# Tips for Setting Scientific Targets on Energy and Water Saving

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## Abstract

Energy and water-saving are always a hot topic in manufacturing. Many countries have a legal requirement to use high energy- and water-efficient equipment to reduce resource consumption, and voluntary environmental compliance programs also regularly inspect this. For example, the Higg Index, amfori Business Environment Programme Initiative (BEPI) and Initiative Clause Sociale (ICS) environmental audit program all include energy- and water-efficient equipment requirements. In addition to these drivers, factories themselves can actually benefit from energy reduction programs to save costs.
Yet, despite these incentives, many factories struggle to set good, scientific targets for their reduction programs and common questions include:

- What needs to be considered when setting a target?
- Which baseline should be used: an absolute or normalized baseline?
- Should targets be set long-term, e.g. five years, or should they be established year over year?

In this paper, UL's experts will provide guidance on setting proper baselines and targets and on introducing energy- and water-saving measures

The steps we will be looking at in more detail below are:

- Choosing a traditional year as baseline and creating a proper baseline base (Absolute or Normalized).
- Identifying the highest energy- and water-use processes as well as possible administration and engineering control programs for reduction.
- Setting energy- and water-saving targets that follow the SMART principle (Specific, Measurable, Achievable, Relevant, Time-Bound).

## 1. How to set a good baseline on energy and water consumption

Before introducing improvements on energy use or water reduction, a factory should first establish a scientific baseline as a starting point for future comparison. Normally, data for a full calendar year establishes this baseline. For example, the volume of water consumed in 2020 determines the baseline, and future performance is measured against this baseline to demonstrate improvement.

Key factors to consider when choosing your baseline year:

- The data in your baseline year must be complete and accurate. This means complete and accurate data must exist for the full year. For example, if you only have 10 months of electricity consumption data in 2020, and the remaining two months are missing accurate data, 2020 is not a suitable baseline year.
- If you are setting your energy target for the first time, make sure you select a recent year in which your factory has had stable operations. For example, the COVID-19 pandemic in 2020 may have led to operational changes and not be the most suitable year to establish your baseline. In this case, a previous year such as 2019 may be a better choice.
- Whether you have a long-term strategy in place to save energy and water. For example, some Chinese factories were subject to local government control for energy consumption and efficiency for a longer-term period between 2016 and 2020. In this case, the year 2016 created the baseline for the entire period of 2016-2020. In other cases, a company may select similar longer-term strategies, e.g., planning to reduce energy consumption by 20% between 2018 and 2025. In this case, 2018 would serve as the baseline for the entire period. When a factory does not have a long-term strategy, the most common baseline is the previous calendar year, e.g., reduce the water consumption by 3% by the end of 2020 compared to 2019. In this case 2019 becomes the baseline year.

Besides choosing an appropriate baseline year, factories must also choose what type of baseline to select. Two options exist:

1. Absolute baseline: the total energy or water consumption in a full calendar year. For example, 10,000 kWh electricity consumed overall in 2020 would be an absolute baseline.
2. Normalized baseline: the energy or water consumption per unit, e.g., piece, kg, ton, value, person) rather than the total quantity. An example of a normalized target would be 0.84 kWh of electricity consumed per product in 2020.

Overall production volume can quickly impact absolute baselines and distort a factory's real energy consumption. For example, where factories may have several saving programs that introduce significant measures, these improvements may be distorted by any production increases that may not clearly show the achievements made. On the other hand, any decrease in production would create the appearance of energy savings. Absolute baselines are therefore not recommended as the preferred baseline. Factories should instead consider using normalized baselines.

As we've seen, when normalized baselines are used, factories will need to select the units measured. It is recommended to use unit of production to measure the energy use. Units can be measured in pieces, meters or tons. Here is an example of a factory that produces dyed fabric for reference:

| 2020 annual volume (meter) | Electricity consumption in 2020 (kWh) | Natural gas consumption in 2020 (m3) | Water consumption in 2020 (ton) |
|---|---|---|---|
| 1,000,000 | 2,000,000 | 500,000 | 5,000,000 |

In this example, the normalized baseline in 2020 will be:

Electricity: 2 kWh electricity consumption per 1 meter product in 2020

Natural gas: 0.5 m3 natural gas consumption per 1 meter product in 2020

Water: 5 ton water consumption per 1 meter product in 2020

Note: If you have multiple products and use different units of measure, e.g., fabric A uses meters but fabric B uses tons, we suggest internally aligning measurements, so the same units of measure are used everywhere.

