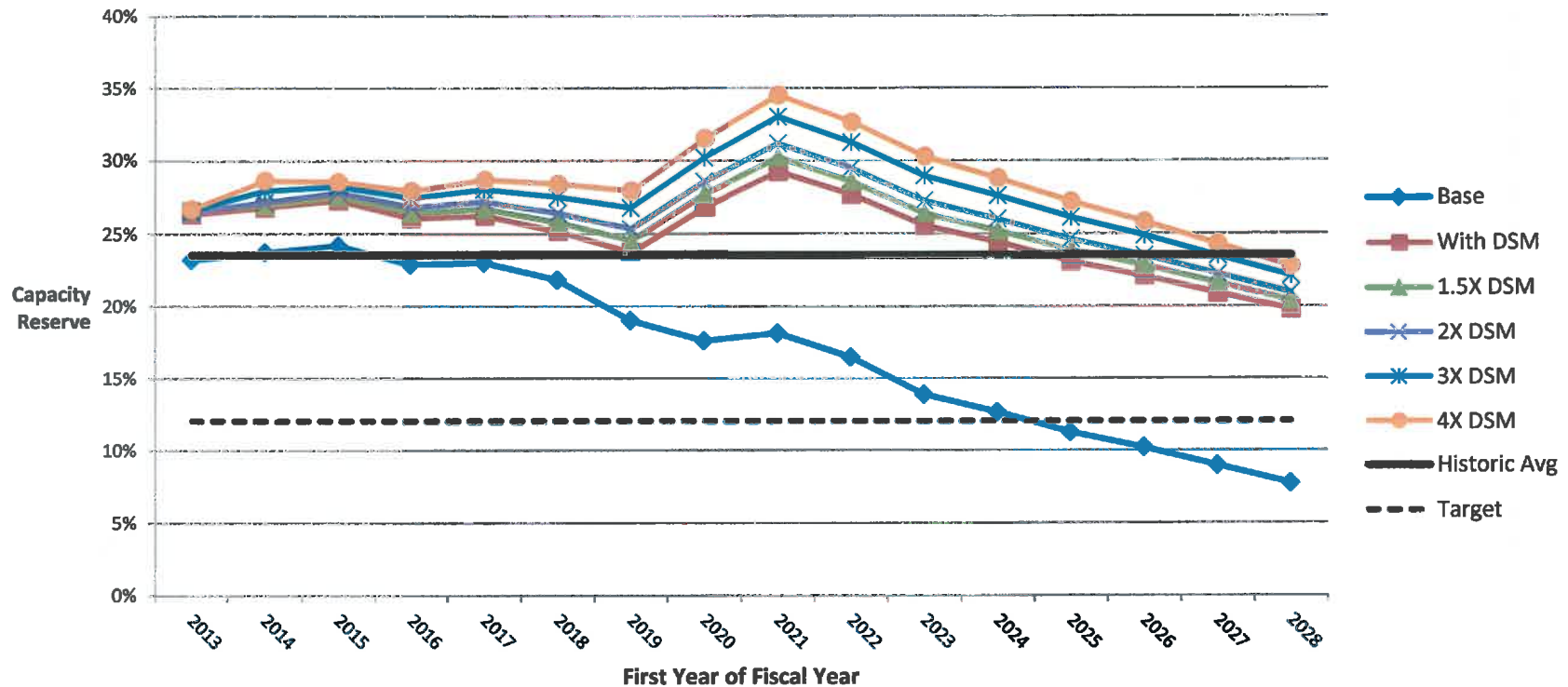


Figure 6 Elenchus DSM Report p 24

Heuristic Stress Test of MH's DSM Analysis (Updated)

Capacity Reserve with Keyask and DSM Capacity Uncertainty and Heuristics(Smoothed)



Achievable potential declines at 2% pa for 1.5X case, 2.5% for 2X, 3% for 3X and 3.5% for 4X

