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LEARNING OBJECTIVES

1. Explain the concept of total cost of ownership and how it relates to medical devices in the sterile processing department.
2. Discuss direct and indirect costs of TCO for different types of sterilization and disinfection equipment.
3. Discuss recurring costs and other factors that impact TCO for reprocessing departments.

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TCO in the SPD

Forethought can lead to more economical equipment ownership and operation

by Melissa Gonsalves and Sarah Lazzara

When buying a car, we are often motivated to purchase by its looks and its final negotiated price. We don't always consider what it's going to cost to buy insurance for that make and model, how long the car is expected to operate reliably, how much the maintenance, parts and service are going to cost as it ages, how much gas, oil and other operating fluids are going to cost for its daily operation, and how much depreciation we can claim over time. These additional factors are part of the total cost of ownership or TCO, which is defined in Wikipedia as "a financial estimate intended to help buyers and owners determine the direct and indirect costs of a product or system."

In healthcare systems, TCO comes into play for many types of major purchases. In the category of medical devices, TCO is defined as a cost-benefit analysis used to compare medical devices before purchase. Healthcare purchasing decision-makers assess the direct costs, indirect costs and benefits associated with a particular medical device over its useful life expectancy, and develop a value that will reflect the full short and long-term cost of a purchase.

What does TCO mean in today's healthcare environment, particularly when a major

capital expenditure is being considered for a sterile processing department? TCO analysis should involve looking beyond the price of the unit, which might or might not include additional immediate and long-term costs to the buyer.

Let's investigate sterile processing and disinfection systems to understand what the hidden costs could be and how they should influence the overall purchasing practices of a department.

A TCO primer for disinfection and sterilization equipment

A long-term asset is one that is expected to be used for more than one year. In the SPD, most of the sterile processing equipment has a useful expected life of multiple years, or even decades, depending on the equipment and its design. When considering the total cost of ownership for any capital asset*, it's important to consider *direct, indirect, recurring, energy, depreciation, and end-of-life costs* in addition to the capital acquisition price.

TCO can also be affected by the type of process the equipment runs, since specific cost factors may be necessary for one system that are not needed for another. Let's compare the cost factors for some typical

Cost Terms and Definitions	
DIRECT COST	An expense that can be traced directly to a specific cost object such as a department, process or product.
INDIRECT COST	An expense incurred in joint usage that is difficult to assign or identify with a specific department, process or product.
RECURRING COST	A regular cost incurred repeatedly, or for each item produced or service performed.
ENERGY COSTS	Monetary and non-monetary (e.g., environmental impact) associated with the production, transmission and consumption of energy.
DEPRECIATION	The gradual conversion of the cost of a tangible capital asset into an operational expense over the asset's useful life. The purpose of depreciation is to: <ul style="list-style-type: none"> • reflect reduction in its book value because of obsolescence or wear and tear; • spread a large expenditure proportionately over a fixed period to match the benefit received from it; and • reduce taxable income by charging depreciation against the organization's total income.
END-OF-LIFE COST (residual value, salvage value)	The estimated residual or salvage value at the end of a product's useful life. This may include disposal costs (cost of selling, incinerating, donating, dumping).

reprocessing systems found in a central services department:

Steam sterilizers

Steam sterilizers are still considered the gold standard for sterilizing medical instruments and other items that can withstand the high temperatures of steam cycles without sustaining damage. However, since “autoclaves” were first developed more than 100 years ago, manufacturers and users have learned that more is required for effective, consistent steam sterilization than the “box,” a power source and a water supply. In today’s department, the direct costs for steam sterilizers must include not only the installation and plumbing costs for the sterilizers; it must potentially include the purchase and installation of additional systems for filtration, high quality water and steam production, and drainage cooling. These costs will vary depending on the quality of incoming municipal water. Many steam sterilizers have a long useful life – 20 years or more if properly maintained. This allows a long depreciation period that can be factored into the TCO. They can also be remanufactured (rebuilt to their original specifications), which makes them valuable to the original manufacturer as trade-ins. Recurring expenses for steam sterilizers typically include biological/chemical indicators and sterilization wraps/containers for daily use, maintenance contracts and services, and standard replacement parts. Departments also need to provide ongoing personnel training to assure proper operation and maintain compliance with current best practices.

Ethylene oxide (ETO) sterilizers

This method has been available since the 1950s as a low-temperature alternative to steam sterilization for delicate devices. At that time, it was the gold standard for low-temperature sterilization and was compatible with many device materials. ETO is an effective sterilant, but it requires extremely long cycle times (2 ½ hours plus 8-12 hours of aeration time) to allow desorption of toxic residual ETO from the loads. In addition to the unit itself, direct costs for an ETO system include the purchase and installation of special ventilation, exhaust, and disposal systems. It also requires the use of specific validated sterilization containers. In addition to maintenance costs, required recurring costs include the sterilant, personnel monitoring and testing supplies, biological

monitoring and testing supplies, and special wraps to package devices. The use of an ETO system can also result in the need to invest in additional device inventory, which assures enough instruments to maintain the surgical schedule while accommodating the longer cycles.

