White paper

Expanding access to care with Dual Source CT

Reduced costs and optimized Total Value of Ownership (TVO) with SOMATOM Pro.Pulse

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Introduction

The clinical benefits of Dual Source Computed Tomography (DSCT), especially in the field of cardiac imaging, have been described in several studies [1, 2] and have also been outlined in a separate white paper from Siemens Healthineers [3]. However, many medical institutions have found this technology to be prohibitively expensive, preventing them from offering reliable cardiac CT imaging to their patients. Surveys, such as those conducted in the United Kingdom [4,5], indicate that a significant portion of the population still lacks easy access to coronary CT angiography (CCTA) exams.

Hospitals and imaging centers strive to provide high quality care, but they are also under significant pressure to reduce costs. Additionally, they must accommodate an increasing number of cases requiring more advanced examinations and treatment options. Consequently, many institutions find themselves unable to invest in DSCT technology, despite being well aware of its clinical benefits.

This white paper will examine how the SOMATOM Pro.Pulse Dual Source CT scanner can reduce the total cost of ownership (TCO) while maximizing the total value of ownership (TVO) of a DSCT system. Considerations when looking at the overall financial impact of a system range from site preparation and power consumption to optimized cardiac revenue streams and improved patient pathways.

All figures and calculations in this white paper are based on specific scenarios and will vary by institution. These examples are provided for illustrative purposes only. However, when considering all factors across the system lifecycle, it becomes clear that the SOMATOM Pro.Pulse improves the accessibility of DSCT technology, enabling more institutions to offer its clinical benefits to their patients.

Total Cost of Ownership (TCO) vs. Total Value of Ownership (TVO)

Hidden costs associated with the procurement of medical equipment — such as site preparation, installation, operation, and system disposal — make up a considerable part of the TCO and should be considered when deciding to invest in new technology.

TCO provides a useful way to compare costs between products or suppliers, but has limitations in assessing a system's full value. The calculation of the TVO, on the other hand, assesses overall revenue generation by considering additional benefits that may translate into additional value.

There are two primary ways to maximize TVO: reducing costs and increasing revenue, with the best results achieved by combining both (Fig. 1). This strategy can significantly alter perceptions of new technology's affordability and lead to a faster return on investment (ROI) compared to focusing soley on acquisition and maintenance costs. Additionally, without comprehensive lifecycle planning, the selected system may not fully unlock the financial potential for a radiology department, or, when considering the entire clinical pathway, for all healthcare providers involved.

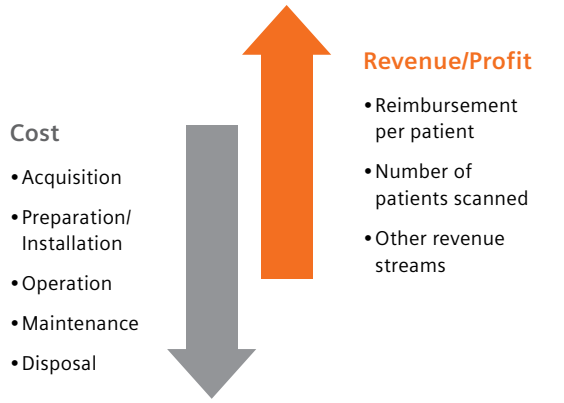

Figure 1: To assess the full value of a system over its entire life cycle, the TCO is weighed against the overall revenue it creates. The TVO is maximized by reducing the TCO but also by creating additional benefits using the new system.

Reduced TCO with SOMATOM Pro.Pulse

Since TCO encompasses all expenses throughout a system's entire lifecycle, it presents numerous opportunities for cost reduction. This includes not only lowering acquisition and maintenance costs but also achieving savings in site preparation, installation, operation, and expenses related to staff, consumables such as contrast media, and energy consumption. A thorough calculation considers all these factors to optimize the TCO.

In CT systems, achieving a low TCO begins with thoughtful system design and advanced CT technology. However, other critical factors also play a role. For example, an optimized workflow powered by intelligent software can streamline image acquisition and reading, significantly saving time and further reducing costs.

This chapter looks at some of the major TCO factors relevant to DSCT systems, including an analysis of how SOMATOM Pro.Pulse supports cost reductions in these areas.