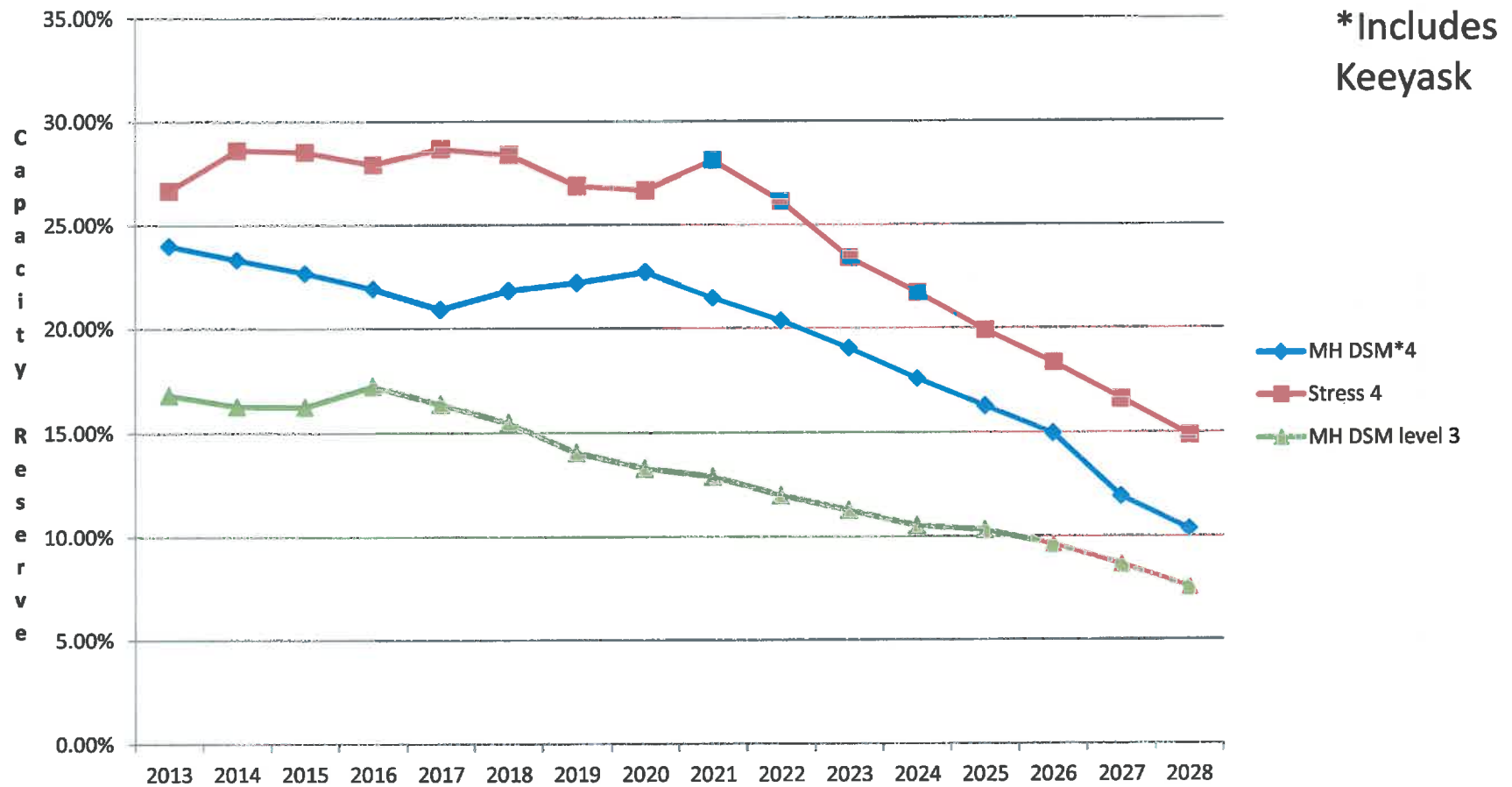


Figure 7 Elenchus DSM Report p 25

Stress Testing Conclusions

- Simulations of uncertainties for top-down DSM savings scenarios show that MH's analysis is robust
- DSM has a minimal impact on the timing of Keeyask
- Conawapa could be modestly affected
- Conclusions unaffected by new MH DSM analysis

Comparison of Updated Business Plan MH Scenarios (No New Resources) and Elenchus*



Refs:DSM4-Appendix 4.2p154;
 Level 3 - pp 21 and 23 of Exh 104-3




Ecological Footprint (EF)

- EF is only one methodology
- Two types: index or qualitative or single metric, e.g.
 - Single metric
 - Economic benefit-cost analysis (\$s)
 - Net energy analysis (GJ, kWh etc.)
 - Index or qualitative
 - Environmental impact matrix
 - Sustainability analysis
- MH's multiple accounts approach is incomplete
 - MH's rebuttal also incomplete (p113 |14-22)
 - Good to avoid being driven to greater levels of detail
 - But need to evaluate all alternatives on commensurate data

Are Manitoba Hydro's Demand-Side Management Factors Complete, Reasonable and Accurate?