Hydrogen peroxide (H₂O₂) sterilizers

These systems, designed for heat and moisture-sensitive devices, have been in the healthcare marketplace long enough that there are now a number of system options to evaluate for use in your department. Unlike steam sterilizers, H₂O₂ sterilizers have no costs related to major installation, special plumbing, special exhaust systems, or special water quality equipment (water is not used in H₂O₂ sterilizers). But there will be cost considerations based on your needs, your device inventory and other factors specific to your department. Let’s explore what to consider for a thorough evaluation of H₂O₂ systems.

TCO in detail: hydrogen peroxide sterilizer example

Direct Costs to include

These are costs that your department is responsible for when you acquire the new system.

- **Capital acquisition cost:** This refers to the direct cost of the capital equipment alone. Some sterilizer manufacturers may offer to trade in existing equipment for newer technology, which reduces the acquisition cost.
- **Installation costs:** In some cases, a department may need to make changes to its available space and/or utilities to accommodate a new sterilizer. Consider the following:
 - **Electrical requirements:** do you have the right outlet and voltage, or will you need to pay for additional work to meet the requirements of the new sterilizer?
 - **Space/footprint:** Do you have the floor space needed for the sterilizer and related convenience products such as loading carts?
 - **Additional utilities:** Does the sterilizer require any additional utilities? For example, if an oxygen tank is needed, is additional plumbing or installation necessary?
- **Training costs:** All new sterilizers require that the staff using the equipment be trained on the safe and proper operation of the sterilizer. This is often offered at a cost

by the equipment manufacturer or a third party, but is also offered online by some at no added cost. If your clinical engineering team will be servicing and performing maintenance on the system, they will need to purchase certified training, usually from the original equipment manufacturer or an authorized agent, to maintain the system’s warranties and operational compliance. They may also be required to participate and pay for annual re-certification.

- **Packaging costs:** H₂O₂ sterilizers require specific validated sterilization packaging such as containers, wraps and pouches. If you are not already using the same system in your SPD, you will need to purchase new containers, trays, wraps or pouches for the new sterilizer. When considering trays, select the products that will allow you to maximize use of shelf space in the sterilizer chamber. Getting more out of each cycle will allow you to increase productivity and possibly reduce the number of cycles (and consumable costs) needed to achieve the same throughput.



Indirect costs to consider

- **Device inventory costs:** You will need to review your devices to determine whether or not they are compatible with the type of sterilant being used by the target system. All “gas” sterilants are not created equal – ETO is not the same as H₂O₂ and H₂O₂ is not the same as H₂O₂/ozone. You may

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therefore need to consider either purchasing a different sterilizer, or buying new compatible instruments and devices.

- **Device repair/replacement costs related to material compatibility:** A sterilization process can impact the material components of your reusable devices if it introduces new chemicals or processes. It is important to understand the potential costs of repair or replacement of your devices, and the impact on useful life of the device.
- **Special equipment costs for temperature control, area monitoring or drying:** It's important to check with the sterilizer manufacturer to confirm any additional cost requirements. For example, all devices have to be dry to be processed in H₂O₂ sterilizers, but some systems are more sensitive to moisture and temperature. This may mean that additional equipment for drying the devices and maintaining the optimal temperature will be recommended by the manufacturer.
- **Connecting to tracking systems:** If you are currently using an instrument tracking system, you will need to determine if the sterilizer you are assessing is equipped to talk to your tracking system. If not, you must determine what you will need to purchase to get the new equipment connected.

Recurring costs to add in

It is crucial to understand what you are going to be paying over the life of a piece of equipment. Here are some recurring costs to evaluate for your prospective system:

- **Consumables costs:** sterilant, biological indicators, chemical indicators and other accessories such as a sterilant disposal box. BE AWARE: the cost of the consumables can vary by sterilizer manufacturer. Some companies will heavily discount the capital equipment, but the consumables prices will be much higher than those of others.
- **Cycle costs:** to get an accurate value, look at the big picture of what it is going to cost you to run your sterilizer. The overview includes:
 - **Productivity:** Manufacturers' cycle claims can help determine the number of cycles you can run per day and your yearly cost for consumables. It can help you calculate turnover time on surgical case sets and determine the number of sterilizers you need to meet your throughput requirements.
 - **Aborted cycles:** They happen, and they can cost you time in terms of reprocessing delays, and money for wasted supplies. Some sterilizers can experience a higher

number of aborted cycles, so it's important to investigate the sterilizer design and determine if it could impact your aborted cycle costs.

- **Service and parts costs:** Connect with your clinical engineering team to understand their goals for maintaining the system. If they want to take care of the unit, what are the maintenance and training options? If you are considering a service contract with the sterilizer manufacturer, what are the annual service contract costs, including planned replacement parts? What is and is not covered under your service contract? This will determine potential out-of-pocket costs. Is the company's service team large enough, and local enough, to provide a quick response time so you can optimize your equipment uptime? This could help prevent loss of productivity and delayed/cancelled surgical cases.
- **Operator Maintenance:** Many manufacturers recommend specific tasks for operator maintenance, such as running a special diagnostic cycle weekly or replacing a vaporizer plate. If you are switching to a new sterilizer, be sure to understand these recommendations and calculate in any related costs.

