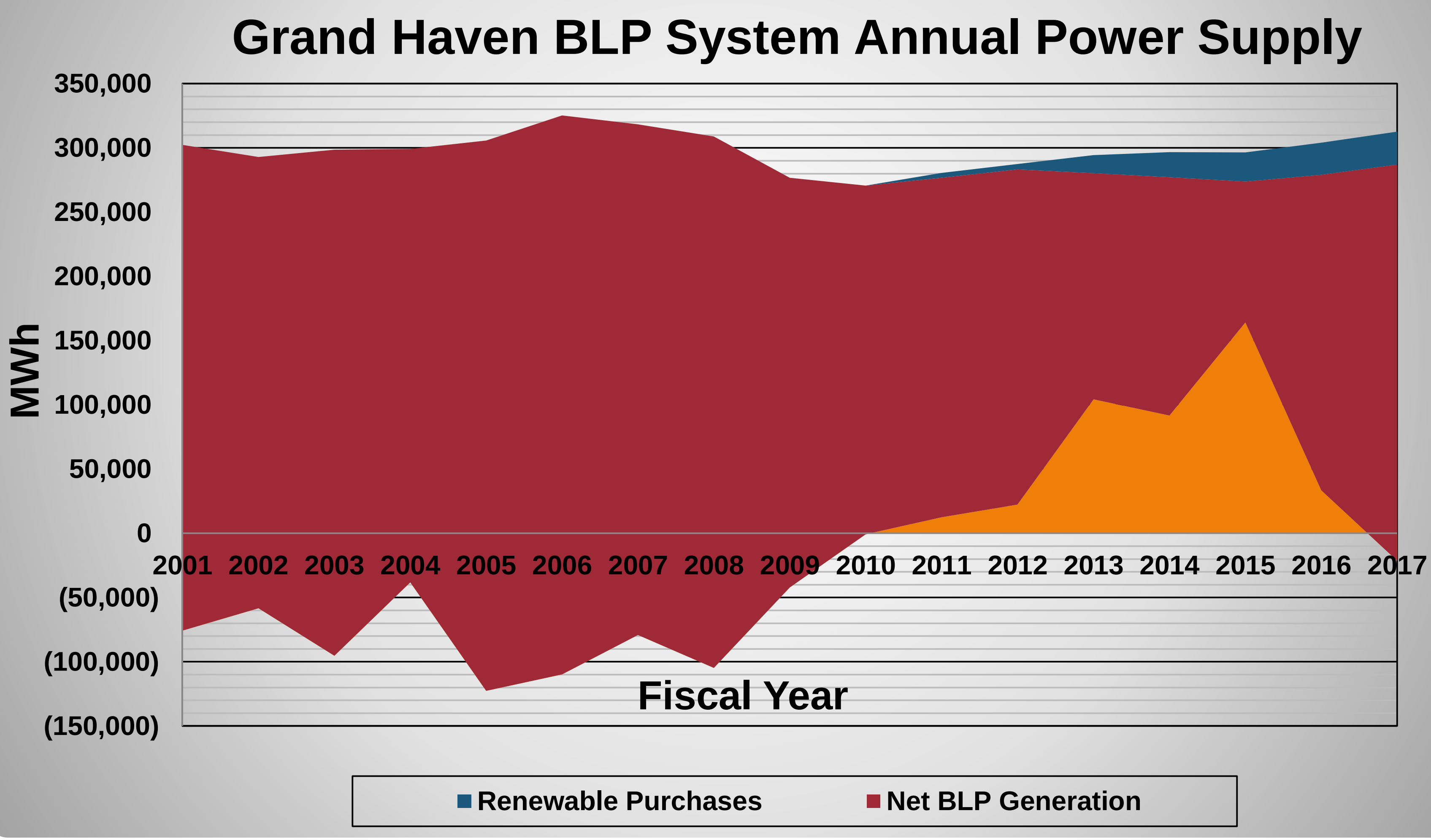
Providing for "a more sustainable, economical, and diversified" Power Supply Portfolio

