BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

DOCKET UE-240006

DOCKET UG-240007

EXH. SJK-4

SCOTT J. KINNEY

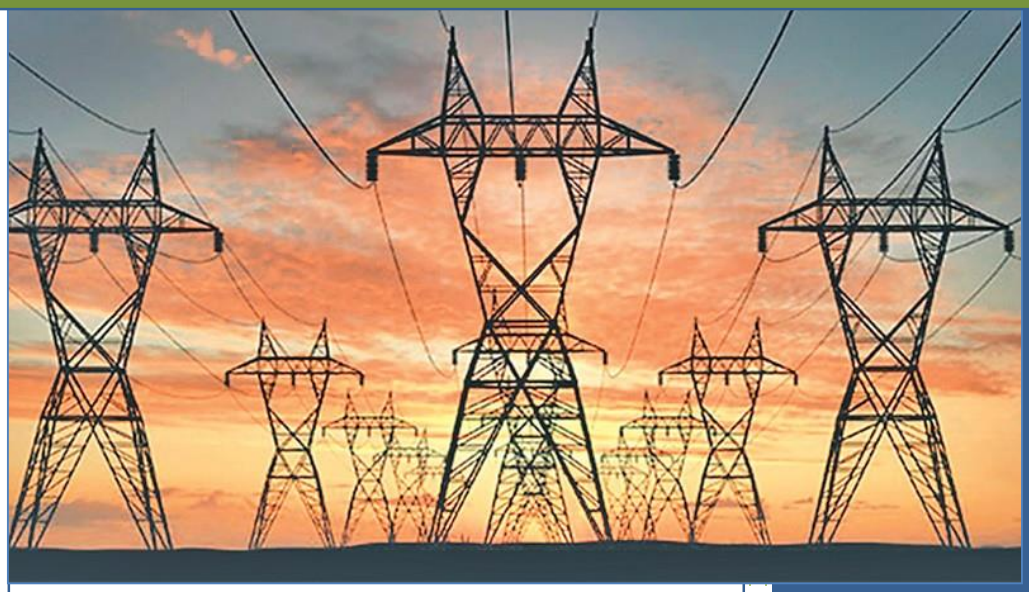
REPRESENTING AVISTA CORPORATION

Utilicast

Utilicast

CONFIDENTIAL AND PROPRIETARY

AVISTA NUCLEUS CTRM ASSESSMENT



PREPARED FOR:

AVISTA CORPORATION

AVISTA

2022.11.02

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

Utilicast performed an assessment of Avista's Nucleus ETRM implementation, evaluating risks and exploring potential options, should Avista move away from Nucleus. This assessment also established a potential case for change from Nucleus to a modern ETRM/CTRM platform (Energy Trading Risk Management / Commodity Trading Risk Management). Further, potential vendors were identified and an overview of the marketplace is presented. Finally, the assessment lays out two potential schedules and budgets for further planning purposes.

Multiple key risks were identified, with 6 of the 17 risks scoring either "critical" or "high", when evaluated on both potential impact and likelihood. This assessment did not evaluate any mitigation plans that may or may not be in place; however, comments from Avista personnel appeared to indicate that where mitigation plans may exist, they were developed in pockets at best.

This assessment identified a path forward for Avista to replace the Nucleus ETRM solution (and surrounding critical spreadsheets) with a modern ETRM/CTRM solution. This would shift all functionality from Nucleus to a combination of the primary CTRM software, other vendor solutions for some specific business functionality, the data lake, and robust enterprise-level reporting tools such as Tableau, PowerBI, QlikView, etc. Although business functionality may be transitioned to more than one software vendor, this does not represent best-of-breed software selection. Rather, the path forward identifies a single (as yet to-be-determined) primary CTRM software suite/vendor. However, some functionality is not supported by that primary CTRM solution, yet is supported in other software packages – some of which Avista already has on-site. Where practicable, that functionality would be implemented in the more appropriate software. Finally, Avista is standing-up a data lake. The potential path forward has Avista leveraging a combination of the primary CTRM software and the data lake for reporting.

The implementation timeline ranges from just over three years to a full four years, and draws resources from a system integrator (e.g., Utilicast), the software vendor(s), and Avista. Cost estimates range from $21.5 million to $26.3 million, with most of that being capitalizable. The potential timelines and budget estimates are for planning purposes and, if Avista is to select to move forward, should be reconfirmed once a primary CTRM software vendor is identified.

2. SUMMARY OF OPTIONS

Although Utilicast was not asked for a specific recommendation, three options are apparent:

- Continue Status-Quo
- Explore Further, Decide Later
- Execute Vendor Selection Process and Begin Implementation

2.1.1 Continue Status-Quo

This option sees Avista continuing to execute the existing Nucleus-centric plan. No further engagement is done in a vendor exploration process.

- ✓ Maintains status quo within the organization
- ✓ Resources and budget remain focused on existing CTRM / Nucleus ecosystem
- ✗ Risk mitigation appears to be a lower priority vs. support / maintenance activities
- ✗ Risk mitigation activities - not coordinated across organization
- ✗ Future business need may compound risks

2.1.2 Explore Further, Decide Later

This option allows Avista to engage potential vendors and further explore potential options. It would develop out a full business case and perform a cost/benefit analysis. This option would allow Avista to further identify and refine risk mitigation plans. Exploration of data-lake benefits would also be included. Finally, this option would allow Avista an opportunity to identify a development path with a post-Nucleus consideration.

- ✓ Allows further exploration into potential vendors, without commitment to change
- ✓ Allows time to build organizational consensus and momentum before major commitments
- ✓ Formulates plan for development prioritization, with consideration of post-Nucleus future
- ✓ Prepares organizational-wide risk mitigation plan to address identified risks
- ✗ Shift to transitional state requires observant change management to maximize success

2.1.3 Execute Vendor Selection Process and Begin Implementation

This option has Avista advancing immediately to mitigate the risks identified in the assessment and implement a new ETRM solution. This option would engage the organization, identify/confirm funding, and quickly begin pre-planning activities.

- ✓ Builds for the future
- ✓ Begins to address risks immediately
- ✓ Staged implementation allows rapid benefit from new solution
- ✗ Potential resource conflicts with other major programs
- ✗ Avista personnel may expect change, but magnitude and timing may be surprising

3. PROJECT OVERVIEW

Avista has had placeholder cards within the Technology Planning Group Special Session (TPGSS) for CTRM since June 2020. Prioritization was discussed during the 2022 TPGSS 5-year plan meeting for potential capital spend in 2023. During that meeting, Avista confirmed the need for an assessment prior to any capital spend. This project is the direct result of that meeting and represents that assessment. During this assessment, Utilicast was tasked with:

1. Providing a risk assessment of Avista's Nucleus application
2. Creating a general roadmap of a potential path forward, should Avista choose to move away from Nucleus
3. Developing preliminary schedule and budget estimates for potential Nucleus replacement

The risk assessment and potential path forward were supported by current state process flows, interface diagrams, spreadsheet summarizations, and interviews with key stakeholders. Some of this Avista had readily available for Utilicast review, while other components were created by a combination of Utilicast and Avista personnel during the assessment.

The scope on the assessment was focused on creating a risk assessment, identifying, and documenting a potential case for change, and drafting a potential schedule and budget. This assessment did not attempt to document the varied benefits of Nucleus. The assessment also did not attempt to perform a risk analysis of a potential new, and as-of-yet-unknown, solution. Finally, the assessment did not attempt to create a cost benefit analysis for a new solution, nor did it create a full business case for moving forward.

4. RISKS

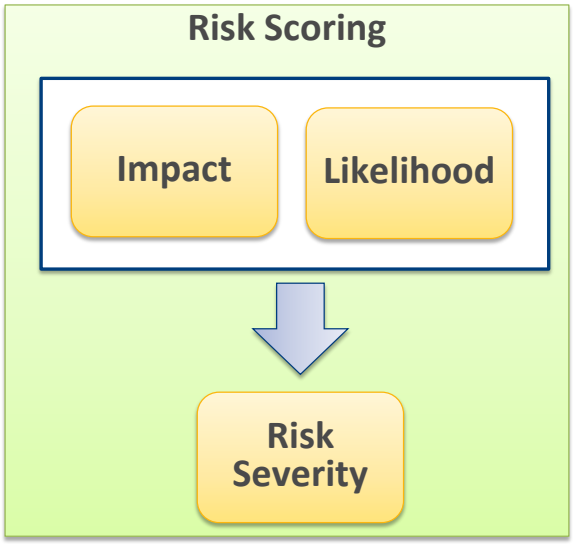
4.1 Risk Overview

This assessment reviewed the risks associated with the Nucleus application and surrounding spreadsheets, as those spreadsheets handle much of the business logic required for Nucleus to be used in successfully accomplishing business objectives. In the sections below, the risk categorization and scoring framework are introduced. These are systematic methods to analysis risks around the current existing solution. These findings are based on conversations with Avista subject matter experts, project data gathering activities, and Utilicast's understanding of Avista. These risks were reviewed multiple times with those involved in their creation, before finalization. As this was an assessment of the current existing Nucleus application, this assessment does not examine what risks may or may not exist with other CTRM solutions.

4.2 Risk Process

Risks are evaluated and structured under three categories: People, Process, and Technology. While some risks overlap categories, this allows a framework for risk classification. Risks around "people" are centered on general personnel risks, but not necessarily any one individual or group of individuals. Process risks highlight areas where current business process may create broader risks for the overall business objective. Meanwhile, technological risk drivers are more centered on the technology in place to support the solution.

All risks are scored based on a combination of impact and likelihood. In this regard, "impact" is defined as the potential effect that could be imposed or introduced by each respective risk. Likelihood is essentially the chance of the risk being realized within a two-year time frame. The timeframe was chosen as a good balance between immediate near-term future activities and longer-range activities (which, in general, with more time available for an event to possibly occur, the higher the probability that it will).



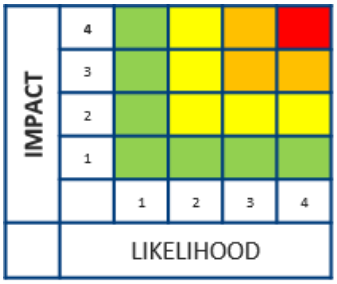
4.2.1 Scoring Criteria

The tables below define in more detail the scoring criteria applied to both "impact" and "likelihood".

Impact Scoring		
Impact	**Score**	**Description**
Low	1	Minor effects to Avista. Temporarily distracting/impacting; manageable
Medium	2	Moderate effects to Avista. Distracting/impacting; managed/overcome with effort
High	3	Meaningful effects to Avista. Disruptive impact to daily operations; managed/overcome with significant effort
Critical	4	Major effects to Avista. Day-to-day business operations may be unacceptably impacted

Likelihood Scoring		
Impact	**Score**	**Description**
Improbable	1	Unlikely to affect Avista within 2 years
Plausible	2	May affect Avista within 2 years
Probable	3	Likely to affect Avista within 2 years
Existing	4	Presently affecting Avista

These are combined to create a "Risk Matrix", for each risk item. The top right section of the risk matrix represents the highest area of risk, while the bottom left represents the lowest overall area of risk.



4.3 Risk Summary

Once the risks were identified and scored individually, they were combined to create an overall risk view. This overall view combined the individual risk matrices to create an overall risk calculation, on a "Critical", "High", "Medium", and "Low" scale. Items in red are "Critical", items in orange are "High", items in yellow are "Medium", and items in green are "Low".

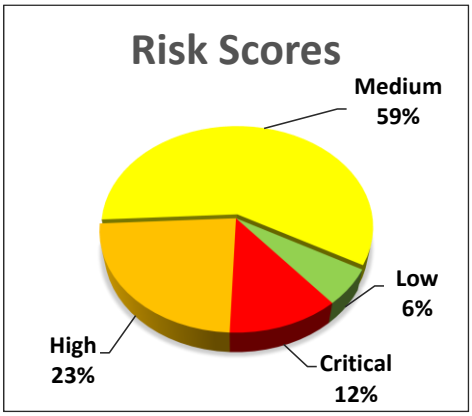
IMPACT					
	4	1	2	3	2
	3	0	0	1	0
	2	0	0	3	5
	1	0	0	0	0
		1	2	3	4
	LIKELIHOOD				

The table to the left shows this scoring. This combines all seventeen risks identified, based on where they were each individually ranked. For example, there were two risks that scored a "4" on impact and a "4" on likelihood. Thus, the "2" in the top right corner (cell 4,4 in the grid).

When the risks identified are combined, they total the following:

- Critical: 2
- High: 4
- Medium: 10
- Low: 1

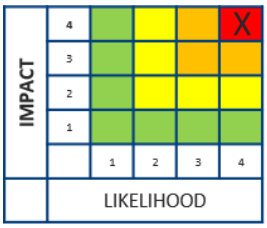
The pie chart on the left shows these numbers as well. The single "low" risk is the potential for an extended Nucleus outage. As discussion later in the risk details, there are backup spreadsheets that could support some critical Nucleus functionality for a period of time, but should an extended outage be incurred, risks could be significant. Thus, this represents the collection of "low-likelihood" / "high-impact" scenarios that exist.



4.4 Risk Details

4.4.1 Personnel Risks Grouping

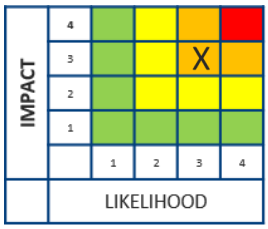
4.4.1.1 Risk 1 – Personnel Retirement



While this risk assessment is focused on Nucleus, broadly, personnel risks are impacting the entire utility industry, including Avista. During the assessment it was identified that various personnel have announced retirement plans and/or are nearing retirement eligibility. Specific numbers may shift, but indications at time of this writing were over 90 individuals across the company have indicated interest in retirement, before the end of 2022 – with some of those being in the sphere of Nucleus. While always a concern, this risk is heightened due to the amount of "tribal knowledge" around Nucleus within Avista. Avista's Nucleus implementation has been highly customized through the years to support Avista's business objectives. The Avista development and support teams supporting the now bespoke Nucleus system and surrounding spreadsheets are strong and are an asset to the company. However, their value to the company also introduces risks as some of these individuals begin to entertain retirement options. Mitigation plans can be developed and implemented (some evidence of this actively occurring exists), yet the decades of experience can be difficult to transition in a matter of weeks. .

As can be seen in the risk matrix, this risk scored a 4 on likelihood, as it is occurring today; and a 4 on impact, as it could potentially lead to unacceptable day-to-day business risk.

