CUSTOMER SUCCESS

Fab mitigates carbon footprint with new energy efficiency initiatives

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CHALLENGES

20% of a Fab's power consumption is from vacuum and abatement processes

Semiconductor manufacturers are striving to reduce greenhouse gas (GHG) emissions while meeting increasing demand for products. Implementing energy efficiency strategies across the Fab has rapidly increased in priority.

Utility consumption, including power, water and process gasses are a prime target for vendors and manufacturers across the supply chain to put in place measures to reduce their carbon footprint.

This Fab needed a reliable way to reduce the environmental impact and utility costs associated with SubFab operations. The vacuum and abatement systems are designed to perform 24 hours a day, seven days a week. However, significant utility cost savings can be achieved by putting equipment into a low power "Green Mode" when the process tools are idle.

Although electrical power was the chosen utility, a process was needed that could be applied to combustible fuel, waste water treatment, purge gases and other consumables.

*Source: Green Mode Overview Customer Study 2017, Edwards Vacuum

TYPICAL FAB ENERGY CONSUMPTION

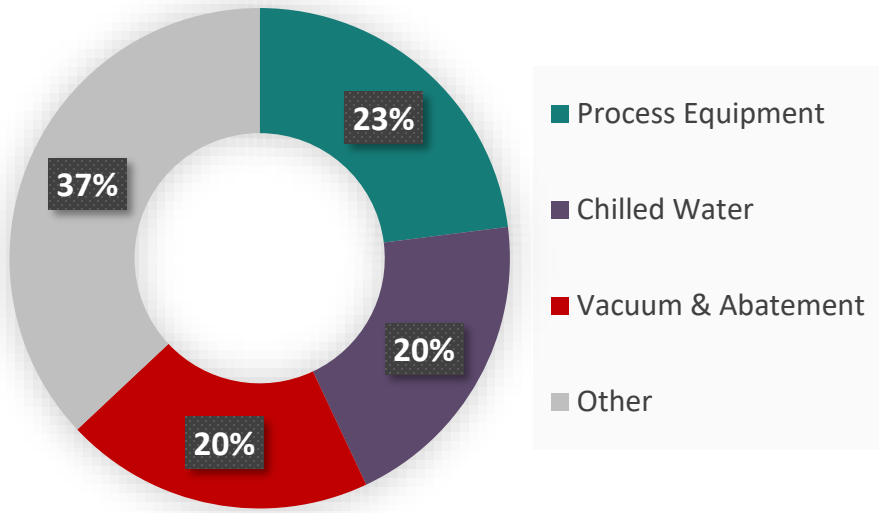


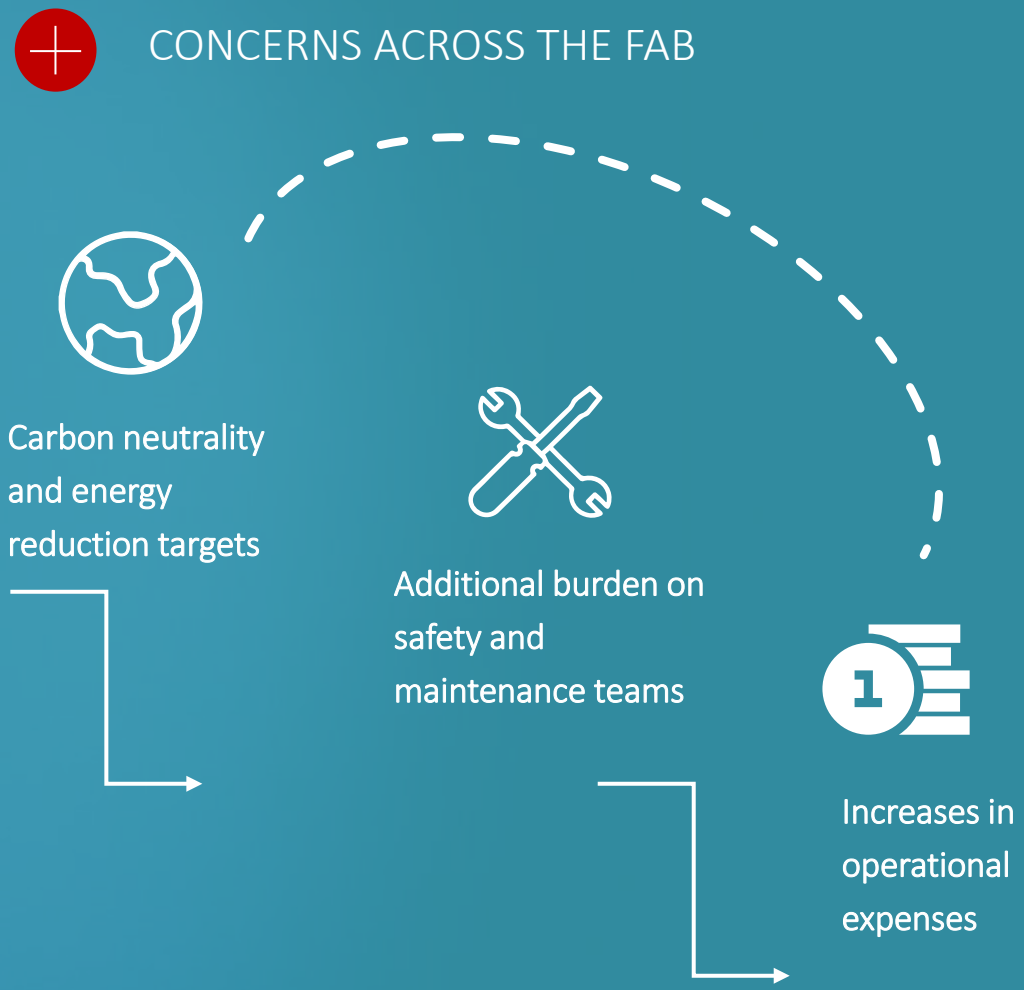
*Figure 1: A 300mm Fab

Unnecessary power consumption and operational costs

The challenge did not lie with the equipment but in establishing a reliable process for communicating when to start and end “Green Mode” status from the process tools to the vacuum system. Not all process tools have a “Green Mode” signal available for this function.

Leaving the system in “Production Mode” unnecessarily increased the risks to expensive process tools, wafer products, and the safety of personnel. Switching to lower energy usage when a process tool is idle, or during maintenance, would minimise both utility consumption and operational costs.

In search of a more effective and accurate energy efficiency strategy, this facility enlisted our help.