Integrated Resource Planning



Integrated Resource Planning

- Without Sims 3 and remaining diesel plant unit, GHBLP current long-term power supply includes:

- **Capacity**
  1) **MPPA Landfill Gas Project**
     a) Energy Developments (formally Granger) and NANR
        GHBLP portion - 16.26% of 15.5 MW (**2.5 MW**)
  2) **MPPA Energy Services Project**
     a) Exelon Generation Beebe 1B Wind Project
        GHBLP portion - 7.31% of 31.2 MW (**2.3 MW**)
     b) Next Era Pegasus Wind Project – expected COD 2019
        GHBLP portion – 9.67% of 62.5 MW (**6.0 MW**)
     c) CMS Energy - PY 20/21–29/30 purchase (**10.0 MW**)

Integrated Resource Planning

- **Energy**
  1) **MPPA Landfill Gas Project** (Energy Dev. & NANR)
     a) 2.5 MW @ approximately 90% CF (**19,700 MWh**)
  2) **MPPA Energy Services Project**
     a) Exelon Generation Beebe 1B Wind Project
        2.3 MW @ approximately 33% CF (**6,600 MWh**)
     b) Next Era Pegasus Wind Project – expected COD 2019
        6.0 MW @ approximately 37% CF (**19,400 MWh**)
     c) CMS Energy - PY 20/21–29/30 purchase (**10.0 MW**)
        No energy (capacity only)

- **In PY 20/21 GHBLP has approximately 19% of required capacity and 14% of projected energy needs currently "hedged" (without Sims 3)**

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- MPPA (through its Renewable Resource Service Committee) is currently evaluating several very viable, competitively priced, larger scale solar projects in Michigan that appear to present GHBLP very attractive alternatives for the "next block(s)" of **renewable energy** purchases (3%-5% of energy needs by 2020)

  Solar projects also provide greater proportional MISO approved capacity as compared to wind – MISO recognizes generation that is more likely to be available during system peaks with higher UCAP values (similar results for Landfill Gas)

- We then need to be looking at filling approximately 82% of our energy needs in 2020 in our current resource planning efforts (as well as remaining capacity needs)

Integrated Resource Planning

- Considerations when evaluating how to fill the remaining needs:

1) Diversification
2) Economies of scale and scope
3) Project location (delivery point)
4) Price certainty
5) Future adaptability and flexibility
6) Balancing supply and load

Integrated Resource Planning

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Diversification

- By definition an "**<u>integrated</u>**" resource plan contains "*various parts or aspects that are linked or coordinated*"

1) To integrate is to "*combine parts one with another so that they together become whole*" ……. i.e. *blend, mix, meld, unify*

2) In a well established IRP, **financial** and **physical risk** as a whole is mitigated through a "*<u>multiplicity</u>*" of projects and/or wholesale transactions of varying fuels, technologies, locations, partnership/ownership structures, contractual arrangements, counterparties, maturity dates and time durations

Diversification

- By definition an "**integrated**" resource plan contains "*various parts or aspects that are linked or coordinated*"

3) Strategic objective is to develop a "portfolio"

4) Avoid "*putting all your eggs in a single basket*" even if that solitary basket appears to be a "*sure thing*" ….. like investing - diversify, dollar cost average, use index funds, etc.

Diversification

- Fuel diversity:

  1) Most proposed and newly constructed generation projects are fueled by **natural gas** or use **renewable energy** (in Michigan primarily wind and solar), however, a large portion of the existing generation base in MISO remains from "aged" coal and nuclear facilities (that still present attractive wholesale purchase alternatives to GHBLP in the short to intermediate term)

     https://www.misoenergy.org/markets-and-operations/real-time-displays/

Diversification

- Fuel diversity:

    2) Most typically, **a wholesale bilateral energy transaction does not specify a particular source or fuel** (is not "unit contingent"), although the specified "delivery point" may be a particular generator's bus bar – most often the power is priced for delivery to a "hub," or the purchaser's commercial pricing "node" (CPN), and the seller takes the risk associated with delivering the energy from any available resource in real time for a particular time duration at the specified price