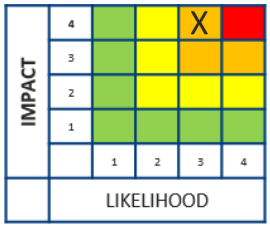
4.4.1.2 Risk 2 - Personnel Replacement & Retainment (Business and Technology)



Following the retirement theme, are replacement and retainment risks. While certainly Oracle Forms developers can still be found (similar to COBOL developers), they will be increasingly more expensive and likely come with little to no domain specific knowledge. Further many development virtuosos may prefer working with more contemporary technology. While subject matter experts (tech or business) are not necessarily attracted solely to Avista due to technology, being able to utilize modern technology can be an attractive proposition. It not only allows them to complete their immediate business objectives, but also allows them the opportunity to build skills relevant in a changing marketplace, regardless of whether they ever decide to move on from Avista.

As can be seen in the risk matrix, this risk scored a 3 on likelihood, as it is probable to affect Avista within the next two years; and a 3 on impact, as it could take significant effort to overcome.

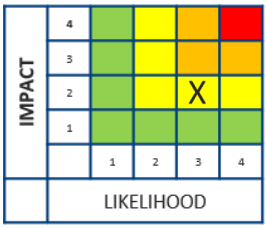
4.4.1.3 Risk 3 - Domain / Technical Expertise to Support Processes / Spreadsheets



It cannot be understated the value Avista's Nucleus development and support personnel bring to Avista. Many of these individuals understand not only the technology required (be it C#, Python, VBA, etc.), but they also have a deep understanding of the business in logic. In fact, there are instances where support/development personnel have designed and built functionality – and then prepared the requisite commentary for regulators. This is rather unusual and speaks to the knowledge and desire of these individuals. Again, while a strength, it also creates a risk. These skillsets can be extremely difficult to find in the marketplace and individuals possessing them are likely to have multiple options available.

As can be seen in the risk matrix, this risk scored a 3 on likelihood, as it is probable to affect Avista within the next two years; and a 4 on impact, as it could potentially lead to unacceptable day-to-day business risk.

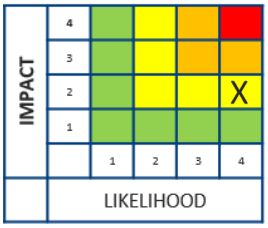
4.4.1.4 Risk 4 - Documentation Limitations



As is often the case, process/technical documentation is usually not high on the list of priorities during system development. During the assessment, it became apparent that some groups/teams had reasonable documentation, yet others' documentation was quite limited. This leads to tribal knowledge and can create significant issues when paired with the retirement risks mentioned above.

As can be seen in the risk matrix, this risk scored a 3 on likelihood, as it is probable to affect Avista within the next two years; and a 2 on impact, as the risks introduced are generally manageable.

4.4.1.5 Risk 5 – Uncertainty of change



This risk breaks into multiple components. First, it was often heard during the assessment that "database access is critical". Multiple personnel asked whether any potential new system would have database access. This shows a resiliency amongst the team to find a way to extend Nucleus to accomplish a business objective, yet also can obscure other more system-native methods to accomplish the same objective. Familiarity with the system and with the underlying database architecture is indeed

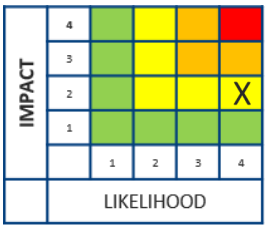
powerful and should be cherished, yet simply because a tool exists and it's the one that's always been used does not necessarily make it the best for the next task.

This risk also is common when any sort of major project is considered. Occasionally, when left without a story, humans tend to make one to fit their desires or expectations. During the assessment, some individuals repeatedly spoke as if replacement of Nucleus was a foregone conclusion, while others spoke as if it were quite unlikely to occur. Regardless of the direction Avista determines, thoughtful messaging should be a key principle.

Per the risk matrix, this risk scored a 4 on likelihood, as it is currently affects Avista; and a 2 on impact, as the risks introduced are generally manageable.

4.4.2 Process Risks Grouping

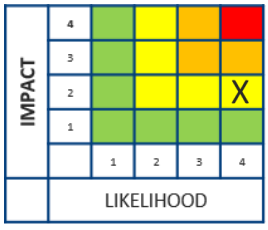
4.4.2.1 Risk 6 - Data Entry – Multiple Manual Entries of Data



During the assessment, there were multiple instances noted of manual data entry of routine data, often of the same data sets. Not only is this manual entry of data a less-than-ideal solution that introduces potential error and lowers personnel efficiency; it also creates data integrity risks. Certainly, some manual data entry will always be expected, yet entering price/volume data multiple times, in multiple locations, for varying purposes is not ideal. Worth note is that the development and support team have analyzed several of these instances to determine whether the effort required to automate them within Nucleus would be worthwhile. It is unknown the extent of what data feeds may have been automated over the past two decades, but the remaining automation candidates were either deemed too onerous to implement or are too low on the priority list to be addressed.

Per the risk matrix, this risk scored a 4 on likelihood, as it is currently affects Avista; and a 3 on impact, as the risks introduced could take significant effort to overcome.

4.4.2.2 Risk 7 – Manual Verification Processes (comparing multiple datasets)

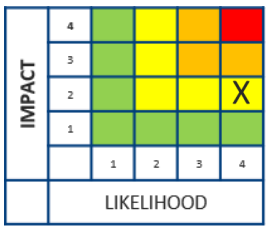


Tasks comparing one data point or set to another are generally more likely to be more efficiently and effectively performed programmatically, than by the human eye. Computers can perform these activities almost instantenously, with a near-zero (or zero) error rate. There are various instances of manual data verification activities being performed, including some that compare two separate reports

that are both generated from Nucleus. Occassional one-off manual verification activities will exist, yet it's the consistent manual verificaiton activities that raise concern.

Per the risk matrix, this risk scored a 4 on likelihood, as it is currently affects Avista; and a 2 on impact, as the risks introduced are generally manageable, albeit with some focused effort from those individuals performing the manual verification activities.

4.4.2.3 Risk 8 – Ability to Maximize Dataset Value

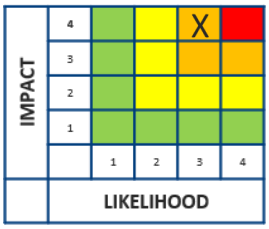


There is significant value in the data that pass through or are consumed/generated by the business processes within Nucleus and the surrounding spreadsheets. The ability to extract these data, understand, transform, combine, and analyze them may lead to unique and important insights for Avista. The risk is that as Nucleus has become the defacto data store for much of these data, which, while beneficial in ways, can also make it more difficult to access and fully utilize that data.

Currently, database access is utilized frequently throughout applications and reporting that interface with Nucleus. Technical savvy business users may build their own queries, while other business users rely on the sophisticated development team to create queries for them returning data sets as desired. This can create a bottleneck either for end-users that must queue for deverloper time. More technical users also may be limited by their understanding of the database structure. These generally limiting effects equate to potential value remaining locked within the dataset, rather than being able to be fully leveraged, potentially leading to improved business outcomes.

Per the risk matrix, this risk scored a 4 on likelihood, as it is currently affects Avista; and a 2 on impact, as the risks introduced are generally manageable, albeit potentially with some focused effort.

4.4.2.4 Risk 9 – New Market Opportunities



Major changes are coming to organized markets in the West. Avista is currently participating in multiple efforts to define a potential Day-Ahead energy market (CAISO EDAM and SPP Markets+ and the related Western Markets Exploratory Group effort). Additionally, Avista is considering entering a centrally organized capacity market (WRAP) and is working to understand the compliance responsibilities under new Washington state greenhouse gas rules.

Unlike participation in the current Western EIM, which might settle 5% of the value of Avista's load, a Day-Ahead Market will clear 100% of the load and schedule Avista's generation. It is likely that the Market settlements and invoice processing will continue to be executed in Settle Core rather than in an ETRM application. However, moving to a Day-Ahead market would likely change the counterparty risk (the MO is the central counterparty for all transactions but defaults by any one participant are share with the other market participants) and the amount of Credit which is required to be posted.

The Initial EDAM and Markets+ designs will not include Virtual Bidding (Convergence Bidding in CAISO) or Financial Transmission Rights (FTRs in most markets; CRRs in CAISO; TCRs in SPP). The SPP design also includes Auction Revenue Rights (ARRs). However, FERC typically requires these products to be part of Market designs so even if they are not included in the initial implementation, they likely will be part of Avista's Merchant operations in the coming years. FTRs are much longer dated products – up to 10 years in duration – and require the posting of secured credit based on the value of the portfolio.

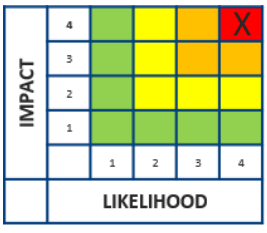
The Washington carbon rules are still being worked out, but compliance instruments and marking the position to market will need to be addressed. These functions require a combination of Nucleus and the PCI Suite for Avista's California obligations. The mechanisms for addressing obligations and compliance within the markets is already complex and that complexity will significantly increase with Washington's rules. If additional states adopt rules which are not copies of the California or Washington rules, the complexity will significantly increase.

The WRAP will create binding forward capacity showing combined with penalties for not meeting the showing. Additionally, there will be obligations to deliver energy to / receive energy from other members in the program.

As can be seen in the risk matrix, this risk scored a 3 on likelihood, as it is probable to affect Avista within the next two years; and a 4 on impact, as it could potentially lead to unacceptable day-to-day business risk.

4.4.3 Technology Risks Grouping

4.4.3.1 Risk 10 – Spreadsheet Reliance



Many of the business objectives accomplished through utilization of Nucleus hinge on elaborate and complex spreadsheets. These spreadsheets have been customed designed and developed by Avista personnel throughout the years and tailored specifically to meet critical business needs. The extraordinary abilities of Avista personnel to develop and maintain these spreadsheets cannot be understated. The team has effectively extended the

Nucleus application with these spreadsheets, allowing it to be extended and to continue to support changing business needs throughout the years.

The “Gas Board” spreadsheet is a good example of the business logic that the team has developed outside of Nucleus. This spreadsheet is used extensively by Gas traders. It has been tailored to provide the exact data where and when they want to see it. The tool is effectively the trading engine and allows Nucleus to be used essentially as a data store for gas trades.

On balance, these spreadsheets are not simply “spreadsheets”, nor are they simply “models”. Yet, indeed, there are models built into the spreadsheets. These spreadsheets are often engines in their own right that perform functionality often found within vendor-developed CTRM applications.

This assessment has identified several risks around this reliance on Excel and the spreadsheets / workbooks with their business logic and models.

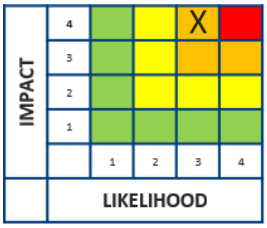
First, these workbooks introduce “key-man risk”. It is not often that the workbooks have issues – and when they do, it’s typically due to upstream data feed changes/issues – yet when issues are encountered, only a small number of individuals have the skillset and background to immediately investigate and resolve the issue.

Secondly, the functionality within these spreadsheets is highly customized. Should business processes evolve, significant changes could be required, which could then ripple downstream. The more potential change required, the more potential nuance and review required.

Along with key-man risk for break/fix, the knowledge transfer requirements necessary to mitigate retirements are significant. Many of these workbooks have a relatively large number of lines of VBA code. The assessment did not review code specifically, although it should be noted that there are comments in the code, at least in some of the workbooks. Should the knowledge transfer activities not be successfully planned and executed, eventually, the only way to understand what the code is doing will be to read the code itself. That is an untenable position as it requires significant time to read and understand the code and business functionality – ideally from someone that understands both the underlying technology and the broader business process. Unfortunately, if this point is reached, it is highly unlikely that those personnel will exist and be available for this analysis.

As can be seen in the risk matrix, this risk scored a 4 on likelihood, as it is occurring today; and a 4 on impact, as it could potentially lead to unacceptable day-to-day business risk.

4.4.3.2 Risk 11 – Vendor Support / Legacy Application End-of-Life



Underlying the Nucleus application are both hardware and software components. The table below lists the server names, the environment they support, the underlying operating system they run, and a brief description. Additional details on the servers can be found in Enterprise Technology's *Resource Library.*

Server	Env.	Version	Description
Developer Machines			
H2017	Dev	Windows Server 2012	Dev Server: Ram Lopelly
H2018	Dev	Windows Server 2012	Dev Server: Satish Namburi
H2019	Dev	Windows Server 2012	Dev Server: Curt Rettenmier
H2020	Dev	Windows Server 2012	Dev Server: Suzanne Carroll
H2043	Dev	Windows Server 2012	Dev Server: Shashank Chada
Development Environment Application and Integration Servers			
NL0215	Dev	RedHat Linux 7	Application Server
H1378	Dev	Windows Server 2012	Integration Server
Model Office Environment Application, Integration, and Web Servers			
NL0216	M.O	RedHat Linux 7	Application Server
H1379	M.O.	Windows Server 2012	Integration Server
NW0641	M.O.	Windows Server 2019	Web Server (load balanced)
NW0642	M.O.	Windows Server 2019	Web Server (load balanced)
Development / Model Office Environment Database Server			
NL0212	Dev/M.O.	RedHat Linux 7	Dev/Model Office Database Server
Production Environment Servers			
PL0098	Prod	RedHat Linux 7	Application Server
H1380	Prod	Windows Server 2012	Integration Server
PL0092	Prod	RedHat Linux 7	Database Server
PW0678	Prod	Windows Server 2019	Web Server (load balanced)
PW0679	Prod	Windows Server 2019	Web Server (load balanced)
Backup Server			
NL0218	Prod	RedHat Linux 7	NUC CBT – Backup

Oracle Forms version: Middleware 12c (12.2.x)
Oracle Database version: Oracle Database 12c Enterprise Edition Release 12.1.0.2.0

Technical End-of-support questions regarding the underlying "architecture" of Nucleus have been raised for some time at Avista. Below is a brief summary of each component, it's "normal" end-of-support / end-of-life date and an extended end-of-life/end-of-support dates.

Item	End-of-Life Date	Extended Date
Windows Server 2012	Oct 2023	Oct 2026
Windows Server 2019	Jan 2024	Jan 2029
RedHat Linux 7	June 2024	June 2026
Oracle Forms Middleware v12.2.x	Dec 2025	Dec 2027
Oracle Database 12c Enterprise Edition Release	Out of Support	N/A

4.4.3.2.1 Windows Server 2012

The Windows Server 2012 Operating System has an end-of-life date of December 2023. This means that normal support will expire for Windows Server 2012 at the end of 2023. However, Microsoft offers extended support for up to an additional three years (expiring Dec 2026) for a nominal fee. Costs are subject to change, but estimates are expected to be $5,000/machine for the entire three-year period. At this time, Microsoft has no public plans to extend that date.

