Atellica Solution Portfolio and Sustainability

A study of water consumption, power consumption, and liquid waste output

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SIEMENS Healthineers

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Introduction

As the world faces increasing environmental challenges, the concept of sustainability has never been more pertinent. We stand at the crossroads of environmental sustainability and technological advancement, and clinical laboratories are significant consumers of resources and generators of waste; they use more energy than standard office buildings, more water, and generate large amounts of waste, nearly all of it considered hazardous. **With the increasing focus on customers and demand for innovative and environmentally friendly solutions, the importance of incorporating sustainability into medical device design cannot be overstated.**

In 1987, the United Nations Brundtland Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."[1] Put another way, the United States Environmental Protection Agency (EPA) states: "Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations."[2] Siemens Healthineers has a strong commitment to sustainability and has aligned its initiatives with both the Paris Agreement for combating climate change and becoming carbon-neutral by 2030 and the UN 17 sustainable development goals. This commitment will not only lead to a healthier and more sustainable planet, but will also have a direct impact on our customers and their resources.

By designing and manufacturing medical devices that are more energy-efficient, use fewer resources, and produce less waste, Siemens Healthineers can make a direct impact on our world.

Three areas in which in vitro diagnostic instruments can have a substantial impact on sustainability are water usage, electrical consumption, and liquid waste output. Conservation of water is not only critical for resource preservation, but also cost-effective for our customers. Ensuring this natural resource is being used efficiently is vital to sustainability. Similarly, electrical consumption and liquid waste output not only have a direct impact on pollution but also contribute to a customer's overall resources and budget. This white paper summarizes the study conducted by Siemens Healthineers to quantify the water consumption, electrical consumption, and liquid waste output of Atellica® Solution Portfolio.

Abbreviations

AIA	Atellica Inegrated Automation
CH	Chemistry
CI	Integrated Chemistry and Immunoassay
DL	Direct Load
EUT	Equipment Under Test
IM	Immunoassay
RH	Rack Handler
SCI	Atellica Sample Handler, Atellica Chemistry, and Atellica Immunoassay analyzer in a modular configuration connected to Atellica Magline
SH	Atellica Sample Handler

Methods

Analyzers in Atellica Solution Portfolio were monitored for power consumption, water consumption, and liquid waste output in various modes of operation. Worklists for each mode of operation were created and used for this testing program. All the testing was done within instrument-specified conditions, and no open channels or STAT tests were used. Specific assumptions were made concerning this testing program that best mimic a customer's experience:

- Worklists were configuration-specific.
- Daily maintenance and weekly maintenance were completed at their normal intervals and schedules, with no errors or retries.
- Analyzers were not intended to be shut down.
- Results may have been software-dependent.

Both stand-alone analyzers and integrated automation configurations of Atellica Solution Portfolio were observed. The term stand-alone analyzer includes the applicable Atellica® Direct Load component, and the integrated automation configuration includes an Atellica® Sample Handler and the respective Atellica Magline® track components for that configuration. A full summary of the configurations is shown in Table 1.

Each configuration was monitored in Standby, Daily Maintenance, and Weekly Maintenance modes. Additional worklists were created based on the data being collected. First, a high-consumption worklist was run to gather electrical power data. This worklist ensured that the analyzers were fully processing and did not go into Standby during the data collection. A second worklist including most frequently used assays was run to gather water consumption and liquid waste data. This worklist was created using customer fleet data to simulate customer labs. A full summary and description of each worklist is shown in Table 2.

Table 1. Configuration descriptions.

Configurations
Atellica® CH 930 Analyzer*
Atellica® IM 1300 Analyzer*
Atellica® IM 1600 Analyzer*
Atellica® CI Analyzer*
Atellica® Sealer†

**Stand-alone analyzer with Atellica Direct Load (DL), Atellica Sample Handler (SH) or Atellica Rack Handler (RH).*
†Atellica Sealer in an Atellica Solution with AIA configuration.

Table 2. Description of test modes.