For water use: if water is only used for domestic applications such as restrooms, cleaning and canteens, the suggested unit is number of persons, e.g., 3.2 tons water consumed per person in 2020.

## 2. How to identify the administration and engineering control reduction program

After establishing a clear and scientifically-based energy and water baseline, it can be tempting to immediately set an ambitious target like "Reduce water consumption per unit product by 15% in 2021 compared to 2020." However, in practice, this target may not be realistically achievable in most cases.

Instead, a more thoughtful next step would be to identify your space for reduction in the next year — or the next three to five years, if you have a long-term strategy — and then design the energy/water-saving plan accordingly. A basic principle of environmental management is that of continuous improvement and factories are encouraged to create savings plans year-on-year and eventually over longer periods (or immediately, if required by environmental program standards such as the Higg Index or a wider corporate strategy). Because most energy-saving plans require some investment, ensure that senior leadership approves the proposed energy saving plan.

It can be useful to consult with an expert, either internal or external, for a complete energy audit or water analysis in order to fully assess the energy and water use performance in your factory and identify areas for improvement. Besides using an external party, you can apply following principles to your internal analysis work:

- Start by identifying the highest energy- or water-use processes in your facilities, considering all aspects of operations. Ancillary facilities should also be in scope, including boilers, generators and compressed air systems. This exercise will allow you to know what processes consume the most energy or water and will allow you to strategically target these factors to improve energy or water efficiency.
- Understand the costs of the saving program you are proposing. Many resource reduction efforts require significant up-front investment. It is important to understand the mid- to long-term savings that can be achieved in order to obtain buy-in. This will also help you know whether you qualify for any government or investment programs that could provide subsidies to offset the investment.
- Learn from the best practices available from factories in your same industry. Many brands host webinars or seminars to showcase energy- or water-saving practices in their supply chain. It can be a good opportunity for you to learn from those best practices.

Investment in energy-saving programs can be valuable and provide many benefits. For example, in China, an investment of approximately $31.5k is required to update the effluent treatment plant (ETP) for wastewater reuse. Once updated, the water can be reused and you will save the water purchased from the government by $7.8K each year. This means the investment can be recovered after four years while the program itself continues saving money in the following years. Meanwhile, the impact to the local environment is also reduced since less wastewater is discharged.
The following list offers some common energy- or water-saving programs you can consider. Some of these programs are focused on administrative control, which means no investment is required, while others are engineering control programs:

| Administration program | Engineering program |
|---|---|
| Worker awareness training | Collect the rainwater and reuse it |
| Optimize the facility layout to prevent unnecessary energy loss (There is only one production line operated in 1st floor while there are 3 production lines operated in 2nd floor; a good way to save energy is to move the production line in 1st floor to 2nd floor so that the light and Air conductions in 1st floor will be saved.) | Reuse the treated wastewater for nonproduction (e.g., toilet, low cost) or production line (e.g., further treatment required, high cost) |
| Ensure no water and steam leakage in its pipelines, especially for the factory, which has long transportation pipes. Regularly monitor the pipelines and repair them when necessary | Heat and steam recovery |
| Pick off unnecessary lights to reduce electricity consumption | Use energy saving lamp, or induction lights/tap to reduce electricity consumption. |
| Control the air conditioning running time and temperature | Use high water-/energy-efficient equipment to replace the old one. |
| | Update the compressed air system by optimizing the pressure, temperature and the motor. |

See the sample savings plan in the below example. To make continuous improvements, the factory concentrated on a different energy saving program each year. Estimated electricity savings are calculated and can be used to set a reduction target. Administration efforts do not require any form of investment.