4.4.3.2.2 RedHat Linux 7

The RedHat Linux 7 Operating System has an end-of-life date of June 2024. This means that normal support will expire for RedHat Linux 7 at the end of June 2024. However, RedHat offers extended support for up to an additional three years (expiring June 2026) for a nominal fee. Costs are subject to change, but estimates are expected to be $5,000/machine for the entire three-year period. At this time, RedHat has no public plans to extend that date.

4.4.3.2.3 Oracle Database 12c Enterprise Edition

The database underlying Nucleus reached end-of-life / end-of-support on July 31st, 2022 and is now only in "sustaining support" from Oracle. "Sustaining support" is of limited to no value, as it only allows access to patches that already exist – should issues be found, cyber security threats uncovered, etc., Oracle's remedy would be for Avista to upgrade to a current, supported version.

4.4.3.2.4 Oracle Forms Middleware v12.2.x

Oracle Forms (more succinctly: Fusion Middle ware 12c (12.2)) is the technology upon which the Nucleus user interface is built. Oracle Forms is generally considered a legacy application, yet still is in use across a variety of industries. Oracle continues to provide support for the application and continues to push the end-of-support date further into the future every few years. The Oracle Forms Middleware has an end-of-life date of December 2025. This means that normal support will expire for Oracle Forms at the end of December 2025. However, Oracle offers extended support for up to an additional two years (expiring December 2027) for a fee. Costs are subject to a variety of factors. Oracle also lists a third tier of support titled "sustaining support", with an "indefinite" end date. Unfortunately, this "sustaining support" amounts to little more than access to a technical chat forum and access to patches that are already in existence. Although Oracle's public end-of-support date is December 2027, Oracle has pushed that date out into the future on multiple occasions. While there is no guarantee that it will be moved beyond 2027, there is also no indication that Oracle will not continue their process of pushing the date.

4.4.3.2.5 Compatibility Risks

While end-of-life and end-of-support dates must always be considered, they must be balanced with other priorities and risks. Applications will continue to function, databases will continue to run, and underlying operating systems will continue to provide a framework for years and years into the future. While Oracle has new offerings to supplant their Oracle Forms framework, they also recognize Oracle Forms is still actively used for many legacy applications, and thus can be a high-margin revenue source.

Perhaps of larger concern than specific end-of-support / end-of-life dates is the risk of incompatibility between new versions of applications. This can be caused by simple upgrades that occur as technology advances. It can also be caused by forced events, such as cyber security threats.

Of concern would be a situation where Avista is forced to update an ancillary application – be it for cyber security reasons or otherwise – and that new version of the application was no longer compatible with other Nucleus architecture components. Worst-case scenario, Avista could be forced to make a decision to allow a cyber security threat to continue to exist, or run the Nucleus application. Being "worst-case" the likelihood of occurrence is relatively low, yet it not zero. As Avista's cyber security team and others in Enterprise Technology are aware, threats to underlying software that has been in place, sometimes for decades, are occasionally uncovered by researchers and cyber security teams.

4.4.3.2.6 Database Update

Should Avista decide to leave Nucleus in place as-is, Avista should consider upgrading the database. While not necessarily simple, these database upgrades can often be made in-place, thus limiting downtime. Running on an out-of-support database for an extended period of time is not preferred.

Balancing technology upgrades, cyber security threats, costs, and impacts is not straightforward. Trade-offs are often made. Enterprise Technology must manage competing priorities, likelihood of risks coming to fruition, and potential impacts of those risks. However, given the impact these decisions can lead to, they should not be made lightly. In the event of an incident, these decisions will be reviewed. Difficult questions will be raised as to why decisions were made. It's imperative that decisions can be defensible. To the extent policies exist governing these decisions, the decisions must be made in alignment with those policies. If decisions are made outside of those policies, detailed documentation explaining the deviation from the policy should be created and retained. Failure to do so can lead to embarrassment or worse, potentially in front of shareholders, regulatory commissions, ratepayers, and possibly others.

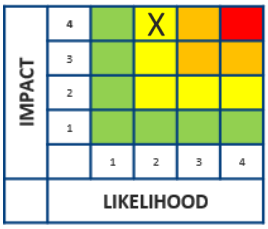
4.4.3.3 Latest Versions:

- Oracle Database: Version 21c – Released August 2021
- Windows Server: Version 2022 – Released August 2021
- RedHat Linux Server: Version 9 – Released May 2022
- Oracle Middleware: Version 12.2.1.4.0 – Released September 2019

4.4.3.4 Links for Further Detail

Oracle Fusion Middleware Details:
https://www.oracle.com/us/support/library/lifetime-support-middleware-069163.pdf
Oracle Database Update Post (Oct 2022):
https://support.oracle.com/knowledge/Oracle%20Database%20Products/742060_1.html
Windows Server 2012 Details:
https://learn.microsoft.com/en-us/lifecycle/products/windows-server-2012
Windows Server 2019 Details:
https://learn.microsoft.com/en-us/lifecycle/products/windows-server-2019
RedHat Linux Details:
https://access.redhat.com/support/policy/updates/errata#Life_Cycle_Dates

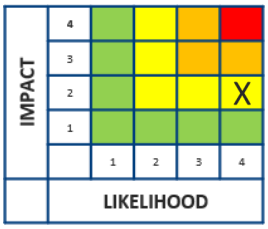
4.4.3.5 Risk 12 – Python Open-Source Package Security



Open-Source Software (OSS) can be immensely powerful and allow developers to utilize best-of-breed software, while reducing the need to "reinvent the wheel". Given this power, OSS should be leveraged by the organization. However, this utilization must have oversight to limit potential cyber security risks. The Nucleus development team utilizes OSS sparingly and most appear to be of either the Python or the .NET variety. Further, the team appears to mainly be sourcing OSS code from major corporations (e.g., Microsoft, RedHat), or common and ubiquitous package providers (e.g., mpm, PIP). More broadly, an internal Avista assessment was completed in May of 2022 that provided recommendations to enhance OSS security within not only the Nucleus development group, but also within Avista overall. Indications are this assessment was well executed and provided potential action items for Avista leadership to prioritize. Again, open-source software is extremely powerful and should be embraced by Avista, as long as it can be appropriately scanned/monitored.

Per the risk matrix, this risk scored a 2 on likelihood, as it is a possibility that open-source code could be exploited thus impacting Avista, although not necessarily expected (especially once scanning/monitoring are introduced). On the impact scale, this risk scores a 4, highlighting the potentially catastrophic impact an attack could produce.

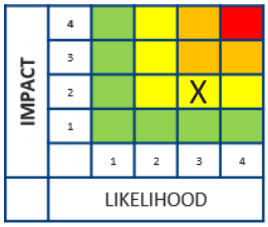
4.4.3.6 Risk 13 – User Interface Quirks



Built on the Oracle Forms User Interface, Nucleus was originally developed over two decades ago. General guided user interface (GUI) improvements have occurred since then, and while some have been implemented in Oracle Forms, many have not. There are also general quirks in the user interface (e.g., having to click twice to get out of a date field, etc.), yet these can – and have been – overcome by users that learned the idiosyncrasies and the methods to get around them.

Per the risk matrix, this risk scored a 4 on likelihood, as it is currently affects Avista; and a 2 on impact, as the risks introduced are generally manageable, albeit with some focused effort.

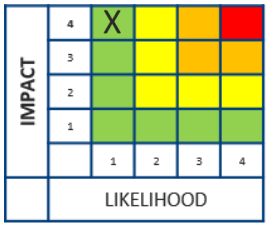
4.4.3.7 Risk 14 – Globalscape and MuleSoft Incongruities



Globalscape is a vendor-supplied system to provide secure file transfer and is used extensively within Avista. MuleSoft is an integration platform and represents leading-edge system integration technology. MuleSoft was successfully implemented during the CAISO Energy Imbalance Market (EIM) implementation, to better enable data transfer between systems. Currently, both Globalscape and MuleSoft exist with no significant issues between the two. The main risk is due to having both integration tools in use at the same time can heighten overall support requirements. During the assessment, it became apparent that the plan is to shift further towards MuleSoft, as future needs arise, which will help to minimize this risk.

Per the risk matrix, this risk scored a 3 on likelihood, as it is likely to affect Avista; and a 2 on impact, as the risks introduced are generally manageable, albeit perhaps with some focused effort.

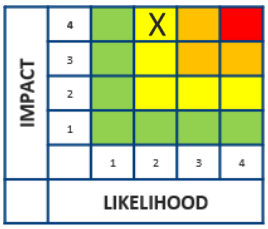
4.4.3.8 Risk 15 – Nucleus Outage Recovery



Nucleus has a four-hour service-level-agreement (SLA) for transitioning Nucleus functionality from Spokane to the backup data center in San Jose. This process is tested regularly and is typically successfully implemented within the timeline identified in the SLA. Nucleus also has backup spreadsheets for some critical functionality that could be utilized to keep some system operations activities running during a Nucleus outage. While it may be hard to envision spreadsheets standing in for Nucleus during an outage, it is likely they would serve their limited intended purpose for at least a moderate period of time. However, should Avista face an extended outage, the potential impact increases significantly. Thus, this represents the collection of “low-likelihood” / “high-impact” scenarios that exist.

Per the risk matrix, this risk scored a 1 on likelihood, as it is unlikely to affect Avista; and yet a 4 on impact, as the risks introduced could potentially lead to unacceptable day-to-day business risk.

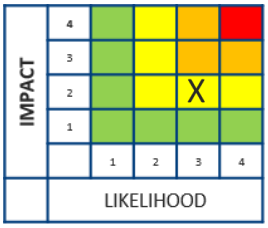
4.4.3.9 Risk 16 – General Nucleus Cyber Security Awareness



The Cyber Security Team appears to have a good understanding of the cyber security risks that may affect the Nucleus application and surrounding spreadsheets. Nucleus is not fully included in the "Security Monitoring Portfolio", although some aspects are included in the portfolio. This means some aspects of Nucleus do not receive as much attention as others, but does not mean there are necessarily cyber security gaps or issues. The number and variety of integrations with Nucleus (including API transfers, SFTP transfers, spreadsheet uploads, etc.) do pose some concern, yet this is a rather typical issue. The Business Continuity / Disaster Recovery documentation may not provide fully appropriate guidance for handling situations such as known active intruder / malicious actors, nor may it fully account for potential ransomware attacks. While these scenarios are uncommon, their numbers are on the rise and their potential consequences can be catastrophic.

Per the risk matrix, this risk scored a 2 on likelihood, as it is always a possibility that cyber-attacks could impact Avista, although they not necessarily expected. On the impact scale, this risk scores a 4, highlighting the potentially catastrophic impact an attack could produce.

4.4.3.10 Risk 17 – Development Tool Acceptance Impacts to Hiring



Corporate standards exist for development tools used at Avista; however, the decision of what tools are used appears to be ostensibly consensus driven. Although not inherently an issue, additional tools do require additional oversight. They also introduce potential hiring risks, as Avista may need to hire developers with functional knowledge of a broader set of coding languages. This could limit the pool of potential developer candidates.

Per the risk matrix, this risk scored a 3 on likelihood, as it is likely it could impact hiring at Avista. On the impact scale, this risk scores a 2, as Avista should be able to navigate around this risk.

5. VENDOR LANDSCAPE

Utilicast presents various CTRM vendors and summarizes their capabilities both functionally and technically.

Utilicast does not recommend vendors specifically, but rather guides clients as to how to consider vendors, including but not limited to providing criteria for selection and, should a client desire to commit, providing guidance and direction through the RFP process.

Utilities are consistently conservative in the process of selection/contracting of software and a CTRM solution selection is no exception. A vendor overview is below, with an "optimistic" view of these vendors along with caution areas.

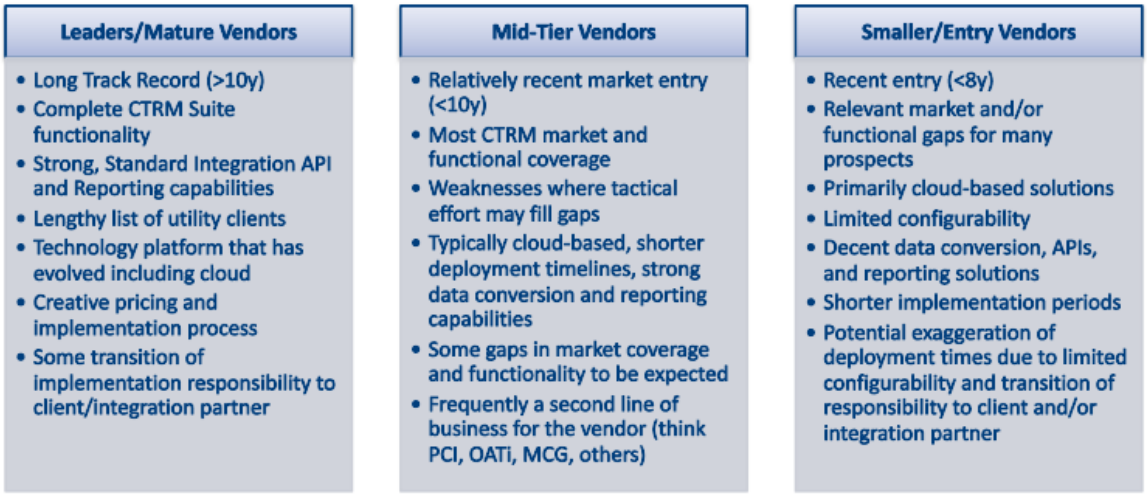
5.1 Vendor Profiles

In this section, Vendor Profiles – general similarities and differences are outlined against the broad profiles identified above.

Recall from prior information, Leading Vendors have longevity, full market coverage, robust and standard integration APIs, powerful standard reporting and reporting "engines", on-premises or cloud implementations, dedicated development/support/implementation teams, creative pricing and execution of industry trends and functionality.

Clients should be aware that trade-offs exist for a CTRM selection process. No product will appear, behave, and perform the same processes in the same manner with the same "process flow" as the current solution does, however all the software for consideration may solve these processes satisfactorily. A successful selection process with scoring at each step along with demonstration test cases and data that have been vetted in legacy solution(s) aide a like-for-like review.

The following are leading vendor / products and a summary of strengths and weaknesses, sorted alphabetically with no preference identified.



Generally, Leaders/Mature Vendors:

- Longer implementations due to more functionality and related capabilities
- Capable, proven support and service organization
- Possibly higher cost of product

Mid-Tier Vendors:

- Partial functionality and related capabilities
- Short to mid-length implementations
- Growing support and service organization
- Lower cost of product

Entry Vendors:

- Incomplete functionality and related capabilities
- Shorter implementations
- Immature support and service organization
- Lower cost of product

5.1.1 ION / Allegro Horizon

Founded in 1984 as an energy management solution, the Allegro Horizon solution provides world-wide clients with ETRM solutions across physical and financial energy markets. Allegro Horizon is considered a Leading/ Mature product. Allegro was merged (purchased) by the ION Group in 2014.