System acquisition and maintenance

Acquiring a scanner capable of delivering the image quality required for complex exams such as cardiac CT is a significant investment. However, several crucial elements can significantly optimize the acquisition and maintenance costs of a DSCT system, making the technology more affordable. For example, the X-ray tube is one of the most expensive components of a CT scanner and influences the overall system design. By reducing the bore size from 78 cm to 70 cm, as in the SOMATOM Pro. Pulse, a less powerful X-ray tube can achieve the same contrast-to-noise ratio (CNR) or image quality. In this case, the Athlon(TM) X-ray tube requires 30% less power than tubes in previous DSCT scanners, potentially reducing both acquisition and maintenance costs. This reduction also simplifies site preparation (see chapter "Site preparation and installation") and lowers operational costs over the system's entire life cycle due to decreased power consumption (see chapter "Operational costs").

Site preparation and installation

Site preparation and installation costs include expenses for preparing the CT room according to system requirements. The main cost drivers are electrical infrastructure, cooling infrastructure, shielding, and floor preparation, although individual sites may have unique needs.

Site preparation and installation costs for DSCT systems were often high historically due to the infrastructure requirements of this advanced technology. Site-specific conditions could further increase the investment, making DSCT system installation seem unfeasible, especially in limited spaces. However, many of these cost drivers have been reduced with the new generation of DSCT systems.

To evaluate the cost impact, Siemens Healthineers conducted a study in 2024 [6] by collecting data from 17 SOMATOM Pro.Pulse installations to illustrate possible cost-saving potential in the following sections.

Cooling infrastructure

One of the most cost-intensive elements of site preparation is the cooling infrastructure. Previous DSCT systems required water cooling, necessitating a new infrastructure when replacing a conventional, air-cooled CT scanner. The additional expenses for water-cooling infrastructure, including new water pipes and potentially a chiller that required maintenance, could be substantial. For example, a radiology department in Germany faced an average installation cost of €50,000 for a water-cooling system. This high cost often favored conventional scanners, especially if an air-cooling infrastructure was already in place.

The SOMATOM Pro.Pulse is the first DSCT to use air cooling, allowing a conventional, air-cooled CT system to be replaced with minimal infrastructure changes if the existing performance capacity is sufficient. Data from the initial installations of SOMATOM Pro. Pulse show that the cooling infrastructure at over 78% of the sites could be reused with either no or only minor adaptations (data on file). At sites requiring a new cooling infrastructure, the costs of air cooling were significantly lower compared to installing water cooling.

Electrical infrastructure
Providing the electrical infrastructure for a DSCT system could become cost-intensive if the main power supply did not meet the scanner's requirements. For facilities with limited power capacities, the cost of the necessary upgrade could deter investment in Dual Source technology.

This has now changed with the SOMATOM Pro. Pulse, which requires less power than previous DSCT systems. An analysis of the first installations showed that the main power supply needed adaptation in only 21% of cases when replacing an existing CT scanner. In contrast, previous-generation DSCT systems would have required power supply adaptations in at least 42% of installations.

Depending on the CT system to be replaced, the existing sub-distribution – including power distribution box, fuses, and cables – can be reused or adapted. This may even be required by local regulations. Instead of the two sub-distribution lines required by previous DSCT systems, SOMATOM Pro.Pulse requires just one. However, the single line might need to be upgraded. Floor preparation is easier with SOMATOM Pro.Pulse as it is designed with just one power cable leading to the gantry so existing core holes can be reused or adapted.

Space requirements
Healthcare providers often have limited space for a new CT system. In the past, DSCT systems, as with most conventional CT scanners, required a separate technical room in addition to the examination room and control area. If this extra space to accommodate the power distribution components and image control system was not available, any CT system requiring a technical room was generally automatically ruled out.

SOMATOM Pro.Pulse solves this problem by integrating the components for power distribution and part of the image control system inside the gantry. This reduces the minimal room size for the system to just 18 m2. If SOMATOM Pro.Pulse replaces a system with a larger footprint or one that required a technical room, the space gained can be used in a productive way, e.g., for storage or for a patient changing area (see Fig. 2).

Furthermore, the optional Integrated 3D camera offers a ready-to-run solution for optimized patient positioning that does not require additional mounting and installation.