- Yes
- While MH does not itself refer to “DSM factors”, MH’s approach to DSM is complete, reasonable and accurate.

SOW 1; Elenchus DSM Report section 3.2.2



Review MH's assessment of technical, economic and real DSM and energy efficiency opportunities relative to other jurisdictions

- MH's assessment of DSM opportunities is comparable to other North American jurisdictions.

SOW 2; Elenchus DSM Report sections 3.2.2 , 3.3.2.2 and 3.3.2.3

Review the extent to which MH has designed and implemented large utility DSM and energy efficiency programs at the residential, commercial and industrial levels in a manner consistent with other North American jurisdictions where such programs have been implemented

- MH's DSM programs for the major customer segments (residential, commercial and industrial) are consistent with utility practices in North America.

SOW 3; Elenchus DSM Report sections 3.2.1 and 3.2.2



Comment on the proper use of TRC and RIM evaluation tools as well as a TSC and benefit analysis from DSM and energy efficiency opportunities

- MH uses TRC, RIM and TSC in manner consistent with North American utility practices in relation to DSM and its consideration of other benefits is reasonable.

SOW 4; Elenchus DSM Report sections 3.2.1 and 3.2.2

Comment on MH's approach to measuring actual DSM and energy efficiency savings

- MH follows accepted industry protocols but these could be improved.
- Specifically, industry protocols do not adequately recognize inherent uncertainties due to un-observability of DSM savings

SOW 5; Elenchus DSM Report sections 3.3. 1.1 and 3.3.2.1



Comment on the appropriateness of MH's adoption of smart grid technologies for DSM

- MH's adoption of smart grid technologies for DSM is appropriate

SOW 6; Elenchus DSM Report section 3.4

Comment on MH's approach to determining marginal costs for measuring DSM

- MH follows accepted industry practice in basing its estimates of DSM marginal costs on reference standard technologies. However, this approach adds to the uncertainty of estimates of actual DSM potential.

SOW 7; Elenchus DSM Report sections 3.2.1.1 and 3.2.2.1



Comment on MH's approach to managing DSM and energy efficiency lost opportunity revenues

- MH includes estimated export revenues in its evaluation of DSM opportunities as part of its multiple metrics approach
- While reasonable, this also adds to uncertainty


SOW 8; Elenchus DSM Report section 3.3.2.6



Comment on the reasonableness, thoroughness and soundness of MH's DSM and conservation forecasts

- MH's DSM forecasts are reasonable, thorough and sound but their uncertainty could be made more explicit and addressed in an improved way.

SOW 9; Elenchus DSM Report sections 3.3.1 and 3.3.2



Comment on whether the preferred and alternative resource and conservation evaluations are complete, accurate, thorough, reasonable and sound.

- The preferred and alternative resource and conservation evaluations are largely complete, accurate, thorough, reasonable and sound.
- There is uncertainty over the accuracy of DSM savings and the evaluation would be more complete if the environmental impacts of DSM programs were evaluated.

SOW 10; Elenchus DSM Report sections 3.3.1, 3.3.2 and 4

Critically Assess Manitoba Hydro's DSM Potential Study

- The DSM Potential Study is a state-of-the-art study but its approach glosses over key uncertainties.
 - Fundamentally DSM savings estimates cannot be falsified
 - Market barriers analysis overstates importance of barriers
 - Evidence from private ESCOs suggests consumers are not willing to pay for DSM for savings levels typically reported by participating utilities

SOW 11; Elenchus DSM Report section 3.3.2.2

Perform independent stress testing of Demand-Side Management levels and an assessment of the reasonableness of Manitoba Hydro's stress testing of 1.5 and 4 times Demand-Side Management spending

- Elenchus' stress testing of DSM levels supports MH's conclusion that DSM programs are not sufficient to justify the deferral of new hydro-electric capacity

SOW 12; Elenchus DSM Report section 3.3.2.4

Examine Manitoba Hydro's current and potential use of Demand-Side Management investments in terms of:

a) System Capacity Dispatchability

- MH treats DSM capacity as non-dispatchable and 100% dependable. Elenchus suggests that DSM should be treated as a non-dispatchable resource subject to **explicit** dependability factors.