Strengths to Reconfirm:

- Complete functional coverage of all markets of interest
- Leading configurability and extensibility
- Integrated APIs for ICE and price data sources
- Standard conversion utilities for implementation
- Standard Reports
- FEA pricing engine added VaR and potentially other capabilities – review "advanced analytics" below
- Flexible on-premises or cloud solution
- Test automation tool – trust but verify
- Numerous utility clients – seek references

Areas for Diligent Review:

- Data Lake integration capabilities
- Reporting – both standard and reporting "engine" - specifically inquire about a reporting engine
- Advanced analytics would be seamless if properly integrated via the FEA pricing/valuation/risk analytics engine; ensure this is true
- Mention of Machine Learning and AI capabilities for valuation
- Mention of Credit capabilities, however another solution (Credit Risk) is offered separately
- Client satisfaction

More information may be found here: https://iongroup.com/products/commodities/allegro/

5.1.2 ION / Openlink

Founded in 1992 as a treasury risk trading and risk management solution. Acquisitions include MCG (subsequently sold) along with an agriculture product and a credit reporting solution. The solution provides world-wide clients with ETRM solutions across physical and financial energy markets. Openlink is considered a Leading/ Mature product. Openlink was merged (purchased) by the ION Group in 2017.

Strengths to Reconfirm:

- Robust functional coverage of all markets of interest
- Strongest foreign exchange and interest rate analytics
- Leading configurability and extensibility
- Integrated APIs for ICE and price data sources
- Standard conversion utilities
- Standard Reports and Report Builder, an integrated end-user tool best for SME or IT
- Integrated simulation engine including VaR – Delta, Monte Carlo, Historical and Volumetric VaR may be calculated
- Flexible on-premises or cloud solution
- Integrated Credit and Risk Limit components with standard MTM, Tenor and other limit capabilities
- Cloud or on-premises deployment
- Numerous utility clients including BPA (recently switched to PCI we believe), PGE, PG&E, Tacoma Power, Seattle City and Light, SoCal, PacificCorp, Ameren, among others domestically and internationally

Areas for Diligent Review:

- Data Lake integration capabilities
- Internal development language(s)
- Client satisfaction

More information may be found here: https://iongroup.com/products/commodities/openlink/

https://iongroup.com/products/commodities/allegro/

5.1.3 ION / Triple Point

The Triple Point solution provides world-wide clients with ETRM solutions across physical and financial energy markets. TriplePoint is considered a Mid-Tier product due to recent refresh of the product, struggles to regain market share and limited utility clients. Triple Point was merged into ION Group in 2013.

Strengths to Reconfirm:

- Robust functional coverage of all markets of interest
- Capable foreign exchange and interest rate analytics
- Via ION's acquisition and separation of FEA pricing engine VaR and other capabilities are increased
- Flexible on-premises or cloud solution
- Limited utility clients
- Cloud or on-premises deployment

Areas for Diligent Review:

- Deep dive on power trading, integration, sub-hourly meter and price data, and other related functionality
- Data Lake integration capabilities
- Reporting – both standard and reporting "engine"
- Mention of Credit capabilities, however another solution (Credit Risk) is offered separately by ION Group
- Client satisfaction

More information may be found here: https://iongroup.com/products/commodities/triplepoint/

https://iongroup.com/products/commodities/allegro/

5.1.4 EKA / EKA

The EKA solution was initially in Ag and Metals, and in 2013, purchased the EnCompass company and associated energy ETRM. EKA is considered a Mid-Tier product due to recent entry point, market coverage, configurability, and limited utility customers.

Strengths to Reconfirm:

- Complete functional coverage of all markets of interest
- Standard conversion utilities
- Standard Reports and Reporting tools
- Strong promotion of rapid implementation and deployment tools / verify / clients have noted tactical deployment development requirements
- Credit capabilities
- VaR and other analytics
- Cloud-only solution

Areas for Diligent Review:

- Deep dive on power trading, integration, sub-hourly meter and price data, and other related functionality is needed
- Configurability and extensibility
- Despite outlining “100 worldwide clients”, foreign exchange and interest rate analytics receive limited discussion on website – investigate if considered significant
- Data Lake integration capabilities
- Reporting – both standard and reporting “engine”
- Client satisfaction

More information may be found here: https://eka1.com/trading-and-risk/

https://iongroup.com/products/commodities/allegro/

5.1.5 Enuit / EnTrade

The Enuit solution provides world-wide clients with CTRM/ETRM solutions across physical and financial energy markets. Enuit is considered a Mid-Tier product due to recent entry point, market coverage, configurability, international focus, and limited utility customers.

Strengths to Reconfirm:

- All desired functional coverage of all markets of interest
- Standard conversion utilities
- Credit capabilities
- VaR and other analytics
- Cloud-only solution

Areas for Diligent Review:

- Deep dive on power trading, integration, sub-hourly meter and price data, and other related functionality is needed
- Configurability and extensibility
- Integration of gas pipelines
- Standard Reports and Reporting tools not discussed on website
- Data Lake integration capabilities
- International focus seems primary
- Client satisfaction

More information may be found here:
https://www.enuit.com/https://iongroup.com/products/commodities/allegro/

5.1.6 FIS / Energy Trading, Risk and Logistics Platform

The recently rebranded "Aligne" solution is now the "Energy Trading, Risk and Logistics Platform" solution providing clients with a multi-commodity CTRM/ETRM solution across physical and financial energy markets. Enuit is considered a Mid-Tier product due to rebuild of its product line after a decade+ acquisition path bringing together the Altra natural gas products, TransEnergy natural gas products, Nucleus power trading solution, and ZaiNet trading and risk management solutions. Despite the multi-decade existence of these products, the aggregation and lack of market acceptance of the solution prevents the FIS Energy Trading, Risk, and Logistics Platform from being a leading solution.

Strengths to Reconfirm:

- Most desired functional coverage of all markets of interest
- Standard conversion utilities
- Credit capabilities
- VaR and other analytics
- Cloud or on-premises solution

Areas for Diligent Review:

- Deep dive on database architecture
- Power trading, integration, sub-hourly meter and price data, and other related functionality is needed
- Configurability and extensibility
- Integration of gas pipelines
- Standard Reports and Reporting tools not discussed on website
- Data Lake integration capabilities
- Client satisfaction

More information may be found here: https://www.fisglobal.com/en/products/fis-energy-trading-risk-and-logistics-platform

5.1.7 MCG / Energy Software Suite

MCG's "Energy Software Suite" solution provides clients with CTRM/ETRM capability across physical and financial energy markets. Energy Software Suite is a result of acquisition of Paragon's trading, credit, risk, gas scheduling and settlements – and is considered a Mid-Tier product due to recent entry point, market coverage, configurability, and limited customers of the ETRM product.

Strengths to Reconfirm:

- Some desired functional coverage of all markets of interest
- Credit and Risk capabilities
- Gas Scheduling
- Cloud-only solution

Areas for Diligent Review:

- Deep dive on power trading, integration, sub-hourly meter and price data, and other related functionality is needed
- Strong promotion of rapid implementation and deployment tools / verify
- Configurability and extensibility / verify
- Integration of gas pipelines
- VaR and other analytics
- Standard Reports and Reporting tools not discussed on website
- Data Lake integration capabilities
- Client satisfaction

More information may be found here: https://www.mcgenergy.com/products/energy-software-solutions/

5.1.8 OATi / ETRM

OATi joined the ETRM space within the last decade with their "ETRM" solution. The OATi ETRM solution, comprised of webTrader, webRisk, webRECS, webCredit, etc.., provides world-wide clients with CTRM/ETRM solutions across physical and financial energy markets. OATi ETRM is considered a Mid-Tier product due to recent entry point, market coverage, configurability, and limited utility customers.

Strengths to Reconfirm:

- Most desired functional coverage of all markets of interest
- Standard conversion utilities
- Risk analytics / verify
- Cloud-only solution

Areas for Diligent Review:

- Gas scheduling / integration with pipelines
- True credit capabilities
- Configurability and extensibility
- Capability of adding Carbon Credits (not mentioned in functional list)
- Standard Reports and Reporting tools not discussed on website
- Data Lake integration capabilities
- Client satisfaction

More information may be found here: https://www.oati.com/solutions/energy-trading-riskhttps://iongroup.com/products/commodities/allegro/

5.1.9 PCI / ETRM

The PCI/ETRM solution provides clients with ETRM capability within physical and financial energy markets. PCI/ETRM is considered a Mid-Tier product due to recent entry point and unknown configurability. Conversation with PCI indicates numerous utility clients.

Strengths to Reconfirm:

- Most desired functional coverage of all markets of interest
- Growing product with several successes of replacing “leading” vendors
- Credit capabilities
- Cloud-only solution via client or vendor

Areas for Diligent Review:

- Review of Heating Oil, RECs and Carbon Credit capability
- Review of options (should this be an eventual requirement)
- Configurability and extensibility
- Integration of gas pipelines
- Standard Reports and Reporting tools not discussed on website
- Data Lake integration capabilities

More information may be found here: https://www.pcienergysolutions.com/solutions/energy-trading-and-optimization/pci-energy-trading-risk-management-etrm/https://iongroup.com/products/commodities/allegro/

5.1.10 Other Vendors

Other vendors are considered Small/Entry Vendors and were not outlined in detail for one or more of the following reasons:

Strengths to Reconfirm:

- Missing desired functional coverage of all markets of interest – generally either gas or power
- Limited to no utility clients
- Broad focus with limited clients
- Missing analytics or analytics focus
- Weak website content preventing due diligence for inclusion

Vendors in this area include:

- Adapt2 – no gas capability
- Brady – no gas capability, European focus
- Envernus – market price tool only
- Ignite – limited client list
- Hitachi/ABB – TRMTracker/RiskTracker – limited clients, power focus
- ION/Aspect – primarily a liquid hydrocarbon and metals solution
- Hartigen – power only solution for ISO and bilateral markets
- InaTech – no power
- Kyos – risk analytics only
- Molecule – missing scheduling, credit, no client list, open-source base code

https://iongroup.com/products/commodities/allegro/

6. POTENTIAL SOLUTION

The following section details options Avista may have, should Avista decide to move away from Nucleus. The plan and timelines are created based on Utilicast's deep experience of CTRM implementations as well as Utilicast's understanding of Avista's business processes and overall situation.

6.1 Solution Highlights

Utilicast suggests that Avista consider a single CTRM system / vendor. This would transition core CTRM functionality from Nucleus to a single CTRM vendor's system. However, as Nucleus is in a constellation of multiple applications supporting various business processes, it is expected that some functionality would transition to other vendors. The transition away from Nucleus will not be a simple "like-for-like" from Nucleus to a new CTRM system, yet any new CTRM system will have substantial capabilities, in many ways, exceeding those found in Nucleus.

In some instances, Avista will have the option to choose between new system CTRM functionality and keeping existing spreadsheets. Further, there will be instances where business processes can be changed and improved, and thus better supported by the new CTRM solution. These potential business process changes would be identified and reviewed during design phases of the project. Often, when implementing a new system, changing business processes to match a more modern system is a better overall solution, than attempting to force a new system to fit antiquated business practices. Again, these will be identified, reviewed, and confirmed during the respective design phases.

There may be instances where Avista chooses to keep some portion or all of a spreadsheet/workbook. In these instances, the new CTRM solution can feed these spreadsheets with necessary data. The CTRM can also write the necessary data to the data lake and allow the spreadsheets to connect directly to the data lake for details. Detailed specifics will be developed and confirmed during the design phase. Utilicast encourages Avista to recognize the new system functionality may change business processes, but is likely to do so for the better.

6.1.1 Interfaces

All CTRM vendor solutions will have configurable integration functionality out of the box. The project will leverage this functionality, regardless of vendor. The solution will also look to use the integration platform *MuleSoft*. MuleSoft is a leading integration solution that was successfully implemented by Avista during the CAISO Energy Imbalance Market (EIM) program implementation.

MuleSoft provides a variety of advantages for integration between systems, including consolidation of interfaces and advanced monitoring. Utilizing CTRM integration functionality and MuleSoft will simplify data transfers both in and out of the CTRM ecosystem.

6.1.2 Reporting

A new CTRM solution will allow Avista to move away from much of its Excel-based reporting. Similar to interfaces, modern CTRM solutions have a bevy of out-of-the box configurable reports. The solution will leverage those where available. The solution will also look to leverage Avista's data lake to make data available to subject matter experts for reporting using tools such as Tableau and PowerBI. These are world-class reporting tools that can be used by a range of users, from those with an expert understanding of the data models, to those with a more cursory understanding.

6.1.3 Data Lake

Avista has already developed a solid foundation for a substantial data lake, based on Amazon's AWS underlying architecture. The data lake is consuming data from CC&B and other applications. The architecture and design team designing the data lake is clearly knowledgeable and has implemented leading practices in design. Data is available for query in the data lake in the same manner as it is available natively in applications – thus from a user perspective, aside from pointing to the data lake vs. the native application, their queries can be executed without change – effectively making the data lake transparent to end-users. Further, the team has designed a data abstraction and visualization layer, which sits on top of the raw/curated data. This abstraction layer allows the joining of data from across systems to create concepts of interest by business analysts (e.g., a "customer" concept may be comprised of data from CC&B, SalesForce, etc.). The CTRM solution will be designed with this functionality in mind. Determining specific data to write to the data lake and which abstraction layer concepts to create will be done in future planning and design meetings.

6.1.4 Optimization

"Optimization" functionality can be difficult to define. Generally, most CTRM solutions have some optimization capabilities, but not necessarily more advanced optimization capabilities. Thus, it is possible that Avista may want to stay with portions of some current optimization spreadsheets, if design/build proves to be more difficult than desired.

Another option is to look for a 3rd party to provide specific optimization tools. This is the one area of the solution where Avista may want to consider best-of-breed in software. If Avista moves in this direction, specific optimization tools tailored to best solve specific optimization problems may be worth exploring. However, depending on the vendor selected, it may be that most optimization can be supported with software configuration within the tool.

6.2 Project Phasing

6.2.1 Phasing Introduction

The proposed solution delivers the project in two phases, with each phase being based on commodity type. The first phase centers around Gas functionality and the second phase revolves around Power. Additional details on the phase contents and two possible timelines follow. This is vendor agnostic and will be confirmed with the vendor once a vendor is selected.

Transition by commodity type has several benefits.

1) By transitioning Gas first, Avista can test much of the overall solution, earlier in the project. Not only will gas trading activities be verified, but the broader invoicing, risk, and integration to EBS will be tested much earlier in the project.
2) Gas is less integrated to the broader overall solution than power
3) Relatively, Gas is less complex than Power.