| Energy Savings Plan | | | |
|---|---|---|---|
| **Year** | **Energy Saving Program** | **Type** | **Estimated saving (kWh)** |
| 2017 | Raising employee awareness by training | Administration | 1,868,000 |
| | Control clean room equipment running time and illumination time | Administration | |
| | Shut down the office illumination during rest time every day | Administration | |
| | Install new energy-saving equipment inside air compressor machine | Engineering | |
| 2018 | Shorten running time of drinking machines in office during the night | Administration | 24,000 |
| | Compressor variable frequency renovation | Engineering | 320,000 |
| | Pick off some daylight lamp in hallway room of half-clean room area | Administration | 24,000 |
| 2018 | Reduce dryer regeneration power consumption | Engineering | 640,000 |
| | Use the air from clean room to reduce compressor room temperature | Engineering | 580,000 |
| | Replace T8 fluorescent tube lighting in office areas to the T5 tubes with electronic ballasts | Engineering | 20,000 |

## 3. How to set a SMART energy and water-saving target

SMART goals are set according to five principles:

- Specific — Target a specific area for improvement.
- Measurable — Quantify or at least suggest an indicator of progress.
- Achievable — Stretch your goal to make you feel challenged but defined well enough that you can achieve it.
- Relevant: Ensure the target should matter to the facility operation.
- Time-bound: Specify when the result(s) can be achieved.

After setting a baseline and identifying areas of improvement, SMART targets for energy- and water-saving can readily be set. Take energy consumption as an example: The 1st step is setting a baseline of energy use, and it is 1.2kWh electricity consumption per meter fabric in 2019; the 2nd step is identifying energy saving programs, and result is about 5% electricity can be saved in 2020; finally you will be able to set a written energy saving target as below:

| Energy Savings Plan | | | |
|---|---|---|---|
| | **Energy Saving Program** | **Type** | **Estimated saving (kWh)** |
| Electricity saving target | Electricity consumption per meter fabric in 2019<br>Baseline: 1.2kWh per meter | Reduce the electricity consumption by 5% in 2020<br>Target: 1.14kWh per meter | 1. Worker awareness training<br>2. Replace the old dyeing equipment with new energy efficiency ones<br>3. Optimize the dyeing parameters to reduce electricity consumption |

This specific target focuses on electricity consumption. You can measure the result in the first quarter of 2021 when you have the complete data of 2020. This target is also achievable since three reduction programs are in place, and the target completion date is Dec. 31, 2020.

Here is another example for water saving:

| Energy Savings Plan | | | |
|---|---|---|---|
| | **Energy Saving Program** | **Type** | **Estimated saving (kWh)** |
| Water saving target | Water consumption per meter fabric in 2019<br>Baseline: 0.8ton per meter fabric | Reduce the water consumption by 5% in 2020<br>Target: 0.76ton per meter | 1. Worker awareness training<br>2. Collect the steam from finishing process and reuse it in dyeing process<br>3. Reuse the wastewater by advanced treatment of the wastewater |

## Conclusion

Setting SMART and scientific targets requires factories to have a good understanding of their energy or water consumption performance. This can sometimes be a complicated task to complete, especially when upfront investment is required. It is important to remember that the facility can also benefit from these energy- and water-saving programs in the following ways:

- Operational cost reduction
- Compliance with local law requirements on energy and water use, e.g., some factories in China are subjected to the clean production audit, which requires energy- and water-saving; some factories in Bangladesh are required to implement the 3R (reduce/reuse/recycle) program for energy and water per the clause of the environment clearance certification.
- Demonstrate sustainable practices to clients in line with their expectations, e.g., Higg index is a tool used by many brands to measure the factory's environment performance. The tool covers 7 sections which include energy and water; energy and water target setting and saving program are the core questions in those sections. I add this sentence so that the reader will know that a good system on target setting will also help them to have better performance on Higg. Good performance on this can help you to earn a higher score.

## Useful resources for energy and water saving best practices

1. NRDC: NRDC's 10 Best Practices for Textile Mills to Save Money and Reduce Pollution (PDF). Guidance from Natural Resources Defense Council (NRDC) on how to reduce the water and energy in an effective way in textile mills.
2. Understanding Cost-Effectiveness of Energy Efficiency Programs. U.S. Environmental Protection Agency
3. SME Energy Saving Handbook. Energy saving guidance for the small manufactory by Lovinggreen.
4. WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities. The Office of Water, U.S. Environmental Protection Agency

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