Diversification

- Diverse technologies:

   1) Certain natural gas generation technologies are better suited for particular applications – for instance, a **natural gas fired combined cycle** (NGCC) facility (with higher initial unit costs but lower heat rates resulting in lower fuel costs) are used as "intermediate" generating resources (say 50-70% annual capacity factor), while a **natural gas fired simple-cycle combustion turbine** (NGCT) or **reciprocating internal combustion engine** (RICE) units (with lower installation costs but higher fuel costs) are better utilized as "peaking" resources (say 5-20% annual capacity factor)

Diversification

- Diverse technologies:

2) Storage technologies will definitely play a role in future IRP planning, however, despite what many claim today, under most circumstances, **storage is simply not yet competitively priced for larger scale utility/commercial applications**

3) Renewable technologies are no doubt becoming more competitively priced, particularly when incentivized through tax treatment

4) Should smaller public power utilities, with fewer resources, take on the substantial financial costs and risks to be "first implementers" of the newest technologies?

Diversification

- Diverse technologies:

5) Wind and solar have unique generation profiles - solar panels only produce when the sun shines and wind turbines only spin when the wind blows; additionally, renewables are typically “**price takers**” in the RTO markets; and excessive utilization will cause “ramp” rate issues (dispatch problems) - these unique characteristics need to be considered in any IRP

6) Smart grid technologies are improving economic dispatch and helping to achieve “optimal” generation utilization of existing resources – with the potential impact of reducing required utility Planning Reserve Margins moving forward

Diversification

- Diverse locations:

1) The location of a generation project (or the delivery point of a wholesale power transaction) must be considered in regards to the current and projected future Locational Marginal Price (LMP) at that location **and** in relationship to the current and projected LMP of the load (the purchaser) – this analysis can make or break the economic viability of any project or purchase transaction

The concept here is actually simpler than it sounds:

The RTO markets were created to incentivize efficient regional operations/dispatch and eliminate transmission "constraints" – a price differential across a constrained interface can be reduced by improving transmission through the problem or building generation (on the load side of the constraint)

Diversification

- Diverse locations:

  2) Generation should always be built at its most economic locations relating to fuel supply (or renewable profile) and electrical interconnection cost and availability, however, if there already is too much generation in the area or if the transmission is "constrained" between that area and load centers, an otherwise viable project can become uneconomical

Diversification

- Diverse locations:

3) Over time, it is inevitable that certain transmission system "constraints" will be removed and others will develop between areas of heavy generation and large load centers – market LMPs will change accordingly – IRPs need to consider this outcome, be "adaptable" and "diversified," so such changes do not disproportionately impact the overall cost of the portfolio

4) The easiest way to address "locational" risk is to have someone else bear it – the seller in a transaction "financially" delivers the product (i.e. "settles" the transaction) at the buyer's CPN

Diversification

- Diverse contractual arrangements and counterparties:

1) Local municipal ownership (using tax exempt revenue bonds) is one mechanism of financing new power generating projects

2) Joint municipal ownership through our joint action agency, the Michigan Public Power Agency (MPPA), is another attractive project financing alternative – several municipal utilities acting together typically possess higher bond ratings (and lower issuance costs) than any single entity acting alone ……….. less risk

Diversification

- Diverse contractual arrangements and counterparties:

3) "Direct" private partnerships or partnerships between MPPA (on GHBLP's behalf) and private parties can provide needed scale to a project – sometimes a taxable entity is required to gain the tax benefits necessary to make the project competitive

4) Such partnerships can be "shared ownership" where each entity brings its own capital or the transaction can be structured as a long-term power purchase agreement (PPA)

Diversification

- Diverse contractual arrangements and counterparties:

5) Developing a portfolio of projects and transactions with multiple counterparties and more diverse contractual arrangements and terms (i.e. shared financial risks) will undoubtedly benefit the GHBLP going forward

6) Power is "traded" in a complex commodities market - financial products and tools (futures, forwards, options, swaps, spark spread etc.) will undoubtedly be utilized to optimize price of the portfolio and reduce risk – experienced and professional partners with extensive knowledge and expertise in these markets are not only helpful, but are vital to smaller entities like the GHBLP

