MURRAYLINK IGBT OBSOLESCENCE

Presentation to the Murraylink Stakeholder Engagement Group

ACKNOWLEDGEMENT OF COUNTRY

We begin today by acknowledging the Traditional Custodians of the land on which we meet today, and pay our respects to their Elders past and present. We extend that respect to Aboriginal and Torres Strait Islander peoples here today.

PURPOSE OF THIS CONSULTATION

- Update stakeholders on the material change to Murraylink – Obsolesence of Insulated Gate Bipolar Transistors
- Outline considerations for solutions
- Discuss approach to the proposal

REASON FOR UPDATE

- When we were talking to stakeholders our estimate of remaining IGBTs in the world was 500-600. Expectation was that Hitachi will allow Murraylink to buy less than half of outstanding IGBTs after announcing obsolescence.
- The proposal was to buy 250 IGBTs to be bought in the next transmission determination period.
- In December Hitachi wrote to APA (operators of Murraylink) informing us that there are only 115 IGBTs available to use on Murraylink
- Our expectation is any accidents on other networks would result in them getting priority and less IGBTs being available to Murraylink

UPDATE

Obsolete IGBTs

SHORT TERM CONSIDERATIONS

- Do we buy the 115 IGBTs? If so when?
  - Alternative is to commence replacement of Generation 2 IGBTs on Murraylink. NPV analysis expected to show buying all available IGBTs the lowest cost long run alternative
  - Risk of accident on another network
- Do we upgrade to generation 3 IGBTs
  - Production of Hitachi Generation 3 IGBTs continuing but will eventually have same problem as generation 1 and generation 2 (obsolescence of inputs).
- Approach other Generation 2 IGBT users and seek to buy their spares or released IGBTs on Updating (lots of unknowns)
  - Unknown how many IGBTs would be released for purchase
  - Unknown failure rate on being removed from operating location
  - Unknown remaining life of used IGBTs
  - Unknown cost

LONG TERM CONSIDERATIONS

- High level questions
  - Do we keep replacing IGBTs as and when they need it?
  - If we do, how do we do it?

DO WE KEEP REPLACING IGBTS?

- If we don't replace the IGBTs then Murraylink will cease operation
- Murraylink should remain in operations until:
  - It's capabilities are not needed, or
  - There is a cheaper alternative way of providing its capabilities
- Replacement of IGBTs will trigger a RIT-T
  - A RIT-T is required to demonstrate the project selected is the one that maximises net benefit
    - This in effect asks and answers whether the capabilities are needed and if Murraylink is the cheapest way to provide it.
- So the result of the RIT-T will provide an answer to this high level question
- We keep replacing IGBTs until a RIT-T finds we should stop!

REPLACEMENT CONSIDERATIONS

- We are restricted to buying upgrades from Hitachi if we replace IGBTs by themselves.
- IGBTs and the Control and Protection System are the "Heart" of the converter station
  - The Control and Protection system is the information technology infrastructure (hardware and software) that runs/controls the converter stations
    - There are subsystems that operate different components of the conversion process controlled by the Control and Protection system
  - IGBTs and the control and protection system must interact flawlessly and on Murraylink both are the intellectual property of the vendor.
    - It is difficult (read: very expensive) to have IGBTs and control and protection systems provided by different vendors.
    - Need to back engineer the other system to ensure smooth interaction.
  - The inverse of this consideration is if replacing both the control and protection system and the IGBTs at the same time Murraylink can tender out to different vendors for replacement

LONG TERM CONSIDERATIONS - CONTINUED

- Do we align life expectancy of IGBTs and Control and Protection systems
- Allows tendering on the replacement of the systems together
  - Will allow cost savings on procurement (which get passed on to customers)
- Reduces depreciable life of IGBTs to shorter than technical life
  - National Electricity Rules use the term "economic life"
    - The boundaries of what can be considered the definition of "economic life" of an asset is not clear
- Materiality of the effect of separating the IGBTs into a separate asset class and depreciating more quickly is currently unknown
  - May be able to determine but may rely on accessing and interrogating old accounting systems.
- Are there other approaches to the issue of IGBT obsolescence in the long term?
  - APA builds capability to engineer converter stations to not rely on Hitachi?

IGBTS AND CONTROL AND PROTECTION SYSTEM - REGULATORY

- Murraylink recently completed the upgrade of its control and protection system
  - Separate replacement was undertaken on the expectation that Generation 2 IGBTs would remain in operation for another 10-15 years.
- For regulatory purposes Control and Protection systems have a life expectancy of 15 years (supported by the technical life experienced on Directlink and Murraylink)
- For regulatory depreciation purposes IGBTs are part of the Switchyard asset class. The Switchyard asset class has a 40 year asset life.
  - Experience on IGBTs is they become obsolete after 20 years and have a phase out of operation.
    - Length of phase out of operation is unknown but Directlink will soon be beginning process. Highly unlikely to be an average of 20 years.

PROPOSAL

What should we include in our original proposal?

WHAT SHOULD MURRAYLINK INCLUDE IN ITS PROPOSAL

- The timing of the notification has meant that there is insufficient time to complete the analysis and consultation necessary to put in a complete proposal.
- The forecast will change as more information becomes available as we conduct analysis and stakeholder engagement.
- Given it is going to be revised due to external factors, what should Murraylink include in its proposal?
- Potential options:
  - Do not include IGBTs (remove any forecast of IGBT purchases subject to further consultation)
  - Forecast purchasing 115 in current period and a contingent project for the next (credible option)
  - Maintain the original forecast from Workshop 2 (it is part of the material most consultated on)
  - Forecast replacement of IGBTs. Cost based on Directlink work (worst case scenario)

ORIGINAL PROPOSAL

- Forecast Capital Expenditure for increasing spare IGBTs ($FY23 '000

	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	Total
IGBTs	0.3	0.7	0.7	0.7	0.7	0.7	**3.9**

- Revenue Forecast ($FY23 m)

Forecast Revenue ($m Real FY23)	2023-24	2024-25	2025-26	2026-27	2027-28	Total
Revenue	13.1	13.5	13.9	14.3	14.8	**69.6**

NO IGBT PURCHASES

- Forecast Capital Expenditure for increasing spare IGBTs ($FY23 '000

	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	Total
IGBTs	-	-	-	-	-	-	-

- Revenue Forecast ($FY23 m)

Forecast Revenue ($m Real FY23)	2023-24	2024-25	2025-26	2026-27	2027-28	Total
Total	13.1	13.3	14.1	14.4	14.4	**69.2**

BUY REMAINING IGBTS

- Forecast Capital Expenditure for increasing spare IGBTs ($FY23 '000)

	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	Total
IGBTs	1.5	-	-	-	-	-	**1.5**

- Revenue Forecast ($FY23 m)

Forecast Revenue ($m Real FY23)	2023-24	2024-25	2025-26	2026-27	2027-28	Total
Total	13.1	13.3	14.1	14.4	14.5	**69.4**

GEN 2 IGBTS ASSET LIFE ADJUSTED

- Forecast Capital Expenditure for increasing spare IGBTs ($FY23 '000)

	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	Total
IGBTs	1.5	-	-	-	-	-	**1.5**

- Revenue Forecast ($FY23 m)

Forecast Revenue ($m Real FY23)	2023-24	2024-25	2025-26	2026-27	2027-28	Total
Total	13.9	14.1	14.9	15.2	15.2	**73.2**