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More carrot, less stick

Europe is driving forward the expansion of the semiconductor industry on a massive scale. But subsidies must be linked to sustainable production

What do 12 million European households, Europe's chemical industry and German agriculture have in common? That's right – high greenhouse gas emissions. In the last five years, all three areas have emitted more than fifty million tons of greenhouse gases – not in total, but each in its own right. It is clear that these emissions are dramatically impacting the climate crisis — after all, the topic has been a subject of public and political debate for many years.

Less well known, however, is the fact that a climate offender of a similar calibre is set to join the club very soon: the European semiconductor industry, whose expansion is being heavily promoted by the EU and some Member States. Its energy-intensive processes, polluting chemicals and high water consumption are threatening to turn it into a genuine obstacle on Europe's path to a green future. On the positive side, the chip industry is also in a position to systematically combine technological progress with environmental and climate protection. For this to be successful, however, we need to be proactive and take immediate action — while keeping a close eye on the ins and outs of semiconductor manufacturing.

Why the twin transition is vital

More than four years have passed since Thierry Breton, the former EU Commissioner for the Internal Market, first highlighted the strategic importance of semiconductors at the Hanover Fair and announced huge investments in European semiconductor manufacturing. Much has happened since. In particular, the goal enshrined in the European Chips Act of manufacturing at least 20 per cent of the world's semiconductor requirements in Europe by 2030 has stayed in people's minds — and it causes controversy each time the first sod of a new construction project is symbolically turned.

Justifications of why this massive expansion is necessary are not in short

supply. Firstly, buzzwords such as the strengthening of technological competitiveness and economic security in geopolitically challenging times regularly feature. Secondly, there is talk of semiconductor technology being key to the green transition; support for initiatives in this field is, however, generally limited to smaller research and development projects.

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Whilst all of this may apply, it is noticeable how little attention is paid to one of the most important aspects: how the expansion of semiconductor manufacturing with its high emission levels will be a barrier to European climate neutrality, if we do not pave the way now for a greener manufacturing approach. The longer politics turns a blind eye to the problem, the more serious it will become, especially as it cannot be resolved overnight.

The root of the problem is the lack of a European semiconductor strategy with feasible goals that systematically takes environmental and climate policy into account right from the start. Europe will succeed neither in becoming the first climate-neutral continent nor in strengthening its technological competitiveness, unless both elements of this so-called twin transition are considered jointly. A strategy that devotes equal attention to both aspects would not only avoid posing a threat to technological competitiveness but would, in the best case, provide Europe with a geographical advantage.

Untapped potential

But how do we go about it? Let's start by taking a look at the ins and outs of the manufacturing process. Semiconductors are tiny, technically highly complex and have a variety of applications, depending on their function in our digitalised world — a modern smartphone processor has little in common with the power semiconductor used to charge an electric car. As a fundamental technology, the survival of countless sectors depends on chips — and at the same time, they are the engine powering technological progress.

The strengths of the European semiconductor ecosystem are similarly complex and diverse. European companies are frequently market leaders or even have a monopoly — in supplier markets such as equipment as well as in chemicals. When it comes to reducing the use of water or energy or developing alternative chemicals with a smaller ecological footprint, the potential is correspondingly large.

Europe could take the lead in the field of greener manufacturing technologies, thereby killing two birds with one stone: European production emissions would be reduced, and a long-term global competitive advantage would develop over time. None of this will happen overnight. Alternatives to PFAs and fluorinated gases are still a decade away, even if we act now — and they will require significantly higher investments in research and development and in the right infrastructure.

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European companies are also market leaders in the fields of sensor technology, automotive chips and power semiconductors, to name but a few. Against a backdrop of the American and Chinese tech rivalry and the boom in AI, the most modern, cutting-edge chips with the smallest technology nodes have recently become a hot topic, driven by their capacity to enhance the performance of new smartphone or server generations. In most cases, however, these particular chips cannot be regarded as pioneers of green change.

For this purpose, semiconductors with larger process nodes, whose differing physical characteristics stand out rather than their processing power, are needed. Examples include gallium nitride- rather than silicon-based power semiconductors that are used in inverters for photovoltaic systems or in the charging infrastructure for electric vehicles. Despite high market entry barriers, Chinese companies are continuing to catch up in these areas.

What a holistic approach could look like

If Europe is to remain competitive and consolidate its long-term market leadership also in this area, greater political awareness and targeted investments are required that go further than small research and development projects. The recent case of the Belgian company BelGaN demonstrates that this focus has so far been lacking: even though this new company with its gallium nitride technology could make an important contribution to electromobility and the energy transition, it was forced to declare insolvency at the beginning of August.

The second pillar of the EU Chips Act, the subsidisation of semiconductor manufacturing, which did not exist in this form in Europe till now, is the most important driver for expanding chip production, with individual construction projects being supported by

amounts in the double-digit billions — an approach with plenty of carrots but few sticks. One option that so far remains untried involves linking these high subsidies to some minimum requirements, to oblige companies to manufacture as sustainably as possible. This approach could, for example, involve the continual expansion of local renewable forms of energy. A further stipulation could involve high water consumption being compensated by a predefined share of water recycling. It is also conceivable that a share of investments be allocated to the research and development of more sustainable semiconductors.

In Europe, the expansion of semiconductor production clashes with the plan to ban PFAs.

Even though it sounds like a platitude, resolving the sustainability problem in chip manufacturing requires a holistic approach that gives equal consideration to aspects of economic and national security, geopolitical and economic dependencies, the goal of competitiveness and environmental and climate protection. This is the only way for political initiatives to be developed that do not run counter to some part of the goals. An example of this is New York State's Green CHIPS Program, which links public financing to compliance with social and ecological standards and to the promotion of sustainable manufacturing. In Europe, however, the expansion of semiconductor production clashes with the plan to ban PFAs. This lack of coordination could be overcome by not only developing internal knowledge but also by sharing it with others.

The large number of international crises has meant that political initiatives have been reactive in recent years, with a one-sided focus on economic security. In individual cases, this may have been understandable, but it has led to the wholesale neglect of climate and environmental issues in the chip industry. Change is long overdue. Visionary thinking is now required — a long-term semiconductor strategy that builds on Europe's 'green' strengths and creates a clear framework for more sustainable production can lower the costs of the green transition and position Europe as a pioneer in the fields of both technology *and* climate protection. Competitiveness and ecological sustainability do not exclude one another — but to link them, it is necessary to set the right course now.



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