Diversification

- <u>Diverse contractual arrangements and counterparties</u>:

7) Similarly, natural gas markets are becoming “intertwined” with the power markets

8) The credit and credit quality of counterparties is of paramount concern in establishing a portfolio – an effective hedge policy ensures no single party dominates the portfolio (many counterparties require long-term transactions to be frequently “**marked-to market**” with associated margin call provisions or posting of collateral)

Diversification

- Diverse maturity dates and durations:

1) It is very important to ensure the entire portfolio of projects or transactions do not retire or terminate at the same time

2) Additionally, because technologies and market opportunities are continuously changing, one wants to keep the duration of portfolio transactions diverse

3) The GHBLP should look to “ladder” its power supply portfolio similar to laddering government securities in its investment portfolio (varying terms, maturity dates, and durations)

Diversification

Restating an earlier comment:

In a well established IRP, **financial** and **physical risk** as a whole is mitigated through a "*multiplicity*" of projects and/or wholesale transactions of varying fuels, technologies, locations, partnership/ownership structures, contractual arrangements, counterparties, maturity dates and time durations

Integrated Resource Planning

- Considerations when evaluating how to fill the remaining needs:

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  2) Economies of scale and scope
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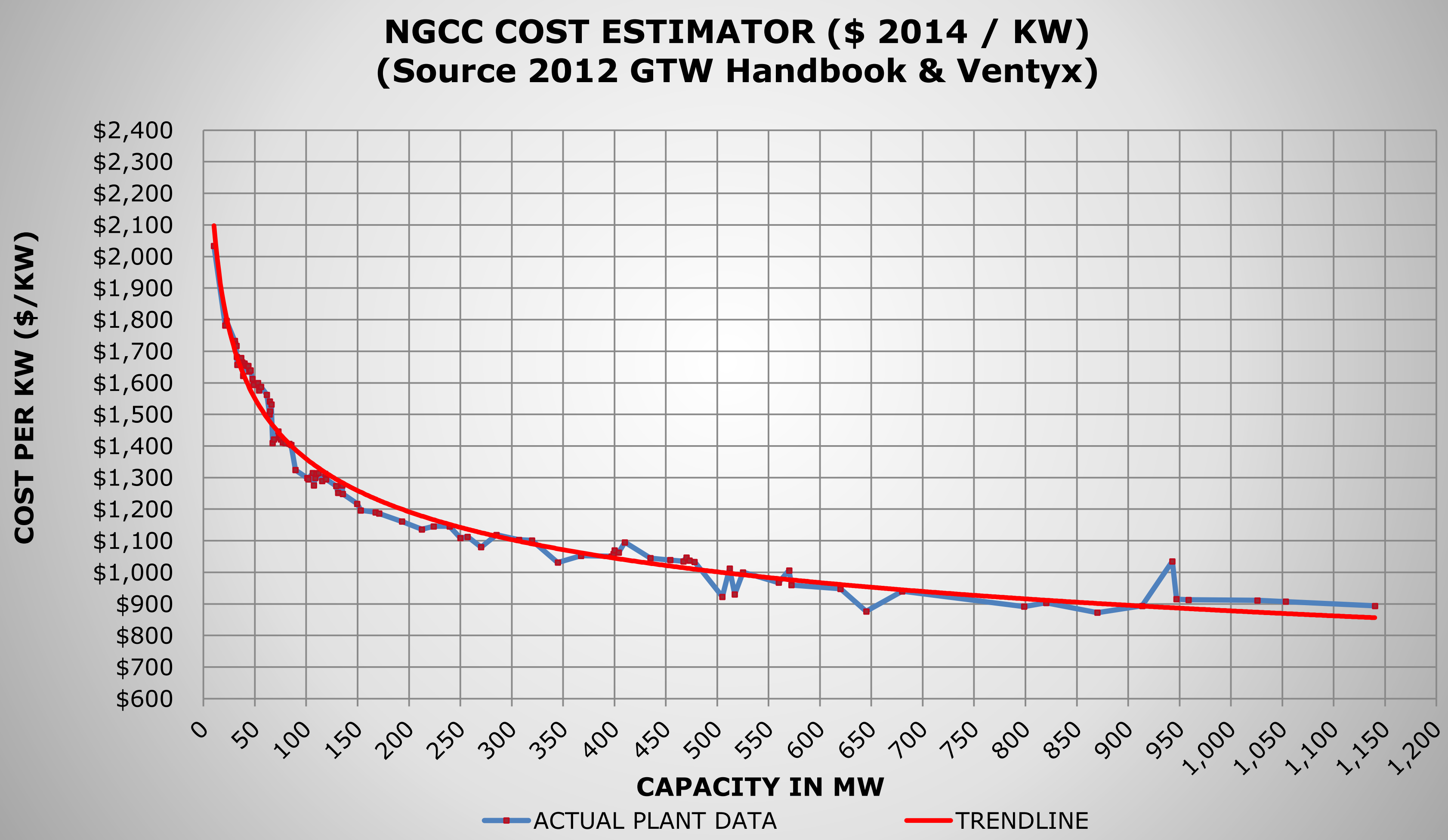
Economies of scale and scope