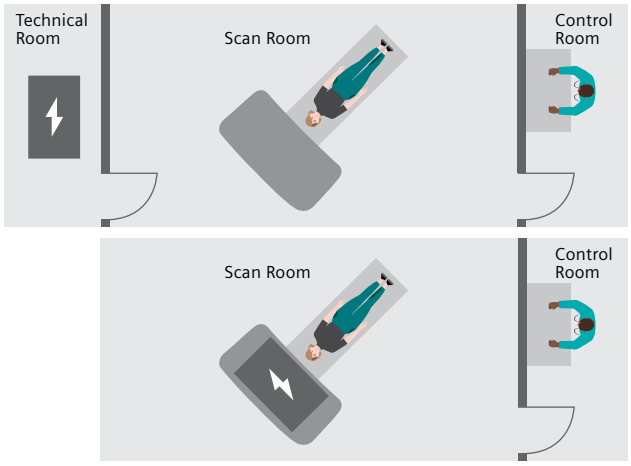

Figure 2: Most CT scanners require a separate technical room. This requirement is eliminated with integrated power distribution units on the SOMATOM Pro.Pulse.

Gantry weight
The weight of the gantry can be a decisive cost factor if the proposed CT room is located in a building with limited floor load capacity and therefore might require static construction measures. The SOMATOM Pro.Pulse gantry weighs 11% less than previous DSCT gantries and is much lighter than many other high-end CT systems [7].

Operational costs

When estimating TCO, operational costs are significant as they accumulate over the scanner's entire life cycle. Staff-related costs are substantial and are usually calculated precisely when deciding on new equipment. Hidden cost drivers of CT scanners include consumables, particularly contrast media, and power consumption. Both will be addressed in the following sections.

Contrast-media usage
Several studies have shown that the use of low tube voltage and fast, high-pitch scans allows a significant reduction in contrast media [3, 8, 9]. This is a direct clinical benefit of DSCT for patients and also represents significant cost-saving potential, as demonstrated with the following sample calculation:

If a 70 kV protocol is used instead of 120 kV in CCTA imaging, the contrast media volume can be reduced by 40% [10]. Assuming a dose of 70 mL at a price of $0.40 per mL for a 120 kV scan, the reduction translates into financial savings of US$13.70 per examination. With a rate of five CCTA examinations per week for 40 working weeks, this represents savings of US$27,400 for the 10 years of the average scanner life cycle.

Further studies have demonstrated that contrast media usage can also be reduced by optimizing the settings for the scanner in combination with different injection protocols [11, 12].

Power consumption
Power consumption becomes increasingly significant with the prospect of rising global electricity prices. There is also growing awareness of the need for energy savings in the healthcare sector in general as it accounts for 5–8% of world industrial energy consumption [13]. Many governments and individual medical institutions have set goals for environmental sustainability. CT scanners with a reduced carbon footprint due to lower power consumption support these goals.

Compared with a number of conventional single source systems as well as the previous generation of DSCT systems, SOMATOM Pro.Pulse consumes significantly less power. This is thanks to improvements in system design, such as the integrated Stellar Detector used in the imaging chain [14].

To estimate potential savings, we consider two simplified scenarios. The power consumption comparison is based on measurements following the setup recommended by the European Coordination Committee of the Radiological, Electromedical, and Healthcare IT Industry (COCIR) [15]. In this scenario, 20 abdominal scans are performed each workday, with each scan session lasting 35 minutes. Figure 3 illustrates a schematic power curve of a CT scanner, showing energy usage during both operational and non-operational periods.

The scenarios are as follows:

1. A CT scanner used in a **typical hospital radiology department** with 12 working hours (operational time). The scanner is reduced to low-power mode or **switched off overnight** for 12 hours (non-operational time).
2. A CT scanner used in an **emergency department** with the same number of exams during daytime. In this scenario, however, the scanner is **not switched off overnight** and remains in idle or "ready-to-scan" mode.

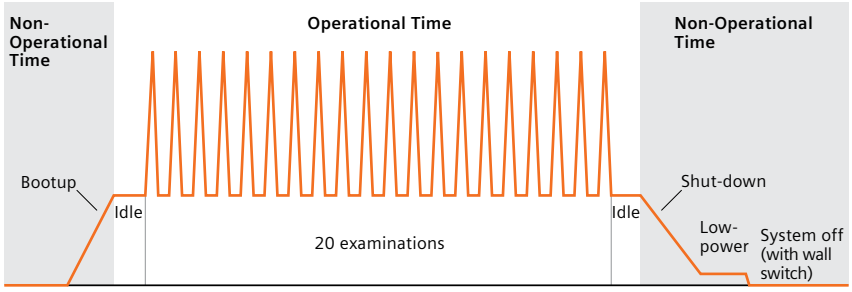

Figure 3: Schematic power curve of a CT scanner during non-operational and operational times.
System off: system shut down via wall switch (zero power consumption)
Low power: minimum energy consumption after shut-down (no wall switch installed)
Idle: system is ready to scan but not actually scanning (no X-ray tube rotation)

Scenario 1 (daytime operation only):
In this scenario, SOMATOM Pro.Pulse consumes up to 30% less energy than the previous generation of DSCT scanners. It also consumes up to 50% less energy in low-power mode than a number of conventional single source scanners [16].