Test Mode	Description
Standby	EUT was powered and in a holding state. No sampling or processing was occurring.
Daily Maintenance	Standard activities
Weekly Maintenance	Standard activities
High-consumption Worklist	This worklist used assays with the intent to be on the high side of water consumption, without running open channels. The worklists ensured that each analyzer was fully processing and did not go to Standby during monitoring.
Average Customer Lab Worklist	This worklist was created using data from an application that gathered current information from the customer fleet connected to an internal remote instrument monitoring tool—Siemens Remote Services (SRS), a Siemens Healthineers proprietary remote connectivity platform. SRS contains an aggregate of laboratory customer information. No patient information or results for tests are available for access in this database. This data was filtered to remove non-functional and very-low-throughput accounts. The top ~75% accounts by assays processed for immunoassay (IA) and the top ~65% accounts for chemistry (CH) (including photometric and IMT) were obtained to create a representative worklist weighted by the most-used assays. The data also filtered out multi-module accounts and left only an Atellica Solution with Atellica IM 1600 Analyzer to create a more realistic throughput.

Results

Power consumption

Power consumption was measured for each configuration in Table 1 and recorded in kVA. Tables 3–6 summarize the data. Testing data proved that the sample loading component (Direct Load or Sample Handler) had a negligible impact on power consumption (0.2 kVA or less), so the data summarized here is by analyzer. The full suite of power data (broken down by sample loading) is detailed in Siemens Healthineers internal test reports.

Table 3. Standby power consumption.

Configuration	Power
Atellica CH 930 Analyzer	1.2 kVA
Atellica IM 1300 Analyzer	1.1 kVA
Atellica IM 1600 Analyzer	0.9 kVA
Atellica CI Analyzer	1.7 kVA
Atellica Sealer	0.7 kVA

Table 4. Daily Maintenance power consumption.

Configuration	Power
Atellica CH 930 Analyzer	1.3 kVA
Atellica IM 1300 Analyzer	1.2 kVA
Atellica IM 1600 Analyzer	1.1 kVA
Atellica CI Analyzer	1.6 kVA

Table 5. Weekly Maintenance power consumption.

Configuration	Power
Atellica CH 930 Analyzer	1.3 kVA
Atellica IM 1300 Analyzer	1.3 kVA
Atellica IM 1600 Analyzer	1.1 kVA
Atellica CI Analyzer	1.7 kVA

Table 6. High-consumption power consumption.

Configuration	Power
Atellica CH 930 Analyzer	1.4 kVA
Atellica IM 1300 Analyzer	1.3 kVA
Atellica IM 1600 Analyzer	1.2 kVA
Atellica CI Analyzer	1.8 kVA
Atellica Sealer	1.2 kVA

Water Consumption

Water consumption was also measured for each of the configurations in Table 1. In contrast to power consumption, this testing revealed that water consumption is impacted by the sample loading component. The data is summarized in Tables 7–9. Note that Standby data was collected in mL/hr.

Table 7. Standby water consumption.

Configuration	Average Water Consumption (mL/hr)
Atellica CH 930 Analyzer, DL	401
Atellica CH 930 Analyzer, SH	290
Atellica IM 1300 Analyzer, DL	51
Atellica IM 1300 Analyzer, SH	37
Atellica IM 1600 Analyzer, SH	6
Atellica CI Analyzer, RH	336

Table 8. Daily Maintenance water consumption.

Configuration	Average Water Consumption (L/hr)
Atellica CH 930 Analyzer, DL	13.5
Atellica CH 930 Analyzer, SH	9.5
Atellica IM 1300 Analyzer, DL	1.6
Atellica IM 1300 Analyzer, SH	1.3
Atellica IM 1600 Analyzer, SH	2.6
Atellica CI Analyzer, RH	1.9

Table 9. Weekly Maintenance water consumption.