SOW 13a; Elenchus DSM Report sections 3.3.1.2 and 3.3.2.5

Examine Manitoba Hydro's current and potential use of Demand-Side Management investments in terms of:

b) Dependable Energy Dispatchability

- MH treats DSM energy as non-dispatchable and 100% dependable. Elenchus suggests that DSM should be treated as a non-dispatchable resource subject to **explicit** dependability factors.

SOW 13b; Elenchus DSM Report sections 3.3.1.2, 3.3.2.5 and 3.3.2

Examine Manitoba Hydro's current and potential use of Demand-Side Management investments in terms of:

c) Backup Resources Required

- MH makes no provision for backup. For operating reserve this is appropriate but for capacity reserve MH should treat DSM as a non-dispatchable resource subject to **explicit** dependability factors.

SOW 13c; Elenchus DSM Report sections 3.3.1.2 and 3.3.2.5

Examine Manitoba Hydro's current and potential use of Demand-Side Management investments in terms of:

d) Cost Effectiveness

- MH considers the cost effectiveness of DSM in terms of the Total Resource Cost (TRC), Total Societal Cost (TSC), Levelized Utility Cost (LUC). These are appropriate tests.

SOW 13d; Elenchus DSM Report sections 3.2.1, 3.2.2, 3.2.1.1 and 3.2.2.1

Examine Manitoba Hydro's current and potential use of Demand-Side Management investments in terms of:

e) Carbon Dioxide Footprint

- While MH has made a thorough assessment of the CO2 impacts of new generation it has not looked at the lifecycle impacts of DSM
- If MH conducts a new assessment of Conawapa could consider an Ecological Footprint analysis as an alternative to its “multiple accounts” approach

SOW 13e; Elenchus DSM Report section 3.5

Examine Manitoba Hydro's current and potential use of Demand-Side Management investments in terms of:

f) The role of the Curtailable Rate (*sic*) (CR) Program (Peak)

- The Curtailable Rates program should play no role in since reliance on the capacity reductions would be imprudent
- Elenchus makes no comment on its other purposes
- MH's position on the treatment of (LC) as part of the DSM program is unclear
 - "Manitoba Hydro does not include the demand benefits available from the Curtailable Rates Program in the assessment and development of its Resource Plan." rebuttal p47|10
 - "Given industry-wide acceptance of demand response as a recognized DSM initiative, it would also appear to be reasonable to then also consider Manitoba Hydro's Curtailable Rates Program as a DSM initiative." p43|18

SOW 13f; Elenchus DSM Report sections 3.2.1.2 and 3.2.2.2

Examine Manitoba Hydro's current and potential use of Demand-Side Management investments in terms of:

g) The Role of the Surplus Energy (SE) Program

- The SE program plays no role in DSM.
- Elenchus makes no comment on its other purposes.


SOW 13g; Elenchus DSM Report sections 3.2.1.3 and 3.2.2.3

Examine Manitoba Hydro's current and potential use of Demand-Side Management investments in terms of:

h) Location of DSM

- MH uses qualitative factors as well as metrics in designing its DSM programs. Location could be a factor but Elenchus is not aware of this.

SOW 13h; Elenchus DSM Report section 3.3.2.7



Identify the potential of DSM or energy efficiency to defer new generation in Manitoba, including Keeyask G.S. and or Conawapa G.S. alone or in conjunction with other non-hydraulic resources

- DSM is not likely to defer Keeyask or Conawapa, alone or in conjunction with other non-hydraulic resources

SOW 14; Elenchus DSM Report section 3.3.2.4

Review and comment on the evidence with respect to Demand-Side Management arising from the last Manitoba Hydro General Rate Application, including the role of Demand-Side Management in deferral of Generation Investments put forth by the Consumer Association of Canada (Manitoba) Inc.'s expert witness. (Dunsky)

- Elenchus agrees with Dunsky's benchmarking of MH's DSM programs

SOW 15; Elenchus DSM Report section 3.3.2.3



Thank You!