6.2.2 Overview: Phase 1 – Gas

Phase 1 focuses on transitioning the Gas business to the new CTRM solution. This phase takes the front office trading, back-office invoicing, and, optionally, the gas-related risk functionality. Credit functionality remains in Nucleus and will be delivered with Phase 2 of the project. Gas trading includes the gas, foreign exchange, community choice aggregations, renewable energy credits, gas scheduling, volume actualization, etc. Once Phase 1 is live, physical and financial trades will be fed back into Nucleus to support credit functionality. This may be accomplished via a direct interface between the new CTRM solution and Nucleus, or the solution may leverage the data lake. Detailed processes will be designed and confirmed during the design portion of Phase 1.

As part of phase one gas implementation the downstream invoicing and EBS integrations will be delivered as well. Risk will have the option to utilize the gas functionality from the new system or continue leveraging existing spreadsheets. Should the risk group decide to stay on existing spreadsheets, necessary data would be fed from the new CTRM system to Nucleus. From the credit perspective, Phase 1 Gas also consists of the gas confirms.

Regardless of the decision by the risk team to either use Gas Risk monitoring and reporting from the new system or Nucleus once Phase 1 is live, daily processing will need to be performed in both the new system and in Nucleus. This will ensure each system functions as expected.

6.2.3 Overview: Phase 2 – Power

Phase 2 implements all Power functionality and the remaining functionality for the overall new CTRM solution.

All of Power will be implemented in Phase 2. This includes physical and financial deals, ICE and bilateral trades, PPAs, etc. The new CTRM system will be used for front office trading, middle office risk and credit management, and back-office invoicing. Beyond the core CTRM system, other changes will be required. MRTU Settlements, which is currently performed in Nucleus will be transitioned to a separate application, possibly to PCI's Energy Accounting software package. The PCI Energy Accounting software package was successfully implemented during the EIM project. There may likely be other software package that could suffice as well for this functionality.

Phase 2 also includes the remaining gas risk functionality and all credit functionality. Due to credit processing activities, credit must be performed in Nucleus until it is fully functioning in the new system (once Phase 2 is live). Credit limits, credit reports, etc. will all be implemented in the new system in Phase 2. Most CTRM solutions provide Value at Risk (VaR) in one form or another (or all). This capability is in-scope for configuration, review and determination of replacement of Avista's current Excel-based VaR solution.

System Operations will also transition during Phase 2. This includes activities such as interchange metering, primary inadvertent calculations, and data exchange with WECC's WIT (Western Interchange Tool). Some custom coding will be required here as Avista is performing calculations to provide primary inadvertent to WECC in a manner that is completely unique to Avista. The solution will leverage the overall Nucleus design, although data will source differently, and interfaces will be different. Specific design sessions will be required to determine the best system in which to implement this functionality. During these planning and design sessions, it will also be determined who is best to build this portion of the solution – vendor resoruces, Utilicast resources, or Avista personnel. Given that the process is unique to Avista, it may be best for Avista tech resources to build it.

From an invoicing perspective, Phase 2 will see power and transmission invoicing implemented in the new CTRM solution. The interface to EBS will be updated as necessary to provide power and transmission data to EBS as well.

6.2.4 Planned Key Activities

Key activities in each phase are highlighted below. These will be confirmed once a vendor is selected, as vendors may handle implementation a bit differently and some vendors may require more/less configuration and/or more/less development. While split separately in the schedule / project timeline; design, build, and test processes are included in the review of each key activity below. Again, these must be reconfirmed once a vendor is selected.

6.2.4.1 Phase 1 Key Activities:

- Modeling and importing of counterparties
    - Counterparties with whom Avista trades and interacts must be entered into the new CTRM solution. This is part of general prep work and will be executed very quickly after the core solution is made available to Avista
    - Key Objectives: Avista's trading counterparties (gas and power) are configured in the new CTRM solution
- Modeling contracts
    - Avista's contacts must also be entered into the new CTRM solution. Again, this is part of general prep work and will also be done early in the implementation.
    - Key Objectives: Avista's gas physical, financial, transportation and storage contracts are configured in the new CTRM solution
- Modeling forward price curves
    - Forward price curves will be configured for natural gas, RECs, carbon credits, interest rates and FX
    - Key Objectives: Avista's gas physical, financial, RECs, carbon, interest rates and FX prices are configured for valuation in the new CTRM solution
- Physical Gas Delivery Structure
    - This consists of gas pipeline and storage facility location data that is static. This includes data points such as pipelines, zones, locations and related data, etc.
    - Key Objectives: CTRM solution has "base", relatively static power-related data designed, configured, and entered – setting the stage for broader solution implementation
- Gas Financial Deals (ICE Futures, Swaps, Basis Swaps, Options)
    - Gas financial deals and deal templates will be configured in the new CTRM solution.
    - Key Objectives: All gas financial deal templates are configured in the new CTRM solution and the system can appropriately process gas financial deals
- Bilateral and ICE Gas Physical Deals
    - Along with financial deals, bilateral and ICE Gas physical deals and deal templates will be configured in the new CTRM solution.
    - Key Objectives: All gas bilateral and ICE physical deal templates are configured in the new CTRM solution, and the system can appropriately process these deal types

- Gas Transportation and Storage Deals
  - Gas transportation and storage deals, including pipelines and storage rate schedules, utilized by Avista will be configured in the new CTRM solution
  - Key Objectives: Gas pipelines, storage facilities, and associated configuration elements are configured in the system and provide deal modeling for position, valuation, and settlement capabilities for successful use of the system
- Renewable Energy Credits (RECs), Carbon, Foreign Exchange, Fees, etc.
  - Renewable energy credits, carbon credit trades, interest rates and foreign exchange deal entry capability will be configured in the new CTRM solution
  - Key Objectives: These various commodity types and associated fees, etc. are configured in the new CTRM solution
- Gas Scheduling
  - The gas scheduling module will be configured for capture of nominations, pipeline estimates and rate schedules for transportation and storage
  - Key Objectives: Accurate and effective review of integrated nominations and/or manually input nomination, estimates and scheduled quantities are available
- Gas Volume Actualization
  - Actual volume import via EDI (NWPL) and/or Excel (GTN and lateral pipes configured) will be enabled
  - Key Objectives: like-for-like functionality promoting ease-of-transition
- End of Day Processing
  - End-of-day processing is critical CTRM functionality. Phase 1 will see this functionality implemented for the Phase 1 commodity types including:
    - Import of forward market and settlement prices
    - End-of-day export to various required ecosystems
    - Consideration of end-of-day export to Avista data warehouse (an assumption of this proposal's cost estimation)
    - "Roll the system date(s)" per CTRM functionality for shifting the system date to the next qualifying business day
  - Key Objectives: End-of-day processing for Gas is configured and can be executed daily. Phase 2 will introduce the remaining components of end-of-day processing. End-of-day processing in both the new CTRM solution and in Nucleus should be executed each day once Phase 1 is live.
- End of Day Daily Reporting
  - End-of-day daily reporting will be configured in Phase 1. During the design phase, Avista will determine whether to utilize this functionality fully, once Phase 1 is live, or wait until Phase 2 is live. Consideration for utilization of both the selected CTRM's standard reports (with required changes to support Avista reporting requirements) and/or data exported to the Avista data warehouse.

  - Key Objectives: End-of-day reporting is configured in the new CTRM solution, regardless of if Avista decides to use it immediately following Phase 1 go-live. Once Phase 2 is live, end-of-day daily reporting will source from the new CTRM solution and/or the Avista data warehouse.
- Invoicing Templates
  - All CTRM systems have standard invoice templates that can be configured. This allows Avista to customize the invoice as desired and yet still have it generate from the CTRM solution itself. Formatting in excel spreadsheets, etc. will no longer be required.
  - Key Objectives: Invoice templates are configured appropriately in the new CTRM solution
- Gas Interfaces
  - As discussed elsewhere in this document, interfaces to/from the new CTRM solution will seek to capitalize on several Avista technology team advantages. MuleSoft will be leveraged where practicable to manage data feeds in/out of the solution. Where standard CTRM vendor supported interfaces exist, Avista will look to leverage those.
  - Key Objectives: Interfaces to/from the new CTRM solution to the various ancillary systems and other systems are successfully implemented and pass previously identified testing criteria
- Data Conversion
  - Nucleus is the data store for a significant amount of data that flows into and through the application. This historical data must be retained and available for retrieval and regulatory/legal reporting. Some data must be converted in such a manner as to be accessible by end-users in the new CTRM solution once live. Specific details and requirements will be defined in overall data conversion planning activities. Data will then be converted in each phase as necessary and as designed during initial planning.
  - Key Objectives: Phase 1 data is identified and converted per plans that have been defined in prior data conversion planning phases. The specifics of the data conversion approach will be determined during planning periods.
- System Testing
  - This phase of testing verifies that the functional and non-functional requirements have been met for each component of the new CTRM solution. Once this phase has been successfully completed, components of the new CTRM solution can move to Integration Testing.
  - Key Objectives: Functional and non-functional requirements are verified and have passed predetermined criteria, as defined in test preparation phases
- Integration Testing

  - This phase allows testing of the various system components ability to appropriately communicate and pass data between each other. Interfaces are tested in an integrated environment in this phase. Phase 2 will see testing of the phase 2 specific interfaces as well as any from Phase 1 that are deemed in test planning as required for retest. Successful completion of this phase is critical before downstream testing activities (such as Performance Testing, Disaster Recovery Testing, User Acceptance Testing, Day-in-the-Life Testing, and Parallel Operations) can be executed.
  - Key Objectives: Interfaces within and between applications in the new CTRM solution are successfully verified, passing previously identified testing criteria.
- Performance Testing
  - Depending on the vendor that Avista selects for the new CTRM solution, this phase may be of more or less value to Avista. If the solution is hosted and can be easily expanded by the vendor, performance testing may be less of a concern. However, if that is not the case, or if Avista anticipates significant expansion of trading activities, this may be more critical. Regardless, details of this phase of testing will be defined in test planning phases.
  - Key Objectives: The new CTRM solution meets or exceeds performance requirements that were previously identified in test planning phases.
- Disaster Recovery Testing
  - Successful execution of Business Continuity and Disaster Recovery (BCDR) plans is critical for any system, especially during the implementation of new system. This phase allows Avista to prove the business can continue to successfully operate in the event of a disaster, and it proves that Avista can restore the CTRM solution within the allowable and predetermined timelines.
  - Key Objectives: The Business Continuity and Disaster Recovery plans are successfully executed and pass BCDR test criteria that were identified in previous BCDR test planning phases.
- User Acceptance Testing
  - This phase is Avista's opportunity to formally "accept" the new CTRM solution. It consists of executing detailed scripts as well as one-off testing of the system. The timeline of User Acceptance Testing is planned to overlap with Day-in-the-Life Testing, as many of the activities required by one are also performed in execution of the other.
  - Key Objectives: End-user acceptance test criteria are successfully executed. As with other test criteria, these will be defined in test planning efforts.
- Day-in-the-Life (DITL) Testing
  - This phase of testing is the main opportunity to test the CTRM solution and associated business processes. Day-in-the-Life testing ensures end-to-end coverage of trade-to-cash activities including integration touchpoint verification

and key reports, confirms, invoices, and other activities providing insight into what a typical day will be like, once the new CTRM solution is live. Specific details of what will be tested will be defined in test planning phases. Successful execution of day-in-the-life testing will provide Avista personnel confidence in both the technical functioning of the new CTRM solution as well as the associated business processes.

- Key Objectives: The new CTRM solution and associated business processes pass previously identified Day-in-the-Life test criteria and Avista is able to execute to or exceed the DITL test criteria.

- Deployment Testing
  - This phase is Avista's opportunity to test the cutover activities from Nucleus to the new CTRM solution. It is critical these activities are executed successfully and smoothly, as any issue could delay the project go-live timeline. This testing requires multiple executions as the first few are likely to uncover issues and defects.
  - Key Objectives: Prove the new CTRM solution can be effectively deployed, including the core system and any ancillary systems, data feeds, etc.
- Parallel Operations
  - Parallel Operations is the final opportunity to test the system, business processes, and organizational preparedness, before the solution becomes live and financially binding. The specific details of parallel operations will be defined in test planning phases, as Avista may choose to perform more or fewer activities in true "parallel", due to a variety of factors.
  - Key Objectives: The new CTRM solution effectively passes the previously identified Parallel Operations test criteria and the organization is ready for the solution to be implemented into Production.
- Vendor Training
  - The selected CTRM vendor will provide initial training to both business and technical project team subject-matter-experts early in the engagement. Also included in that training will be the initial trainers that will provide training to the broader Avista user audience – whether they be SMEs or more dedicated training resources. This training will set the stage for initial design activities.
  - Key Objectives: SMEs and future trainers gain an understanding of the system with enough clarity to begin design activities.
- End-user Training
  - The selected project team subject-matter experts and/or designated trainers will provide CTRM solution training to both Avista business and technical subject-matter-experts prior to User Acceptance and other subsequent testing.
  - Key Objectives: End-users gain an understanding of the system with enough clarity to begin User Acceptance Testing and subsequent testing and deployment activities.

6.2.4.2 Phase 2 Key Activities:

- Counterparty validation
  - During Phase 2, any counterparties that were not previously entered will be entered and configured into the system. In addition, a revalidation of the existing counterparties will be executed.
  - Key Objectives: Confirm counterparties are successfully configured in the new CTRM solution
- Contract validation
  - During Phase 2, any contracts that were not previously entered will be entered and configured into the system. In addition, a revalidation of the existing contracts will be executed.
  - Key Objectives: Confirm contracts are successfully configured in the new CTRM solution
- Modeling forward price curves
  - Forward price curves will be configured for power
  - Key Objectives: Avista's power prices are configured for valuation in the new CTRM solution
- Credit Limits and Margining Process
  - The CTRM's Credit component will be configured with counterparty limit by exposure type. The margin process (calls, letters, etc.) will be configured with a goal of better automating the margin process.
  - Key Objectives: Credit limits are fully configured in the new CTRM solution for all Phase 1 and 2 commodities.
- Credit Exposure
  - The CTRM's Credit component will be configured with both MTM Exposure and Term limits per Avista current credit functionality, with a goal of real-time limit checks for both exposure and term limits.
  - Key Objectives: The new CTRM solution can effectively calculate credit exposure and make that available as desired to Avista personnel
- Credit Reporting
  - Required credit reports will be developed from CTRM vendor standard reports and/or anew to ensure like-for-like key credit reports are available.
  - Key Objectives: Necessary credit reports are configured in the system and appropriate users are able to access them as necessary.
- Physical Power Delivery Structure
  - This consists of power transmission line location and meter data, including control areas, locations, and other required data.