When the scanner is in low-power mode for 12 hours a day, SOMATOM Pro.Pulse consumes about 34.6 kWh in 24 hours. Assuming 260 working days per year (weekends excluded) and a price of US$0.18 per kWh, this represents an annual cost of US$1,619. Calculating with energy savings of 40% compared with a conventional CT scanner, SOMATOM Pro.Pulse enables a TCO reduction of almost US$10,800 over the average 10-year life cycle of the system.

An even greater energy-saving potential can be realized by incorporating a wall switch to reduce energy consumption to zero during non-working hours.

Scenario 2 (emergency use around the clock):
The calculation is slightly different if the scanner is used in an emergency department where it cannot be switched off and has to remain in idle mode both day and night. In this setting, SOMATOM Pro.Pulse consumes up to 20% less energy than the previous generation of DSCT scanners and up to 28% less than a number of conventional single source scanners [16].

In this case, the energy consumption is approximately 65.7 kWh for 24 hours. Again, assuming 260 working days per year and a price of US$0.18 per kWh, this amounts to an annual cost of US$3,075. If the system is used for 10 years and saves about 25% energy compared with other scanners, this represents a TCO reduction potential of well over US$7,500.

SOMATOM Pro.Pulse therefore even enables substantial operational cost savings compared with conventional CT scanners – with the additional benefits of DSCT that add to the TVO of the system.

Improved TVO with Dual Source CT technology

While SOMATOM Pro.Pulse offers TCO saving potentials, as shown in the previous chapter, implementing DSCT technology in general enables a higher TVO with higher revenue, improved operational efficiency, and faster exams.

Optimized cardiac CT revenue stream

TVO can potentially be increased through additional reimbursement from advanced procedures such as cardiac exams for a greater number of patients.High temporal resolution is fundamental to achieving this because it improves image quality and helps to reduce motion artifacts caused by high or irregular heart rates. This is enabled by SOMATOM Pro.Pulse with its temporal resolution down to 86 ms.

The great potential to increase revenue with DSCT often lies with outpatient facilities that add cardiac CT to their exam portfolio with the help of a new system. Taking the current reimbursement rate for cardiac CT in the USA (hospital outpatient service) as an example, each additional cardiac exam performed would lead to an additional revenue of US$286.40 (CPT code: 75574) [17]. If six additional cardiac exams were performed each week, this would generate an additional revenue of US$68,740 per year (assuming 40 working weeks a year). If ten additional cardiac exams are performed, the revenue increase totals US$114,560 (Fig. 4). An even higher increase in cardiac CT throughput can possibly be achieved in some countries, which in turn translates into an even higher additional revenue generated by introducing DSCT.

In countries such as Germany, the introduction of new reimbursement rates for CCTA exams and the preceding Calcium Scorning scans in the outpatient scenario will open up a new revenue stream for private practices and make the investment in DSCT technology even more affordable.

Improved operational efficiency

Lack of experienced staff to perform advanced procedures is a common barrier to offering cardiac CT exams. While technology alone cannot resolve this situation, the SOMATOM Pro.Pulse can help improve operational efficiency with its integrated AI-powered workflow, myExam Companion.

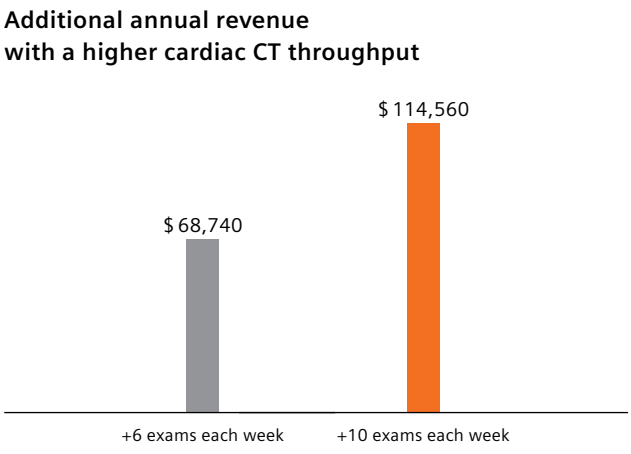

Figure 4: Additional annual revenue generated in a typical U.S. hospital outpatient facility by also performing cardiac CT exams. Reimbursement = US$286.40 per exam; 40 working weeks per year.