Substantial economies of scale and scope are, for the most part, prevalent in all electrical generating technologies

The desire for diversity to serve a particular load favors multiple smaller projects or transactions while economies of scale support larger projects (or joint projects)

.............Finding a balance between this two principles is vital to the success of our IRP efforts

Economies of scale and scope



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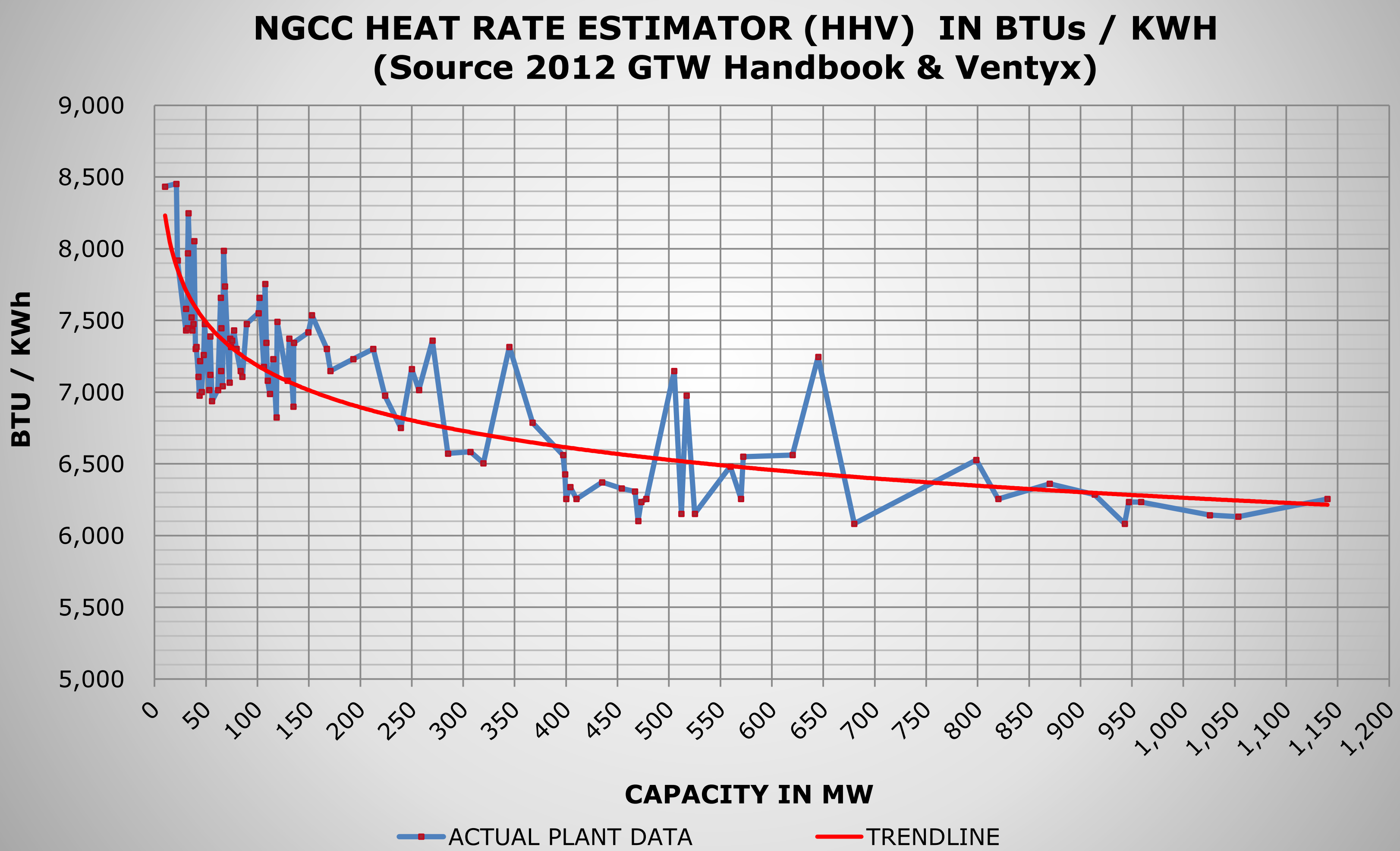