  - Key Objectives: CTRM solution has “base”, relatively static power-related data designed, configured, and entered – setting the stage for broader solution implementation
- Physical and Financial ICE Deals for Power
  - Both physical and financial power deals done on the Intercontinental Exchange (ICE). These will be programmatically fed from ICE.
  - Key Objectives: New CTRM solution is configured to handle Physical and Financial ICE deals
- Bilateral Power Physical and Financial Deals
  - Any physical and financial power deals that are done bilaterally and not on an exchange.
  - Key Objectives: Bilateral Power Physical and Financial deals and deal templates are appropriately configured in the new CTRM soluti0on
- Power Purchase Agreements (LT PPAs, QFs, etc.)
  - The new CTRM solution will support a variety of power purchase agreements. These will be designed, configured, and tested during Phase 2.
  - Key Objectives: Power Purchase agreements including long-term agreements, qualified facilities, solar agreements, etc., are configured appropriately in the new CTRM solution
- End of Day Processing
  - Components of end-of-day processing will already exist from the implementation of Phase 1. This adds to Power physical and financial trades, and Transmission activities, to those processes.
  - Key Objectives: End-of-day processing for the remainder of the solution is configured and can be executed daily. End-of-day processing in both the new CTRM solution and in Nucleus should be executed each day once Phase 1 is live. Once Phase 2 is live, end-of-day processing in Nucleus can be discontinued.
- End of Day Reporting
  - Similar to end-of-day processing, components of end-of-day reporting will already exist from the implementation of Phase 1. This adds to Power and Transmission activities to those processes.
  - Key Objectives: All end-of-day reporting is configured in the new CTRM solution, regardless of if Avista decided used any of the functionality immediately following Phase 1 go-live.
- Position Reporting
  - Position reporting is highly configurable within CTRM systems, as clients typically have specific nuances for how they prefer to view and report on current positioning. Avista’s position reports will be evaluated against standard vendor functionality and remediated for use in the new system.

  - Key Objectives: Position reporting is fully configured as described in the new CTRM solution. Reports are published as identified in requirements.
- Credit Limit Management
  - Credit limits for power trades will be added in Phase 2 to those that were established for Gas in Phase 1. At the completion of Phase 2, all credit limits will source from the new CTRM solution.
  - Key Objectives: Credit limits have been established in the new CTRM solution per design.
- Risk Limit Management
  - Risk limit management is frequently a capability of CTRM vendor offerings, and this component will be evaluated for replacement of Avista's Excel-based solution for both gas and power trades in Phase 2.
  - Key Objectives: Risk limits may be established in the new CTRM solution per design.
- Financial Reporting
  - Power and Transmission will be added to the financial reporting created in Phase 1. At the completion of Phase 2, all financial reporting will source from the new CTRM solution. The new CTRM solution will feed EBS and will also have configurable financial reporting capabilities. Nevertheless, Avista will have the option to keep financial reporting spreadsheets if desired, with them sourcing from the new CTRM solution and/or the data lake.
  - Key Objectives: Financial reporting is supported by the new CTRM solution, including feeding EBS and, possibly, spreadsheets, as identified by Avista in the requirements documentation
- Check-Out Processes
  - Check-out processing is currently executed by the resource accounting group, front-office power, and front-office gas. These processes will be candidates for redesign, as the new CTRM solution should offer improved methods. Phase 2 will complete the checkout processing.
  - Key Objectives: Check-out processes have been fully designed, implemented, and tested in the new CTRM solution and successfully leverage other technology (email, etc.) as necessary to complete business processing
- Settlements and Invoicing
  - CAISO MRTU Settlements will transition from Nucleus to another provider, likely PCI, as PCI is the current solution for managing MRTU trades. While that is likely the most straightforward and easiest solution to implement, there are other options and they may be worth considering. Power Settlements was implemented successfully with the CAISO EIM program, yet due to upstream processing factors, it may be easier to transition MRTU settlements to PCI.

  - Key Objectives: Avista's MRTU business settlements is transitioned to appropriate application identified in the broader CTRM solution (perhaps PCI since they handle upstream MRTU business currently, perhaps elsewhere).
- Power Invoice Templates
  - All CTRM systems have standard invoice templates that can be configured. This allows Avista to customize the invoice as desired and yet still have it generate from the CTRM solution itself. Formatting in excel spreadsheets, etc. will no longer be required.
  - Key Objectives: Power and Transmission invoice templates are configured in the new CTRM solution and generate appropriate power and transmission interfaces
- System Operations Functions
  - System Operations has several functions that rely upon or are executed within Nucleus, specifically: interchange metering, primary inadvertent management, time error correction, generation metering, dynamic schedule updates, and tag calculations. While all of this functionality will transfer from Nucleus, some will end up in the new CTRM core system, while other functionality will end up in other ancillary systems. For example, the management of primary inadvertent interchange is likely to be implemented in PCI's Energy Accounting system, regardless of the overall CTRM core system vendor selection. PCI's Energy Accounting system was successfully implemented during the EIM implementation and can handle much of the required functionality. These decisions will be finalized during system operations planning and design efforts.
  - Key Objectives: Transfer System Operations functionality from Nucleus to the new CTRM solution and other associated-ancillary systems.
- Remaining Interfaces
  - As discussed elsewhere in this document, interfaces to/from the new CTRM solution will seek to capitalize on several advantages. MuleSoft will be leveraged where practicable to manage data feeds in/out of the solution. Where standard CTRM vendor supported interfaces exist, Avista will look to leverage those.
  - Key Objectives: Interfaces to/from the new CTRM solution to the various ancillary systems and other systems are successfully implemented and pass previously identified testing criteria
- Data Conversion
  - Nucleus is the data store for a significant amount of data that flows into and through the application. Not only must this historical data find a home, but it must be converted in such a manner as to be accessible by end-users once the new CTRM solution is live. Specific details and requirements will be defined in overall data conversion planning activities. Data will then be converted in each phase as necessary and as designed during initial planning.

  - Key Objectives: Phase 2 data is identified and converted per plans that have been defined in prior data conversion planning phases.
- System Testing
  - This phase of testing verifies that the functional and non-functional requirements have been met for each component of the new CTRM solution. Once this phase has been successfully completed, components of the new CTRM solution can move to Integration Testing.
  - Key Objectives: Functional and non-functional requirements are verified and have passed predetermined criteria, as defined in test preparation phases
- Integration Testing
  - This phase allows testing of the various system components ability to appropriately communicate and pass data between each other. Interfaces are tested in an integrated environment in this phase. Phase 2 will see testing of the phase 2 specific interfaces as well as any from Phase 1 that are deemed in test planning as required for retest. Successful completion of this phase is critical before downstream testing activities (such as Performance Testing, Disaster Recovery Testing, User Acceptance Testing, Day-in-the-Life Testing, and Parallel Operations) can be executed.
  - Key Objectives: Interfaces within and between applications in the new CTRM solution are successfully verified, passing previously identified testing criteria.
- Performance Testing
  - Depending on the vendor that Avista selects for the new CTRM solution, this phase may be of more or less value to Avista. If the solution is hosted and can be easily expanded by the vendor, performance testing may be less of a concern. However, if that is not the case, or if Avista anticipates significant expansion of trading activities, this may be more critical. Regardless, details of this phase of testing will be defined in test planning phases.
  - Key Objectives: The new CTRM solution meets or exceeds performance requirements that were previously identified in test planning phases.
- Disaster Recovery Testing
  - Successful execution of Business Continuity and Disaster Recovery (BCDR) plans is critical for any system, especially during the implementation of new system. This phase allows Avista to prove the business can continue to successfully operate in the event of a disaster, and it proves that Avista can restore the CTRM solution within the allowable and predetermined timelines.
  - Key Objectives: The Business Continuity and Disaster Recovery plans are successfully executed and pass BCDR test criteria that were identified in previous BCDR test planning phases.
- User Acceptance Testing

- This phase is Avista's opportunity to formally "accept" the new CTRM solution. It consists of executing detailed scripts as well as one-off testing of the system. The timeline of User Acceptance Testing is planned to overlap with Day-in-the-Life Testing, as many of the activities required by one are also performed in execution of the other.
- Key Objectives: End-user acceptance test criteria are successfully executed. As with other test criteria, these will be defined in test planning efforts.

- Day-in-the-Life Testing
  - This phase of testing is the main opportunity to test the CTRM solution and associated business processes. Day-in-the-Life testing ensures end-to-end coverage of trade-to-cash activities including integration touchpoint verification and key reports, confirms, invoices, and other activities providing insight into what a typical day will be like, once the new CTRM solution is live. Specific details of what will be tested will be defined in test planning phases. Successful execution of day-in-the-life testing will provide Avista personnel confidence in both the technical functioning of the new CTRM solution as well as the associated business processes.
  - Key Objectives: The new CTRM solution and associated business processes pass previously identified Day-in-the-Life test criteria and Avista is able to execute to or exceed the DITL test criteria.
- Deployment Testing
  - This phase is Avista's opportunity to test the cutover activities from Nucleus to the new CTRM solution. It is critical these activities are executed successfully and smoothly, as any issue could delay the project go-live timeline. This testing requires multiple executions as the first few are likely to uncover issues and defects.
  - Key Objectives: Prove the new CTRM solution can be effectively deployed, including the core system and any ancillary systems, data feeds, etc.
- Parallel Operations
  - Parallel Operations is the final opportunity to test the system, business processes, and organizational preparedness, before the solution becomes live and financially binding. The specific details of parallel operations will be defined in test planning phases, as Avista may choose to perform more or fewer activities in true "parallel", due to a variety of factors.
  - Key Objectives: The new CTRM solution effectively passes the previously identified Parallel Operations test criteria and the organization is ready for the solution to be implemented into Production.
- Vendor Training
  - The selected CTRM vendor will provide initial training to both business and technical subject-matter-experts early in the engagement. Also included in that training will be the initial trainers that will provide training to the broader Avista

user audience – whether they be SMEs or more dedicated training resources. This training will set the stage for initial design activities.

- Key Objectives: SMEs and future trainers gain an understanding of the system with enough clarity to begin design activities.

7. POTENTIAL TIMELINE

This assessment presents two possible timelines for Avista's consideration. The activities performed within each are largely the same, with the main difference between the two timelines being the start date of phase 2. Both of these timelines are vendor-agnostic.

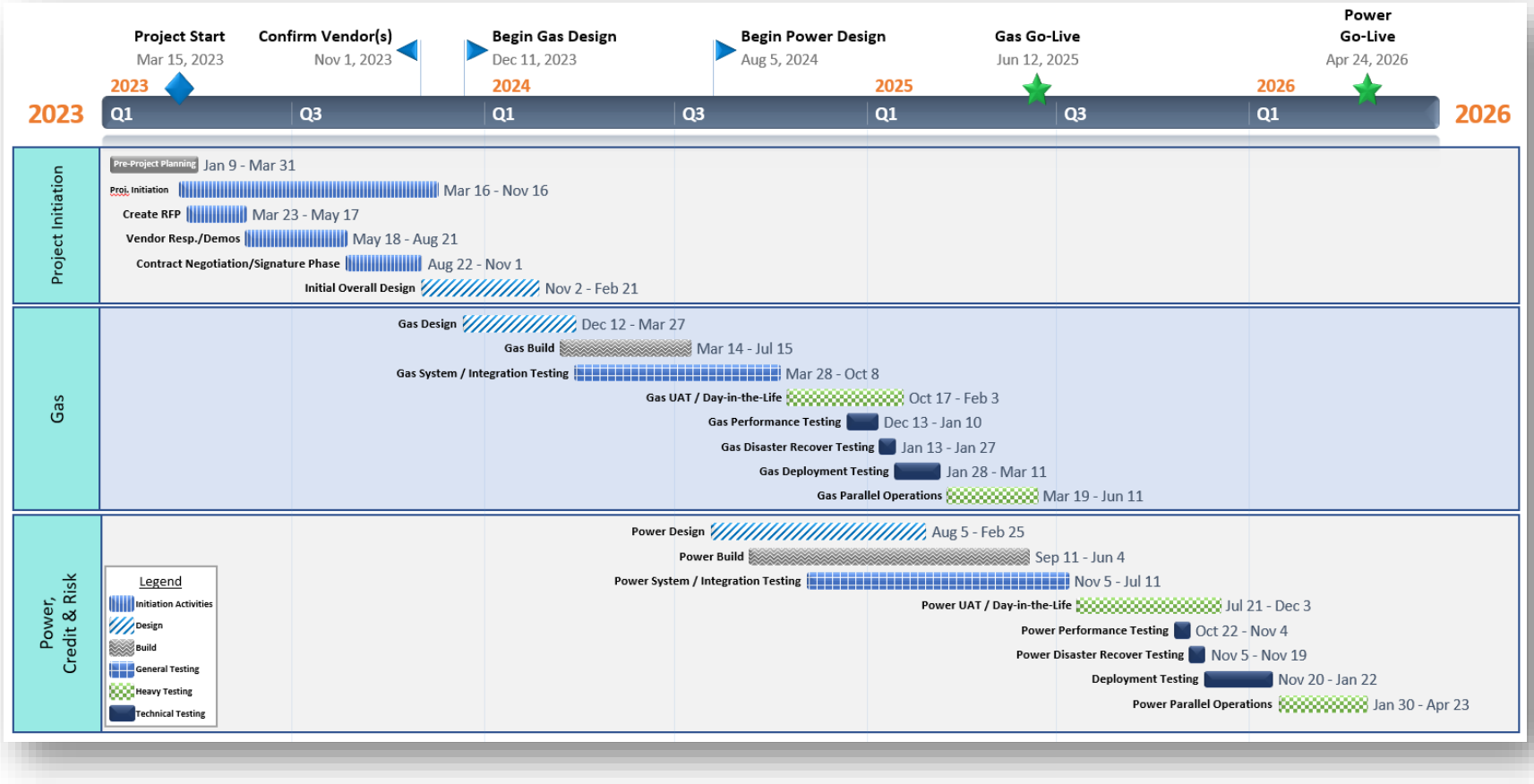
The first timeline overlaps the Phase 2 Power activities with the completion of Phase 1 Gas activities. The second timeline shows Phase 2 beginning sequentially, after Phase 1 is complete and live. Each timeline has benefits and potential drawbacks, which are discussed in this document.

Although this timeline is vendor agnostic, it should be reviewed and confirmed / updated once a vendor selection has been made by Avista. Vendors have differing processes, capabilities, staffing, and preferences that are likely to influence the schedule.

The overlapping timeline shows completion in roughly three years. The sequential timeline shows completion in roughly four years. It is quite possible both timelines could be shortened somewhat, depending on variety of factors, such as: resource availability, RFP process execution, vendor configuration vs. build requirements, etc. Again, these should be revisited once a vendor has been selected.