Configuration	Average Water Consumption (L/hr)
Atellica CH 930 Analyzer, DL	11.0
Atellica CH 930 Analyzer, SH	11.7
Atellica IM 1300 Analyzer, DL	1.9
Atellica IM 1300 Analyzer, SH	1.8
Atellica IM 1600 Analyzer, SH	2.5
Atellica CI Analyzer, RH	6.9

A worklist was created to gather data from the customer fleet to represent the most-used assays. The data was filtered to remove non-functional and very-low-throughput accounts. Additionally, the data filtered out multi-module accounts, leaving only Atellica SCI with an Atellica IM 1600 Analyzer, to create a more realistic throughput. An equivalent worklist was then created for Atellica CI Analyzer, as there was no customer data available at the time of this study to create a system-specific worklist. Lastly, the same worklist was also run on an Atellica SCI with an Atellica IM 1300 Analyzer.

The top 65% assays for chemistry and IMT were K, NA, UN_c, GluH_3, Crea_2, CL, ALP_2c, CL, ALP_2c, TBil_2, ALT, TP, AST, Chol_2, ECre_2, CO2_c, GGT, Alb, UA, IP, Trig, D_HDL, ALTPLc, and Iron_2.

The top 75% assays for immunoassay were TSH3UL, Fer, FT4, VB12, VitD, FolSerum, PSA, TnlH, HBsII, FT3, aHCV, PTH, ThCG, aHBs2, T4, CHIV, and T3.

Water consumption for the worklist is summarized in Table 10.

Table 10. Average water consumption for customer lab worklist.

Configuration	Average Water Consumption (L/hr)
Atellica CH 930 Analyzer	28.9
Atellica IM 1300 Analyzer	2.0
Atellica IM 1600 Analyzer	2.5
Atellica CI Analyzer	23.0

Liquid Waste Output

Liquid waste was measured for each configuration in Table 1 during Standby, Daily Maintenance, and Weekly Maintenance modes. Liquid waste output was also collected during the average customer lab runs. All the data is summarized in Tables 11–13. Note that Standby data was collected in mL/hr.

Table 11. Average liquid waste output for customer lab worklist.

Average Customer Lab Worklist	
Configuration	**Liquid Waste Output (L/hr)**
Atellica CH 930 Analyzer, DL	24.4
Atellica IM 1300 Analyzer, DL	2.2
Atellica IM 1600 Analyzer, SH	2.4
Atellica CI Analyzer	18.5

Table 12. Standby liquid waste output.

Standby	
Configuration	**Liquid Waste Output (mL/hr)**
Atellica CH 930 Analyzer, DL	350
Atellica CH 930 Analyzer, SH	863.6
Atellica IM 1300 Analyzer, DL	15.1
Atellica IM 1300 Analyzer, SH	37.4
Atellica IM 1600 Analyzer, SH	35.1
Atellica CI Analyzer	670.9

Table 13. Maintenance liquid waste output.

Configuration	Waste Output (L/hr)	
	Daily Maintenance	Weekly Maintenance
Atellica CH 930 Analyzer, DL	13.9	11.3
Atellica CH 930 Analyzer, SH	16.1	11.9
Atellica IM 1300 Analyzer, DL	2.7	2.9
Atellica IM 1300 Analyzer, SH	1.8	2.6
Atellica IM 1600 Analyzer, SH	3.1	3.1
Atellica CI Analyzer	1.6	6.3

Conclusion

The data collected during this study calculated the power consumption, water consumption, and liquid waste output of Atellica Solution Portfolio during all modes of operation. Standby and maintenance resource usage was collected, as well as usage representative of our customers' most common worklists. The customer-representative worklist used in this study was generated using a proprietary remote connectivity platform that contains an aggregate of laboratory customer information. No patient information or results for tests are available for access in this database.

Because of Siemens Healthineers commitment to sustainability, we were pleased to report that the data generated in a real laboratory environment confirms that the Atellica Solution Portfolio performs on par or better compared to other currently available chemistry and immunoassay analyzers. See Figure 1 and Table 14 for comparisons of water and power consumption vs. other analyzers available on the market.

