



European Power Quality Survey

SEMICONDUCTOR INDUSTRY

EXPENSIVE PRODUCTION LOSSES
DUE TO INADEQUATE POWER SUPPLY

At semiconductor manufacturing plants, Power Quality (PQ) solutions can be the deciding factor in maintaining competitiveness

Semiconductor production lines are designed to print an ever higher number of integrated circuits on one chip. However, increasing production complexity also increases the sensitivity to irregularities in the power supply. The semiconductor industry has adopted various mitigatory solutions, but nevertheless poor Power Quality generated production stoppages still happen, resulting in costly process failures.

A European Copper Institute (ECI) Survey has identified that poor Power Quality (PQ) costs semiconductor manufacturing companies up to 10 per cent of their pre-tax profits (EBITDA). Consequently, making production lines immune to irregularities in the power supply can be a decisive factor in maintaining the competitiveness of a semiconductor manufacturer.

Several phenomena affecting production equipment

It happens more often than one cares to remember that short power interruptions affect key equipment (lithography equipment, vacuum pumps, ion implanters, etchers, memory testing benches...), bringing a production line to a halt. The same counts for short variations in the voltage supply level (dips or surges).

Apart from those issues that seriously affect power availability and were also quantified by ECI's PQ Survey, other PQ phenomena can also affect semiconductor plants' equipment, namely uncontrolled harmonics. According to ECI's industry contacts, those phenomena are seen to be of increasing – as yet unquantified – management concern.

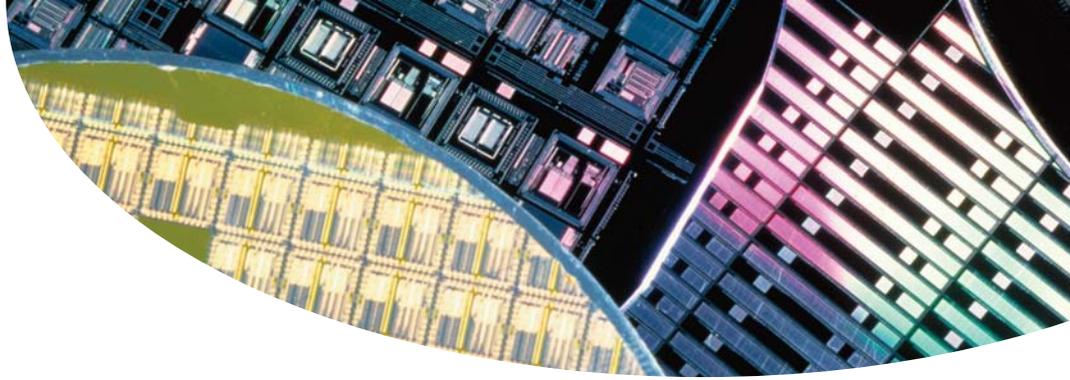
Wide ranging financial losses caused by inadequate Power Quality (PQ)

Semiconductor production line failures result in production losses that are both extremely costly and seriously undermine the companies' efforts to minimize material wastage. The immediate consequences are:

- **Wasted Work In Progress** and raw materials (eg. etching and polishing)
- **Wasted man-hours** between stoppage and re-start
- **Equipment damage**
- **Additional maintenance efforts** to re-start the process

These impacts usually disrupt production planning and can result in **delivery delays**, unfulfilled client contracts, loss of reputation for reliability and consequently loss of business. Another main problem is that these losses, again according to the Survey, **tend not to be assessed as a totality**, relating as they do to different cost centres and occurring at different moments in time.





PQ problems faced by the semiconductor industry are often caused by the end users' own electrical installations' inadequate design

€40 MILLION FOR ONE POWER INTERRUPTION

A semiconductor manufacturing plant experienced a production line break-down nearly every week. Those breakdowns were caused by dips in the electrical supply voltage. The total cost of each breakdown mounted up quite dramatically, consisting of lost production, raw material losses, staff downtime, the time to recover production loss, equipment damage, and maintenance costs to restart the process. Some of the events also resulted in penalties for unfulfilled client contracts and for environmental issues. In one case, the cost of a single interruption mounted to over €40 million. The total annual cost of the power interruptions in this company's case was estimated to be in the region of €88 million.

UNDERSTANDING THE PROBLEMS – DESIGNING THE SOLUTIONS

ECI's PQ Survey demonstrates that the majority of the PQ problems faced by the semiconductor industry result from the end users' own electrical installations' inadequate design. The solutions therefore lie very much in the industry's own hands.

Electrical design engineers involved in this survey recommend a holistic approach to review all the issues at hand, based on three operational pillars:

- ▶ **Correct measurement**, to assess the full impact of PQ events, and why they are happening
- ▶ **Appropriate design** for the electric installations, beyond the most stringent SEMI standards as required to ensure system reliability and resilience
- ▶ **Considered investment** justified by assessing system renovation cost set against the accumulated losses

PROFITABLE INVESTMENT OPPORTUNITIES

The semiconductor sector suffers unnecessary financial losses caused by their own electrical power systems that often cannot cope with a variable electric power supply. ECI's Survey has identified extensive financial losses and much resource wastage due to poor PQ in this sector. It has demonstrated that PQ solutions in the main cost less than the financial losses they resolve.

Current investment into PQ solutions for the companies interviewed was 3% of net margin and the average losses caused by unresolved PQ issues accounted for over 28% of their annual electricity bill.

Do you know what PQ is costing your organisation?

Your engineering management can contact us at <http://contact.leonardo-energy.org> to find out how the issues raised here may be affecting your company.