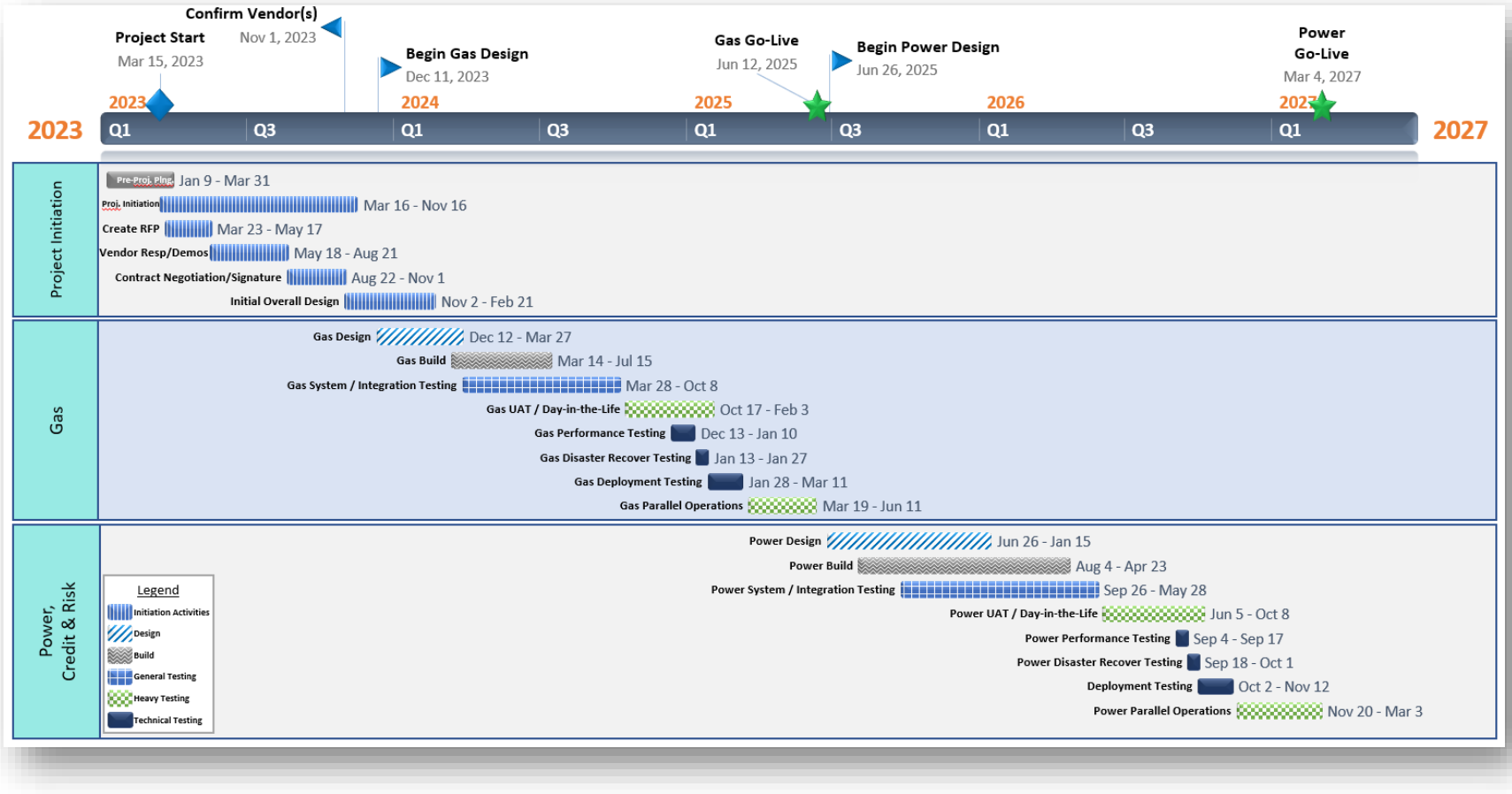
Of note the dates shown are representative of a Mid-March 2023 start date. As of this writing, this date is for representative purposes only. Avista has not made any decision regarding any potential next steps. However, should a decision be made, the schedule can generally be shifted to accommodate the appropriate start-up date. Also of note, the program would not take Phase 1 or Phase 2 live mid-month (e.g., Gas Go-Live showing June 12, 2025). This date is a result of project planning, without adding padding/adjustments for the projected mid-month go-live. Given the general planning nature of this plan and the fact it must be reviewed/updated once a vendor is selected, shifting the date to be start/end of month is of little value.

7.1 Overlapping Timeline



The timeline above is the "Overlapping" version, which shows Phase 2 activities beginning while Phase 1 activities are still in progress. As mentioned, the "Key Activities" defined elsewhere in this document are split into Design, Build, and Test phases as shown in the timeline.

7.2 Sequential Timeline



The timeline above is the "Sequential" version, which shows Phase 2 activities beginning after Phase 1 activities are complete and Phase 1 is live.

The phase contents and structure are the same between the two timelines – again, with the major difference being that Phase 2 does not begin until Phase 1 is live. As mentioned, the "Key Activities" defined elsewhere in this document are split into Design, Build, and Test phases as shown in the timeline.

7.3 Timeline Details

Both timelines are broken into three main swim lanes. The first being "Project Initiation", then "Gas", the "Power, Credit & Risk". The following section briefly reviews these swim lanes and the activities within.

7.3.1 Project Initiation

Project initiation consists of typical project launch activities, as well as activities specific to the project. Pre-Project planning includes tasks such as gaining approvals for the project and procuring overall system integrator services. This period may stretch, depending on Avista's prioritization of the program and preferred timeline. Vendor identification and the vendor selection process (including creation of a Request for Proposal (RFP), vendor responses and demonstrations, as well as contact negotiation) are included in this phase. The vendor selection and contract negotiation process may likely be able to be completed in less time, but the process can be complex and involved.

Initial overall design activities are also in the Project Initiation swim lane. This includes activities such as: identification of core project team and project charter creation. Higher-level major design activities such as book structure layout, initial trade modeling, environment planning, overall interface planning, broad data conversion process planning, and overall test planning are also included in these phases. While more details of each of these activities will be identified and documented in detailed design sessions, this overall project initiation design will set the path forward.

7.3.2 Phase 1 (Gas) and Phase 2 (Power, Credit & Risk)

The components of the swim lanes are reviewed in more detail in other sections of this document (see the "Planned Key Activities" section). For each of the functional items listed in "Key Activities", design, build, and test phases occur. These are represented in the timelines shows.

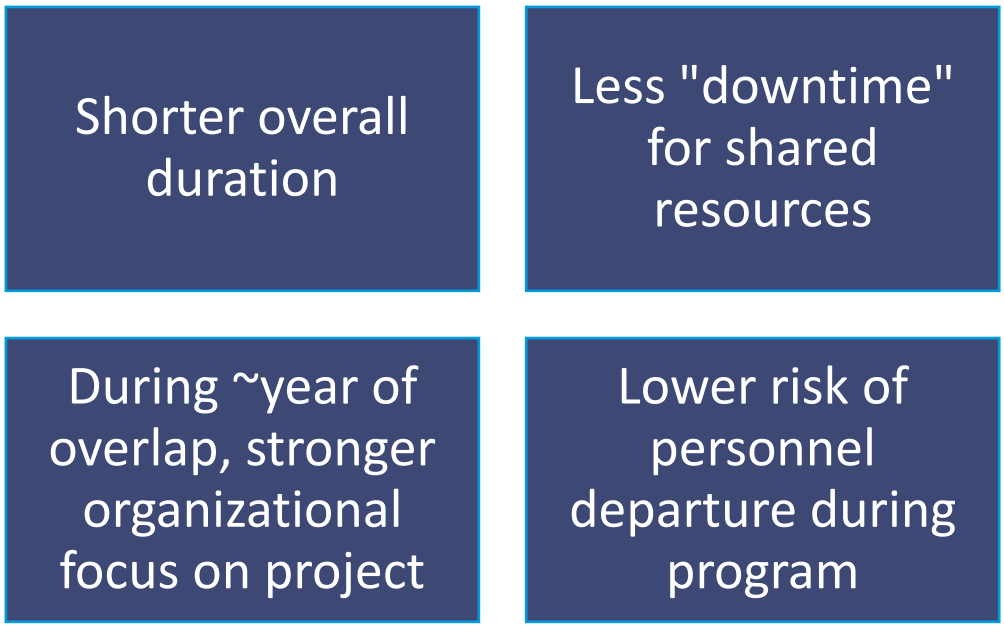
The Design and Build stages consist of the design/build activities of those Key Activities listed elsewhere in this document. For the sake of brevity, those activities are not listed again here. Please see that section for more details of what those activities involve. Worthy of note is that much of the "build" phase is technically configuration of the core application within the CTRM solution.

The testing phases are also defined elsewhere in this document. Each testing phase will have its own governing document that defines the phase, entry/exit criteria, test case/script management, and defect management. All of these items will be established in test planning efforts for each respective phase.

7.4 Timeline Benefits and Risks

There are benefits and drawbacks to both the overlapping timeline and the sequential timeline. This section reviews some of those benefits and drawbacks.

7.4.1 Benefits of Overlapping Phase 1 and Phase 2:



7.4.1.1 Shorter Overall Duration

A shorter overall duration of the project can be beneficial by allowing the organization to focus on program implementation for a shorter period of time. More focused time may be required of organizational resources, yet the ability to complete the project sooner may allow Avista to move on to other projects more swiftly and reap the benefit of the new CTRM capabilities.

7.4.1.2 Less Downtime for Shared Resources

Shared resources include personnel such as developers / enterprise technology personnel, and mid/back-office SMEs (e.g., resource accounting, credit, risk). In the case of running the project in an overlapping manner, these resoruces have less non-project time in between phases. For example, the schedule has developers completing gas development and then within a few short weeks, beginning power development. This keeps the development team focused and moving forward on the program. It allows skills that were developed during the gas build phase to be honed by the rather immediate start of power development. Similarly, mid/back-office SMEs have the benefit to move from Gas design into Power design and a minimal amount of delay. Again, skills developed during system and process design of Gas can be further honed during the Phase 2 of the project, with an overlapping schedule.

7.4.1.3 Organizational Focus

Executing the project in an overlapping manner may be suited for Avista, if the program can be the main project-of-focus for the organization. A dedicated focus to success across the organization will help keep morale up and help make priorities clear to personnel. This stronger organizational focus and drive engagement and help the project be successful.

7.4.1.4 Personnel Risk

As identified in the risks section of this report, Avista has multiple resources that have reached or will soon reach retirement eligibility. Executing the project in an overlapping manner reduces the potential impact of retirements. It is also possible some personnel that are borderline at retirement may choose to stay on at Avista to see the project through to completion.

7.4.2 Risks of Overlapping Phase 1 and Phase 2:

7.4.2.1 Organizational Workload

Unfortunately, there are risks with a executing the program in an overlapping manner. Perhaps foremost is the increased workload on the organization. Personnel will be stretched during the overlapping period (roughly a full year). Further, should there be competing major programs, resoruces may be unable to perform fully for both programs, thereby potentially creating broad program risk. This risk should be explored and, if not mitigated, at least acknowledged during program initiation.

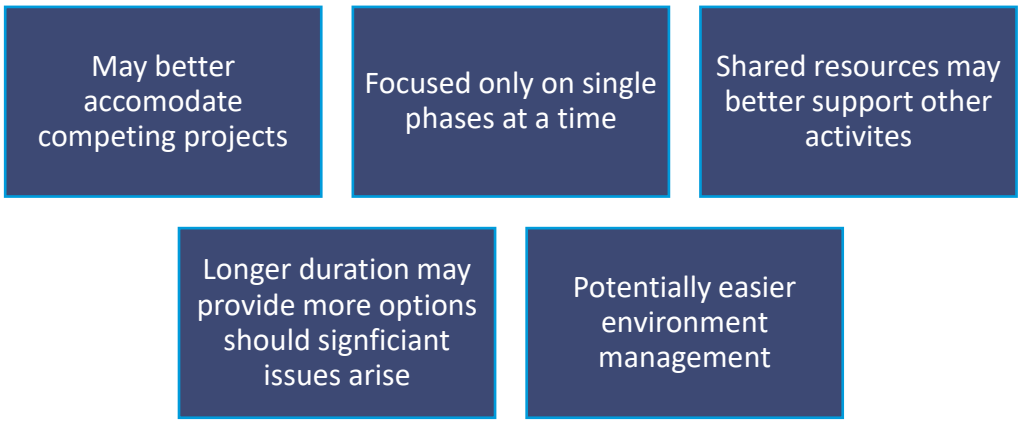
7.4.2.2 Less Flexibility

Running the program in an overlapping manner may also provide less schedule flexibility, should significant issues arise during the program. By running in an overlapping manner, there are simply fewer calendar dates to accommodate any schedule slippage. Moreover, the dates that do exist may already be at or very near capacity – again limiting any schedule flexibility, without putting the final project end date in jeopardy.

7.4.2.3 Environment Management

Running the program in an overlapping manner at a minimum requires more environment management and may require additional environments. These details should be explored during vendor selection processes and confirmed once a vendor is selected. Depending on the vendor selected, creating/supporting additional environments may be more or less of a burden to Avista.

7.4.3 Benefits of Sequential Phase 1 and Phase 2:



Rather than executing the project in an overlapping manner, Avista may consider running the program phases sequentially. Running the program sequentially will have Phase 1 Gas completing and virtually being fully live before Phase 2 Power activities commence. Benefits and risks of this approach are detailed below.

7.4.3.1 Competing Projects

It is possible that Avista may have competing projects occurring during the same timeframe (e.g., ADMS, perhaps others). Other projects competing for critical Avista resources may create staffing and scheduling issues for the program. Thus, by running the program sequentially, Avista can space that staffing need across a longer time period and perhaps support multiple major capital efforts. These potential constraints should be explored in initial planning and vendor selection. Resource constraints may cause issues that cascade through the project schedule – and perhaps through the competing project(s) schedules.

7.4.3.2 Single Phase Focus and Shared Resources

By running the project sequentially, many resources can focus on a single program activity at a time. SMEs involved in testing will not also find themselves completing for time in design efforts. This is most likely to impact shared resources such as enterprise technology, mid/back-office SMEs, since front office power and trading resources are generally different personnel.

7.4.3.3 More Time to React

Running the program phases sequentially may also provide Avista more time to react, sh9ould significant issues arise. By not having multiple activities stacked, resources may have more flexibility and time to commit to resolving unexpected issues – unless those resources are otherwise "stacked" by commitments to other projects. Thus, this potential longer time frame may provide more flexibility, or it may create the illusion of more flexibility, but in fact may not provide those potential benefits.