Value-added services that save on costs

- **Workload assessment and recommendation on workflow:** This service, offered as part of the purchase by some manufacturers, is helpful because it will aid in selecting the appropriate type and number of sterilizers to cover present needs and expected future growth.
- **Operator training:** If this is offered as an added benefit of purchase, it will save on the cost of training for operators.
- **Engineering training:** This may be offered as an economical option to allow in-house staff to maintain your equipment while keeping the system in compliance with warranties and best practices.
- **Trade-in services:** If a manufacturer negotiates a trade-in as part of the purchase, this could save on purchase cost and on end-of-life costs to dispose of or move an old system.

Ready for your next TCO analysis?

Although this module is not exhaustive in scope, it does provide some typical examples of the types of potential costs and factors involved in a sterile processing long-term asset acquisition. It can help set the framework for a thorough TCO evaluation before you make a major equipment purchase.

Purchasing a healthcare capital asset can seem like a huge undertaking, but there is support available. And, by conducting a thorough TCO analysis, you will avoid unnecessary costs and select the optimal system for your needs and budget. Membership organizations like MD Buyline (mdbuyline.com) and ECRI Institute (ecri.org) may be able to provide useful comparative information. In addition, some equipment manufacturers are willing to provide a wealth of added support. Check to see if your prospective system's equipment manufacturer will help you by providing TCO information, assisting with low or no-cost in-servicing and education, providing measurements and information to help with workflow design, shipping and installation, reviewing your device inventory, and providing tools such as competency checklists and work instructions to make the transition smooth and painless. **HPN**

*A capital asset is one that is not easily sold for cash, and that typically plays a role in the organization's productivity or ability to turn a profit. In addition, a capital asset is expected to provide benefits that extend beyond a calendar year.

**Semi-critical medical devices are those that come into contact with intact mucous membranes and do not ordinarily penetrate sterile tissue. Reusable semi-critical devices should receive at least high-level disinfection, which is defined as the destruction of all vegetative microorganisms, mycobacterium, small or nonlipid viruses, medium or lipid viruses, fungal spores, and some bacterial spores.

Melissa Gonsalves, BS, MEM, is the product manager of Low Temperature Sterilization Solutions at STERIS Corporation. She is responsible for the development and distribution of hydrogen peroxide gas sterilizers. Melissa holds a B.S. in Biomedical Engineering from Michigan Technological University and a Master of Engineering and Management from Case Western Reserve University.

Sarah Lazzara, BS, MBA, director of IPT Marketing at STERIS Corporation, is responsible for the management of sales and marketing for the Company's Vaporized Hydrogen Peroxide (VHP) technologies. She received her BS. in Management Information Systems from Pennsylvania State University and her MBA from Lake Erie College. Sarah is also a certified Lean Six Sigma Black Belt.

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TCO in the SPD

Circle the one correct answer:

1. **TCO in the healthcare environment can be defined as:**
 - a. A cost-benefit analysis used to compare medical devices before purchase
 - b. An assessment of the direct costs, indirect costs and benefits associated with a particular medical device over its useful life expectancy
 - c. A value that will reflect the full short- and long-term cost of a purchase
 - d. All of the above
 - e. a and b
2. **TCO analysis should involve:**
 - a. The price of the unit
 - b. Immediate and long-term costs
 - c. Energy costs
 - d. a and b
 - e. All of the above
3. **The purpose of depreciation is to:**
 - a. Reflect reduction in value because of obsolescence or wear and tear
 - b. Spread a large expenditure over a fixed period to match the benefit received
 - c. Increase taxable income by adding depreciation to total income
 - d. None of the above
 - e. a and b
4. **Direct costs are costs that can be traced directly to a specific sterilizer**
 - a. True
 - b. False
5. **Direct costs include those for the system, installation, sterilization packaging, room cleaning, and training.**
 - a. True
 - b. False
6. **Expenses for biological indicators, sterilant, wraps and maintenance parts are recurring costs.**
 - a. True
 - b. False
7. **Aborted cycles, if they occur frequently, could carry an ongoing recurring cost for wasted supplies.**
 - a. True
 - b. False
8. **If the H₂O₂ system you select is highly sensitive to moisture and temperature, it may require added expense in the form of _____ recommended by the manufacturer.**
 - a. Pre-cleaning equipment
 - b. Soft drying towels
 - c. Device-drying and temperature control equipment
 - d. Sterilization wraps
9. **Some manufacturers offer services that reduce overall cost or add value. These may include:**
 - a. Device audits and workflow assessments
 - b. Training for operators and in-house engineers
 - c. Additional installation requirements
 - d. a and b
 - e. None of the above
10. **To achieve an accurate TCO, it's important to understand what you are going to be paying over the useful life of a piece of equipment.**
 - a. True
 - b. False



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