Firm proposes $1B natural gas-fueled power plant near Fowlerville
http://www.livingstondaily.com/story/news/local/community/handy-township/2018/01/24/firm-proposes-1-b-natural-gas-fueled-power-plant-near-fowlerville/1058008001/

DTE Energy plans advanced $1-billion natural-gas power plant in St. Clair County
https://www.freep.com/story/money/business/michigan/2017/08/01/dte-energy-natural-gas-power-plant-macomb/527961001/

$1 billion natural gas power plant proposed in Niles
https://www.southbendtribune.com/news/business/billion-natural-gas-power-plant-proposed-in-niles/article_d2cfdd8c-326a-5c76-aeac-922ea923fc2b.html

New $400 million power plants in the works for Marshall
http://www.battlecreekenquirer.com/story/news/local/2017/09/18/new-power-plant-works-marshall-energy-center/679132001/

$500 million expansion planned for Midland Cogeneration Venture
http://www.mlive.com/news/saginaw/index.ssf/2017/04/500_million_expansion_planned.html

BWL to build $500 million natural gas power plant in Delta Twp.
https://www.lansingstatejournal.com/story/news/2017/12/18/bwl-build-500-million-natural-gas-power-plant-delta-twp/960504001/

Economies of scale and scope

1. Developers for NGCC projects suggest these projects reach economic "scale" at 500 MW
   - Over 500 MW these plants typically duplicate components and configuration – some additional scale savings above but not much (the cost curve flattens)

2. Larger solar projects, primarily in shared ancillary equipment and utility interconnection, also see scale savings above 10 MW

3. Commercial wind projects experience economies of scale over 50 MW

Economies of scale and scope

- The GHBLP simply does not serve enough load to maintain a diverse portfolio of generation resources built at economic scale without partnering with others in some fashion (particularly **baseload** and **intermediate** natural gas generation options)

- GHBLP system peak load is approximately 70 MW and our average load is approximately 35 MW (a 50% load factor) – again, we have already contracted for approximately 15% of this energy

- Large entities, with multiple generating facilities, and well developed trading operations (scope) can typically build and operate projects more economically and efficiently

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Project location (delivery point)

- With network transmission service (NITS), the “network” is responsible to deliver networked generation resources to networked load – generators need to establish “deliverability” of their asset

- The costs of maintaining the network are shared proportionately by networked load (generators do not pay for transmission service)

Project location (delivery point)

- The physical location of a generator(s) used to facilitate a power purchase transaction to a NITS load is really quite meaningless to the buyer if the seller is responsible (bears the financial risk) of “delivering” the energy to a “hub’ or the Commercial Pricing Node (CPN) of the buyer