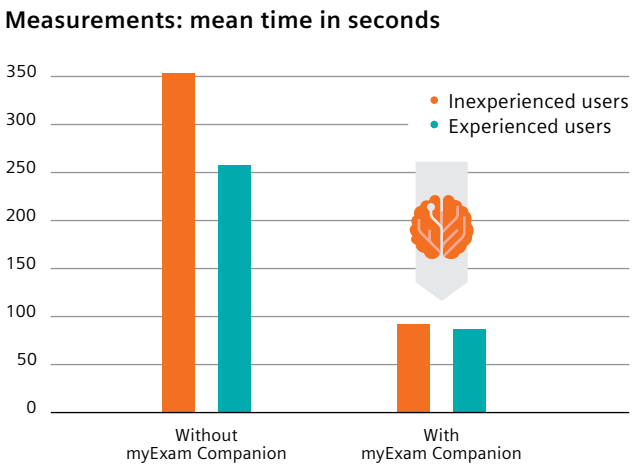

Figure 5: Reduction in the duration of a CCTA exam with the help of myExam Companion.

myExam Companion is an intuitive, guided workflow tool that helps users to perform CT scans. It uses clinical language and visuals that are easy to follow to simplify operation, even for users who are less familiar with CT imaging. The guided operational workflow helps enhance operational efficiency and productivity, which in turn optimizes the utilization of limited resources.

In a study carried out at Kantonspital Baden, Switzerland [18], 15 inexperienced users needed 74% less time with the support of myExam Companion to perform a CCTA examination. Even 31 experienced user profited significantly from the support of myExam companion with an average exam time reduction of 66% (Fig. 5).

According to interviews with clinicians and business managers in medical institutions across Europe, Asia, and the USA [19], the intuitive workflow support offered by systems such as SOMATOM Pro.Pulse was one of the main reasons to invest in DSCT technology, as it maximizes both clinical quality and operational efficiency. This enables healthcare providers not only to provide advanced CT imaging, but also to provide it in a more cost-efficient way. Moreover, the higher workflow efficiency also enables a potential further revenue increase through more CT examinations.

Time gains without beta blocker usage

Usually, optimal image quality in cardiac imaging can only be achieved when the patient has a low and regular heart rate. The recommended target rate is 60–70 bpm during the scan to avoid motion artifacts. When a patient has a higher heart rate, beta blockers are often used to slow down the heartbeat. This is usually done in increments to achieve the right amount of beta blocker to reach the desired heart rate. However, this step-wise administration takes extra time, material, and staff resources. In addition, the patient needs to be monitored for a prolonged period of about 30 minutes after the exam for adverse effects or a further heart rate drop (see Fig. 6).

With its high temporal resolution, DSCT has the potential to reduce or avoid the use of beta blockers because it delivers reliable image quality even at heart rates significantly higher than 60 bpm. This eases the CCTA workflow and may save time for patient preparation and post-examination monitoring. The high intrinsic temporal resolution of DSCT scanners like the SOMATOM Pro. Pulse can save experienced staff time and allow for more CCTA scans, including exams for patients intolerant to beta blockers who were previously excluded from such scans.

CCTA protocol with beta blocker

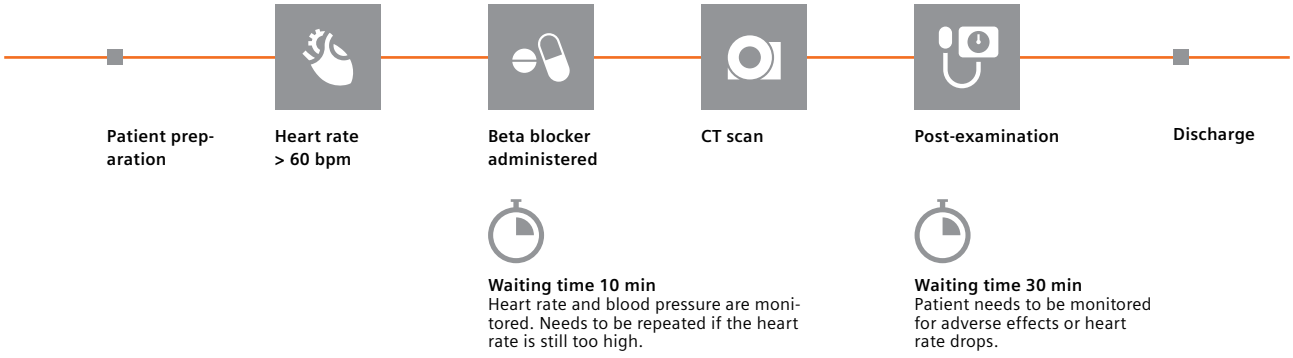

Figure 6: Conventional CCTA workflow with beta blocker for heart rates over 60 bpm.