SOLUTION

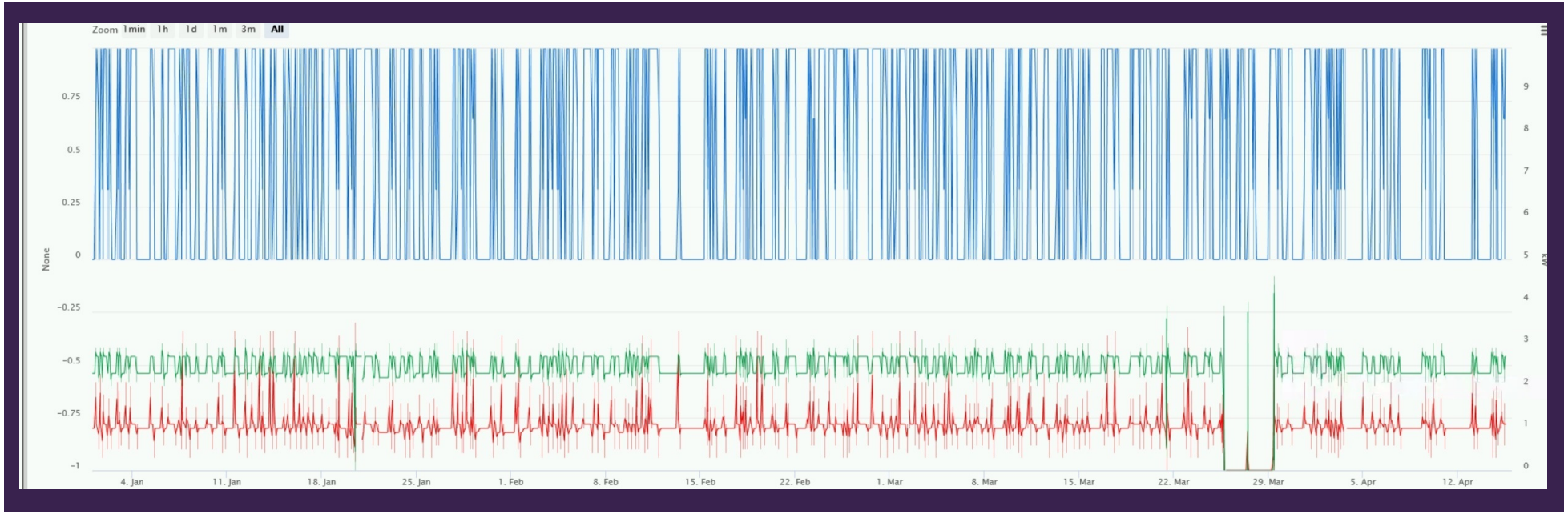
Enabling efficiency savings

The SubFab teams applied a monitoring system to gather data for assessment. To make sense of the data and validate any proposed improvements, the process tool managers collaborated with the Edwards team to create the best-fit solution.

The solution was installed on a three-chamber deposition cluster tool with three process chamber pumps, a load lock pump and a transfer chamber pump. By using the load lock pump activity as an indicator, the team could monitor power consumption variations.

When there is no activity, the monitoring system signals the process chamber pumps to enter low power “Green Mode”. After repeated investigations this proved a reliable indicator of the operating status of the process tool.

- Load Lock: Process On/Off
- Booster Power
- Dry Pump Power



The opportunity to save energy

Data was collected from our monitoring and analytics system over a 126-day period. Although the site was in full operation, a surprising amount of “off process” time was observed over that period. The data shows the average off process time to be 61%. The combined booster and dry pump power on process was on average 4.5kW and reduced to 3.2kW in Green Mode.

Green Mode saving on the process tools

61% Average “Off Process time”