Settlement example

- Again, typically the buyer doesn’t “physically” receive the electricity actually produced by the contracted generator

Project location (delivery point)

- If you own a particular generator, however, the location of that generator in relationship to its position in the marketplace becomes critical to you (what you get paid for delivering energy to the grid is dependent on this location)
- For instance, a renewable energy project with a particular renewable local profile may be projected to produce energy at a very low cost – however, if the LMPs are projected to be even lower in the vicinity (say because there is already too much similar generation in that area as compared to load), the project is not viable economically

Project location (delivery point)

- Understanding the concepts and locational nature (the Locational Margin Pricing or LMPs) of the RTO/ISO markets, from both the generator and load perspective, is critical when developing an effective IRP

- GHBLP does not buy (or sell) power at its own CPN – it uses the Cons.MPPA CPN – a computer generated weighted average of elemental pricing nodes of all MPPA members utilizing this node (because of the weighted nature and the diversity of members – this CPN is typically very close to the price at the Michigan Hub)

Project location (delivery point)

- With NITS, a new Behind-The Meter (BTM) generator doesn't provide PTP transmission savings, however, it does provide energy at the same LMP as our load (eliminates any LMP differential between delivery point and Cons.MPPA) – i.e. eliminates locational risk

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Price certainty

- Owned or jointly-owned projects only hedge your power supply costs to the level operating costs are fixed (i.e. hedged fuel costs)
- Renewables obviously have no exposure to varying future fuel costs
- “Hedging” (or fixing a future cost) reduces risk of adverse commodity price movement – provides “firm” price or price certainty

Price certainty

- The Board needs to review and potentially re-establish its future “hedge plan” as part of the IRP process (as well as its Risk Management Policy)

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Future adaptability and flexibility

- Any long-term IRP should have as a foundational characteristic a longer-term "open position" for a portion of its load that can be filled with a future project or PPA – in other words, don't hedge your power supply at 100% for the next 20 years
- Maintaining some short-term transactions are vital in these regards
- The next opportunity could be better than anything previously (technologies are improving, operational and fuel costs change over time)

Future adaptability and flexibility

- Call options and peaking facilities allow you to buy energy from the Day Ahead and Real Time markets when LMPs are lower and cap exposure to peak prices when they are at their highest

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Balancing supply and load

- The ISO has the responsibility of balancing network loads and resources in the short-term markets and to ensure resource adequacy in the capacity markets, however, each utility's IRP needs to consider peak and RTC purchases (seasonal and time of day load patterns) to ensure the optimal use of owned and contracted facilities (and PPAs)
- **When** generators produce (or when PPAs provide energy) matters – its not just the price!

Balancing supply and load

- While average annual prices are quite stable going forward, off-peak prices are trending down and peak prices are increasing
- An IRP should not contain resources that only produce energy when the sun shines or when the wind blows – the plan needs to effectively integrate resources to optimize the benefits, and mitigate the risks, of each technology, project, fuel supply, and PPA
- Again, fast start peaking assets, or call options are important ways to mitigate these issues

Staff Recommendations

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2. Revisit and revise as necessary, Sims 3 operating schedule and dispatch provisions to "optimize" economically the remaining life of the plant

3. Complete construction of necessary 69 kV improvements and obtain Network Integrated Transmission Service (NITS)

Staff Recommendations

4. Continue to work with MPPA to evaluate potential jointly owned projects and PPAs to fill void created by these closures

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5. Review, and revise as necessary, GHBLP Energy Risk Management Policy and Hedge Plan used to facilitate future power transactions and energy trading activities

Staff Recommendations

6. Continue efforts to evaluate a local replacement of at least some of the lost generation capacity from Sims 3 and the Diesel Plant – at this time the most cost effective alternative for this purpose appears to be a "peaking" facility utilizing newest technology natural gas fired reciprocating internal combustion engines (RICE units) with a combined capacity of approximately 30 MW

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7. Throughout, the goal is to provide for "**a <u>more</u> sustainable, economical, and diversified**" Power Supply Portfolio