7.4.3.4 Environment management

Environment management will, generally, be less complex with sequential program execution, compared to overlapping execution. For example, with build and test activities not overlapping, integrated environments can be committed to one or the other, with minimal concern for conflicts with other program activities.

7.4.4 Risk of Sequential Phase 1 and Phase 2:

7.4.4.1 Longer Duration

The most significant downside risk to the sequential phasing of the project is the longer overall duration. Costs are likely to be higher. Personnel may tire of a multi-year program. Morale may suffer as the broader organization may feel as if they are always "stuck in project mode".

8. POTENTIAL BUDGET

The overall program budget is expected to range between $21.5 million and $26.4 million. This budget is based on a combination of Utilicast expertise, an understanding of Avista's business, and other factors.

The sections below represent various low-vs.-high budget estimates for the duration of the project. In some cases, the estimates are quite similar, in others, some difference exists.

This is due to Utilicast experience with prior projects, different vendor profiles (functionality, configurability, vendor approach to implementation, integration API availability, standard reports, etc.), and Avista required functionality. Multiple assumptions are outlined later in this section.

8.1 Program Total Budget

Program Totals		
Totals	**Low**	**High**
Labor - CapEx	$ 15.5 M	$ 18.8 M
Labor - OpEx	$ 1.6 M	$ 1.8 M
Travel (8% avg.)	$ 1.5 M	$ 1.5 M
Licenses	$ 3.0 M	$ 4.2 M
Total	$ 21.5 M	$ 26.3 M

The table above shows estimated high and low overall program costs, split by labor capital vs labor operating expense, travel, and software licenses. The following sections and tables break the costs into other views. The view below shows the estimated implementation cost range split by entity and type.

	Implementation					
	Capital		O&M		Totals	
	Low	High	Low	High	Low	High
Avista - Labor	$ 4.3 M	$ 5.1 M	$ 0.4 M	$ 0.5 M	$ 4.6 M	$ 5.6 M
Sys Integrator - Labor / Travel	$ 8.3 M	$ 9.1 M	$ 0.9 M	$ 1.0 M	$ 9.2 M	$ 10.1 M
Vendor - Labor / Travel	$ 4.6 M	$ 6.3 M	$ 0.1 M	$ 0.1 M	$ 4.7 M	$ 6.5 M
Licensing	$ 3.0 M	$ 4.2 M	$ -	$ -	$ 3.0 M	$ 4.2 M
Totals	**$ 20.2 M**	**$ 24.7 M**	**$ 1.4 M**	**$ 1.7 M**	**$ 21.5 M**	**$ 26.3 M**
	Low	High	Low	High	Low	High

8.2 Program Labor by Year

Labor is the largest single cost in the program. The tables below show labor cost by year, by entity, and by capital vs. operating expense type.

Low - Labor by Year					
	Year 1	Year 2	Year 3	Year 4	Total
Avista					
Labor - CapEx	$0.40 M	$1.18 M	$1.57 M	$1.08 M	**$4.23 M**
Labor - OpEx	$0.34 M	$0.00 M	$0.08 M	$0.00 M	**$0.42 M**
Sys Integrator					
Labor - CapEx	$0.83 M	$2.03 M	$2.53 M	$1.79 M	**$7.17 M**
Labor - OpEx	$0.84 M	$0.00 M	$0.17 M	$0.00 M	**$1.00 M**
Vendor					
Labor - CapEx	$0.32 M	$1.29 M	$1.51 M	$0.95 M	**$4.07 M**
Labor - OpEx	$0.05 M	$0.00 M	$0.10 M	$0.00 M	**$0.15 M**
CapEx Total	$1.56 M	$4.49 M	$5.62 M	$3.81 M	**$15.47 M**
OpEx Total	$1.22 M	$0.00 M	$0.35 M	$0.00 M	**$1.57 M**
Totals	**$2.78 M**	**$4.49 M**	**$5.96 M**	**$3.81 M**	**$17.04 M**

High - Labor by Year					
	Year 1	Year 2	Year 3	Year 4	
Avista					
Labor - CapEx	$0.45 M	$1.50 M	$1.78 M	$1.31 M	**$5.04 M**
Labor - OpEx	$0.40 M	$0.00 M	$0.14 M	$0.00 M	**$0.55 M**
Sys Integrator					
Labor - CapEx	$0.66 M	$2.50 M	$2.51 M	$2.28 M	**$7.95 M**
Labor - OpEx	$0.89 M	$0.00 M	$0.18 M	$0.00 M	**$1.07 M**
Vendor					
Labor - CapEx	$0.47 M	$2.00 M	$1.93 M	$1.45 M	**$5.85 M**
Labor - OpEx	$0.04 M	$0.00 M	$0.14 M	$0.00 M	**$0.18 M**
CapEx Total	$1.58 M	$6.00 M	$6.22 M	$5.04 M	**$18.83 M**
OpEx Total	$1.33 M	$0.00 M	$0.46 M	$0.00 M	**$1.79 M**
Totals	**$2.91 M**	**$6.00 M**	**$6.69 M**	**$5.04 M**	**$20.63 M**

8.3 Program Labor by Task Group

The follow tables are another view of the estimated labor cost. These show labor costs by entity, capital vs. operating expense type, and by task group.

Labor - Low Cost by Entity					
Type	Task	Avista	Sys Integrator	Vendor	Totals
OpEx	**RFP Process**	$0.18 M	$0.50 M	$0.00 M	**$0.68 M**
OpEx	**Vendor Contracting**	$0.11 M	$0.25 M	$0.00 M	**$0.36 M**
CapEx	**Overall Design**	$0.15 M	$0.36 M	$0.07 M	**$0.58 M**
CapEx	**Gas Design**	$0.19 M	$0.36 M	$0.18 M	**$0.74 M**
OpEx	**Gas Design**	$0.05 M	$0.09 M	$0.05 M	**$0.18 M**
CapEx	**Gas Build**	$0.32 M	$0.53 M	$0.32 M	**$1.17 M**
CapEx	**Gas System / Integration Testing**	$0.40 M	$0.65 M	$0.40 M	**$1.45 M**
CapEx	**Gas UAT / Perf / DR / Deploy Testing**	$0.27 M	$0.49 M	$0.32 M	**$1.09 M**
CapEx	**Gas Parallel Ops**	$0.25 M	$0.47 M	$0.31 M	**$1.02 M**
CapEx	**Power Design**	$0.32 M	$0.66 M	$0.41 M	**$1.39 M**
OpEx	**Power Design**	$0.08 M	$0.17 M	$0.10 M	**$0.35 M**
CapEx	**Power Build**	$0.70 M	$1.04 M	$0.61 M	**$2.35 M**
CapEx	**Power System / Integration Testing**	$0.61 M	$0.93 M	$0.55 M	**$2.09 M**
CapEx	**Power UAT / Perf / DR / Deploy Testing**	$0.53 M	$0.87 M	$0.57 M	**$1.97 M**
CapEx	**Power Parallel Ops**	$0.49 M	$0.82 M	$0.32 M	**$1.63 M**
CapEx	CapEx Total	**$4.23 M**	**$7.17 M**	**$4.07 M**	**$15.47 M**
OpEx	OpEx Total	**$0.42 M**	**$1.00 M**	**$0.15 M**	**$1.57 M**
	Totals	**$9.30 M**	**$8.18 M**	**$4.21 M**	**$17.04 M**

Labor - High Cost by Entity					
Type	Task	Avista	Sys Integrator	Vendor	Totals
OpEx	**RFP Process**	$0.26 M	$0.62 M	$0.00 M	**$0.88 M**
OpEx	**Vendor Contracting**	$0.10 M	$0.21 M	$0.00 M	**$0.31 M**
CapEx	**Overall Design**	$0.22 M	$0.35 M	$0.21 M	**$0.78 M**
CapEx	**Gas Design**	$0.16 M	$0.21 M	$0.17 M	**$0.54 M**
OpEx	**Gas Design**	$0.04 M	$0.05 M	$0.04 M	**$0.14 M**
CapEx	**Gas Build**	$0.35 M	$0.47 M	$0.47 M	**$1.29 M**
CapEx	**Gas System / Integration Testing**	$0.45 M	$0.78 M	$0.60 M	**$1.83 M**
CapEx	**Gas UAT / Perf / DR / Deploy Testing**	$0.37 M	$0.66 M	$0.50 M	**$1.53 M**
CapEx	**Gas Parallel Ops**	$0.40 M	$0.68 M	$0.52 M	**$1.60 M**
CapEx	**Power Design**	$0.57 M	$0.72 M	$0.55 M	**$1.85 M**
OpEx	**Power Design**	$0.14 M	$0.18 M	$0.14 M	**$0.46 M**
CapEx	**Power Build**	$0.71 M	$1.01 M	$0.78 M	**$2.50 M**
CapEx	**Power System / Integration Testing**	$0.56 M	$0.86 M	$0.66 M	**$2.08 M**
CapEx	**Power UAT / Perf / DR / Deploy Testing**	$0.58 M	$1.02 M	$0.78 M	**$2.38 M**
CapEx	**Power Parallel Ops**	$0.67 M	$1.18 M	$0.60 M	**$2.45 M**
CapEx	CapEx Total	**$5.04 M**	**$7.95 M**	**$5.85 M**	**$18.83 M**
OpEx	OpEx Total	**$0.55 M**	**$1.07 M**	**$0.18 M**	**$1.79 M**
	Totals	**$5.59 M**	**$9.01 M**	**$6.03 M**	**$20.63 M**

8.4 Travel and Software Licenses

Non-Labor CapEx	Low	High
Travel (8% avg.)	$1.51 M	$1.51 M
Licenses	$3.00 M	$4.20 M
Total	**$4.51 M**	**$5.71 M**

Travel and licensing are also significant components of the total cost and can be quite variable. The pandemic of course drastically decreased business travel. Business travel has only partially returned, as many entities' remote work policies have remained in place, thereby reducing the benefit of having consultants / vendors on-site. Some travel is expected, but that is significantly less than what it would have been pre-pandemic.

Licensing costs tend to vary broadly as well. Vendors may discount heavily to win business or not negotiate flexibly if they have won recent business and have few available resources to staff an implementation. License fees should range from $25,000 a seat (e.g., $2.5m for 100 seats, similar to Avista's current user count. At times, the license fee may be as high as $3.5m for similar seat counts and when "extra components" are licensed. Avista should expect a negotiable annual maintenance fee of approximately 20% of license fee.

Again, this should be used for planning purposes and will be revisited after vendor selection is complete.

8.5 Assumptions

The lists outlines assumptions used to formulate the above schedule and budget estimate.

1. Avista will be able to staff the resources – some will be approximately 50% allocated during the project, with times of lower participation (during configuration/build) and other times more active (System, Integration, UAT, and training).
2. Avista will be able to staff specific roles key to the project:
    1) Project Manager – 100%
    2) Avista Solution Architect – 50%
    3) Technical Lead – 50+%
    4) 3-4 Technical resources – 100%
    5) Risk resource – 50%
3. Significant reliance on Data Warehouse being available for post-EOD reporting during both Phase 1 and 2
4. Significant reliance on MuleSoft becoming the standard integration platform; additionally, standardized APIs for inbound trade receipt (separate APIs for Gas vs. Power vs. Other commodities), volume receipt (separate for gas vs. Power vs. Other commodities), similarly, outbound trade and volume APIs may be standardized.
5. Vendor integration APIs for forward market prices and settlement prices are operational and require minimal modification.
6. Vendor integration API for trade and volume/meter data exist and may be used as a foundation for final trade APIs.
7. Vendor conversion utilities exist for data migration for counterparties, contracts, and trades.
8. WECC interchange tool (WIT) inbound/outbound Nucleus processes do not require redesign and may be leveraged as design formation
9. Other Assumptions will be outlined should Avista determine to proceed with a system selection process and Utilicast be selected as system integrator.
10. Vendor Software Solution
    a) Solution will be hosted in cloud
    b) All vendor software installation is completed in a timely manner, within plan
    c) Vendor software arrives in environment configured appropriately
11. AVA Resources:
    a) Group level SMEs (Front Office / Trading, Gas Scheduling, Credit (confirms only), Resource Accounting / Settlements, Risk Mgmt)
    b) 1-3% of a DBA for environment mgmt with "hot times" vs. limited daily DBA work
    c) Technical resources are assumed to be "to project" allocation
    d) Understood that Avista has other projects on-going (e.g. ADMS) that may compete for resource time
12. Reporting:
    a) New solution Standard Reports (with or without modification)
    b) Existing Excel-based extracts with extract from new solution
    c) Data Lake with extracts of relevant data from new solution
    d) Reporting from data lake is adopted and deemed acceptable by business users
    e) A combination of the three

13. Integration will be standardized via:
    a) Single IN-bound APIs FROM trade conversion, inbound ICE trades and any other solution will also leverage (to best of ability) with a standardized API - fill the fields necessary for ALL interfaces including Nucleus and Data Lake integration ensuring build once, test once, solve once.
    b) Single OUT-bound APIs for trade communication TO other required solutions to also leverage (to best of ability) with a standardized API - fill the fields necessary for ALL interfaces ensuring build once, test once, solve once.
    c) Standard IN-bound volume interfaces FROM various solutions - NWPL volume interface for example may be leveraged via GTN spreadsheet-based volume API.
    d) Standard OUT-bound volume interfaces TO various solutions - Nucleus gas volume changes through Power go-live for NWPL/GTN volume changes and Data Warehouse with a standard API.
    e) Where possible - all gas trade and volume integration (inbound and outbound) will leverage the above API simplifying development, testing, maintenance and ongoing support
14. Full test program will be defined as part of the project, including:
    a) Test strategy (types of testing (Unit/System/Integration/UAT, etc.)
    b) Test Case generation - much of this will be developed by the business community
    c) Test execution by relevant parties during the execution of testing
    d) Defect reporting from AVA resources will be required for all Test phases relevant to requested participation. They will be prioritized (High/Medium/Low) and Design and Test responses.
    e) Design, Test, and other key milestones will be accepted will be performed and responded to in writing (email acceptable) in a mutually agreeable, timely fashion.
    f) Performance test requirements / necessity (depending on vendor solution, performance testing by Avista may be unnecessary)
15. Optimization
    a) Unlikely to be fully supported by CTRM system
    b) Keep existing spreadsheets and point to data lake / 3rd party optimization software / Best-of-breed may be worth exploring here

9. CLOSING

This assessment has evaluated the risks associated with the current Nucleus ETRM solution. It has identified a case for change and laid out planning timelines and budgets. Although Utilicast was not asked for a specific recommendation from this assessment, potential options for next steps are documented earlier in this document, immediately following the Executive Summary.