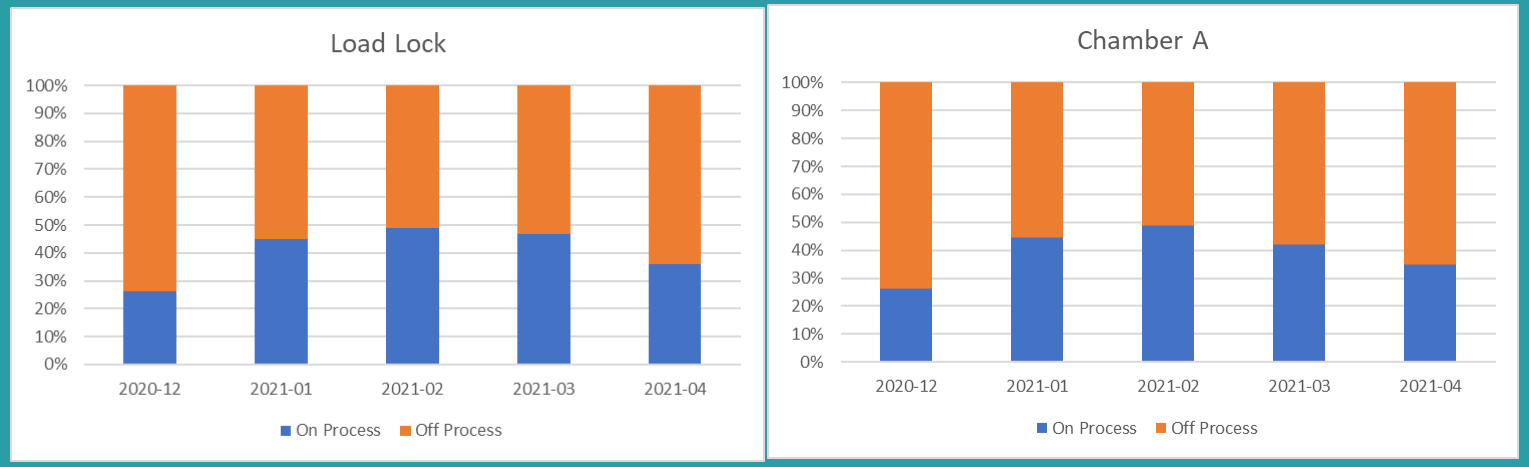


Figure 2: On/Off Process figures from monitoring system over 126 days

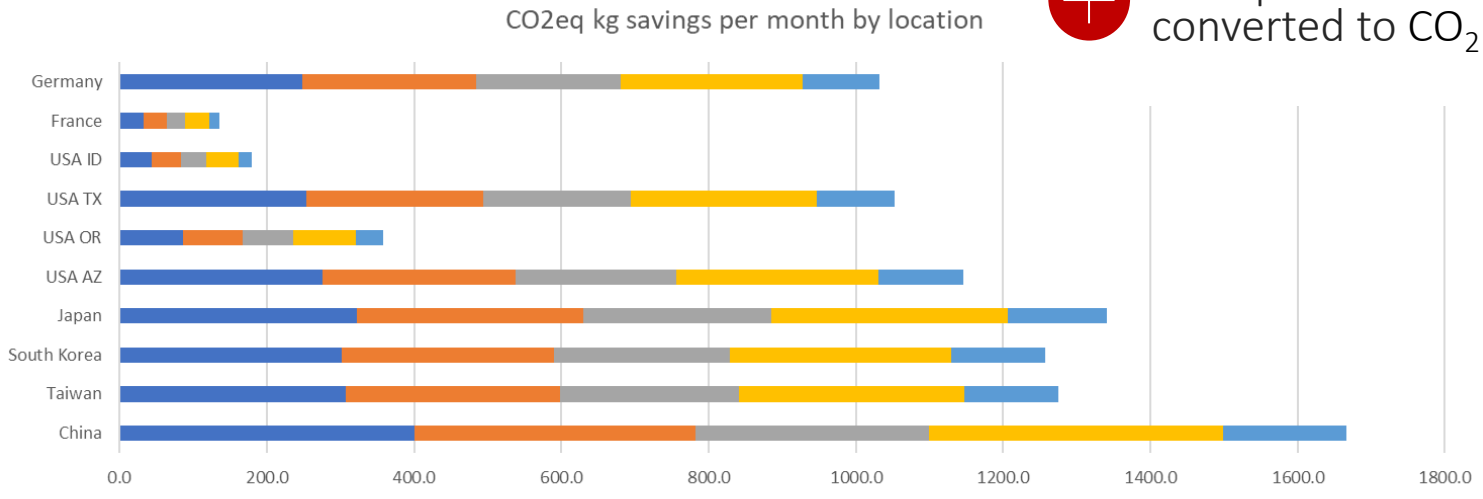
OUTCOME

Potential saving of 394 CO_2eq kgs per pump per year

The savings during the 126 day period equates to 2,344kWh for each process chamber pump. If the utilisation remains at this level, that is the equivalent of 6,792kWh per pump per annum. For this European customer the CO_2 equivalent saving would equate to 136 CO_2 eq kgs for each process chamber pump (equivalent of 394 CO_2 eq kgs per pump per annum).

This trial proved a successful step in their strategy to reduce GHG emissions. The manufacturer expects to extend the process across this site and others, truly demonstrating their commitment towards carbon reduction and energy efficiency in manufacturing.

Examples of the energy savings converted to CO_2 by country



	China	Taiwan	South Korea	Japan	USA AZ	USA OR	USA TX	USA ID	France	Germany
2020-12	401.2	307.0	302.5	322.8	276.0	86.0	253.3	43.2	32.7	248.3
2021-01	381.1	291.6	287.3	306.6	262.1	81.7	240.6	41.0	31.1	235.8
2021-02	317.3	242.8	239.2	255.3	218.2	68.0	200.3	34.1	25.9	196.4
2021-03	399.7	305.8	301.3	321.5	274.9	85.7	252.3	43.0	32.6	247.3
2021-04	167.6	128.3	126.4	134.9	115.3	35.9	105.8	18.0	13.7	103.7

FURTHER LEARNING

To explore more opportunities to increase SubFab efficiency, download the infographic "5 reasons to align the Clean Room and the SubFab" edwardsinnovation.com/operational-excellence

Sources for conversion of electrical energy to CO_2 eq kgs
www.electricitylocal.com/states/oregon/hillsboro/
www.eia.gov/dnav/ng/ng_pri_sum_a_epg0_pin_dmcf_m.htm
www.ceicdata.com/en/china/gas-price-36-city
www.globalpetrolprices.com/natural_gas_prices/
www.eia.gov/electricity/data.php
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/920484/table_531.xlsx

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