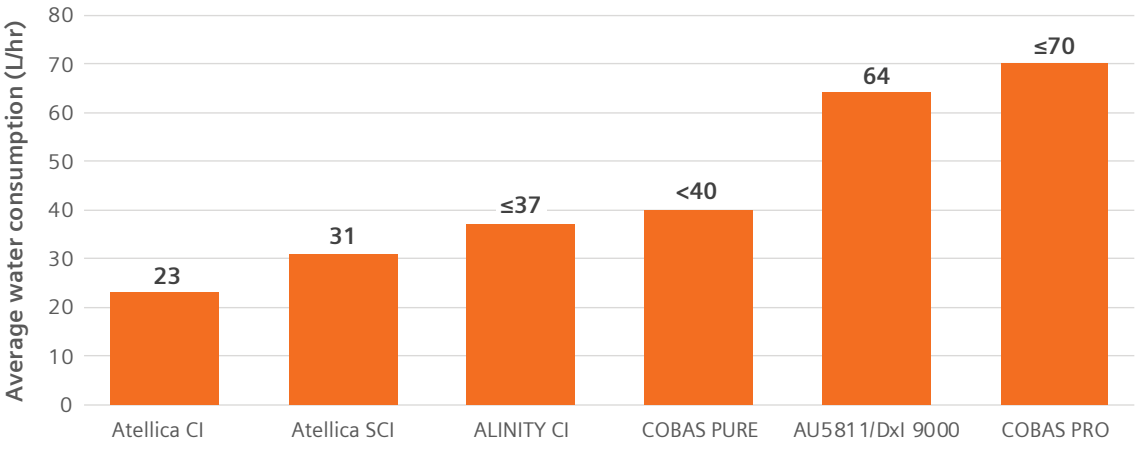

Figure 1. Atellica CI and Atellica Solution Analyzers consume the least water compared to other combined analytical systems.*

Table 14. Power rating requirements (kVA).[3]

Atellica SCI	Atellica CI	ALINITY CI	COBAS PRO
<2.7	1.8	2.1	<5.5

Sustainability is everyone's responsibility. Siemens Healthineers is proud to be a leader in upholding sustainability initiatives within the in vitro diagnostics industry.

**Atellica Solution average water consumption with Atellica IM 1300 and Atellica CH 930 Analyzers for a representative worklist of the top-used assays by customers. cobas pro (ISE/c503/e801 - User Guide – Publication version 3.3 - Software version 02-03).Consumption depending on the number of analytical units. cobas pure integrated solutions Software version 01-03 User Guide Publication version 2.1. Alinity ci-series Operations Manual 80000071-105. AU5800 Chemistry Analyzer - Beckman Coulter - Instructions for Use - PN A98352AC (September 2015). The Beckman AU5811 cannot be combined with the DxI 9000 in one system. https://www.beckmancoulter.com/en/products/immunoassay/dxi-9000-access-immunoassay-analyzer.*

At Siemens Healthineers, we pioneer breakthroughs in healthcare. For everyone. Everywhere. Sustainably. As a leader in medical technology, we want to advance a world in which breakthroughs in healthcare create new possibilities with a minimal impact on our planet. By consistently bringing innovations to the market, we enable healthcare professionals to innovate personalized care, achieve operational excellence, and transform the system of care.

Our portfolio, spanning in vitro and in vivo diagnostics to image-guided therapy and cancer care, is crucial for clinical decision-making and treatment pathways. With the unique combination of our strengths in patient twinning,* precision therapy, as well as digital, data, and artificial intelligence (AI), we are well positioned to take on the greatest challenges in healthcare. We will continue to build on these strengths to help overcome the world's most threatening diseases, enable efficient operations, and expand access to care.

We are a team of more than 71,000 Healthineers in over 70 countries passionately pushing the boundaries of what is possible in healthcare to help improve the lives of people around the world.

**Personalization of diagnosis, therapy selection and monitoring, aftercare, and managing health.*

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References

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Siemens Healthineers Headquarters
Siemens Healthineers AG
Siemensstr. 3
91301 Forchheim, Germany
Phone: +49 9191 18-0
siemens-healthineers.com

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Siemens Healthcare Diagnostics Inc.
Core Lab Solutions
511 Benedict Avenue
Tarrytown, NY 10591-5005
USA
Phone: +1 914-631-8000

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