In a recent study, Kim et al. have shown that with the help of DSCT, the overall CCTA examination time can be reduced by more than 20 minutes when beta blocker administration and heart rate monitoring is not required [20].

Improved patient pathways

To judge the overall value of a new CT scanner, it is also helpful to look beyond its immediate use in individual exams and consider its impact on clinical pathways in general. With its high cardiac image quality, DSCT has the potential to simplify and speed up diagnostic and therapeutic pathways as the example of the EHC Morges Hospital in Switzerland shows.

Nicolas Barras, MD, Head of Cardiology at EHC, decided to use cardiac CT for broader screening of coronary artery disease. With high-quality CT imaging, they could reliably detect the severity levels of the narrowing in the coronary arteries of the patients who subsequently underwent coronary angiography and then benefited from a more precise treatment.

With the installation of a SOMATOM Pro.Pulse, screening scans have now become an integral part of the clinical pathway within the same facility and ideally complement the treatment in the cardiac catheterization lab of the hospital. According to Nicolas Barras, the use of DSCT can potentially reduce the number of diagnostic procedures in the cath lab. This might help reduce the risk for the patients that results from an invasive diagnostic procedure. The time saved in the cath lab can, in turn, be used to focus more intensely on therapeutic procedures.

The new SOMATOM Pro.Pulse at EHC Morges has also proven to be reliable in the acquisition of CCTA scans in an emergency setting. This then opens up yet another field of clinical and financial benefits. Several studies at other institutions have shown that performing CCTA in an emergency situation can help reduce the length of stay and improve cost effectiveness of the services offered by the hospital [21].

In some institutions where the potential of DSCT beyond cardiac imaging has been explored, operational efficiency was improved, especially for patients suffering from bone edema. In the previous pathway without DSCT, patients had to be scheduled for MRI imaging with long waiting and examination times. Using DSCT instead not only added extra diagnostic quality but also helped reduce waiting times, increased patient throughput, and optimized revenue [22].

Conclusion

This white paper outlines some key factors that make high-end CT technology more affordable with the introduction of the next generation of Dual Source CT (DSCT) scanners. It has shown that a system such as SOMATOM Pro.Pulse can maximize the Total Value of Ownership (TVO) by lowering the Total Cost of Ownership (TCO) and also increasing revenue.

Considering the TVO and TCO and the individual factors that influence each can help facilities decide on an investment in a new technology like DSCT and select the most suitable scanner for purchase. While the situation at different institutions can vary, it has been shown that SOMATOM Pro.Pulse enables a lower TCO by reducing the costs of acquisition, site preparation, installation, and power consumption compared with the previous generation of DSCT scanners.

At the same time, healthcare providers can optimize the TVO with the increased revenue that DSCT can bring to their institution in addition to its well-documented clinical benefits. This white paper shows the possibility to improve revenue streams and operational efficiency as well as how DSCT was used in different clinical areas, also beyond cardiology. Further benefits of DSCT include increased patient and staff satisfaction. Although these factors are difficult to quantify economically, they also contribute to an optimized TVO and should be considered in any purchasing decision.

This white paper explains how SOMATOM Pro.Pulse, the latest addition to the CT portfolio of Siemens Healthineers, is a system designed to tackle the financial challenges in healthcare and improve patient access to DSCT imaging.

List of abbreviations

bpm	beats per minute
CCTA	coronary CT angiography
COCIR	European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry
CPT	Current Procedural Terminology (the US procedural code set)
CT	Computed Tomography
DSCT	Dual Source CT
MRI	Magnetic Resonance Imaging
ROI	return on investment
CNR	contrast-to-noise ratio
TCO	Total Cost of Ownership
TVO	Total Value of Ownership

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[1] *Personalization of diagnosis, therapy selection and monitoring, after care and managing health.*

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