

The Technology Is Ready. Now What?

A warning is not a blueprint.

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A warning is not a blueprint.

It can tell us what must change, but it cannot establish what will work instead, who will finance it or how the institutions involved are supposed to make it happen.

After roughly twenty-five years working with electrification, vehicle fleets and industrial transformation, I have learned to be cautious about one announcement: *The technology is ready.*

Quite often, it is. That is when the difficult questions begin.

We live in an age of remarkable technical capability. We can generate renewable electricity at industrial scale, store it, develop increasingly sophisticated machines and automate work that once required considerable human expertise. Yet our ability to translate these advances into reliable, affordable and widely accessible services has not always kept pace.

There is a revealing contradiction here. We invest enormous resources in expanding what technology can do, while struggling to organise the conditions under which people can actually benefit from it.

Meanwhile, much of our public discussion about the future concentrates on what may go wrong.

In debates about aviation, legitimate environmental concerns lead to proposals for higher prices, restrictions and reduced travel. In debates about artificial intelligence, the prospect of greater productivity is accompanied by predictions of unemployment and declining purchasing power.

These are serious concerns, not imaginary problems. But why does technological progress so often produce a detailed account of what people might lose, while the practical work of creating better alternatives receives considerably less attention?

We have become skilled at announcing what must be prevented. We should be equally demanding about what we are prepared to build.

Aviation, Access and the Cost of Change

Aviation illustrates the difficulty of balancing environmental responsibility with human opportunity.

Aircraft emissions contribute to climate change, including through effects beyond carbon dioxide. Sustainable aviation fuels can reduce lifecycle greenhouse gas emissions, depending on how they are produced, but their availability remains limited and they cannot eliminate every climate effect of flying.

According to the European Union Aviation Safety Agency, sustainable aviation fuels accounted for approximately 2.8% of the aviation fuel reported by suppliers at EU airports in 2025. This exceeded the first mandatory European target, although conventional fuels still accounted for the overwhelming majority.

Cleaner fuels, more efficient aircraft, better operations and credible alternatives such as rail all have roles to play. So can measures that influence demand where technological improvements cannot deliver sufficiently rapid reductions.

But the purpose of environmental policy should not be confused with making valuable activities inaccessible.

Someone travelling to maintain family connections, a student pursuing an opportunity abroad and a frequent leisure traveller with substantial disposable income do not necessarily have the same alternatives or ability to absorb higher costs.

That does not exempt any journey from its environmental consequences. Effective policies must consider both actual emissions reductions and the distribution of their social costs.

The IPCC has documented the potential to reduce energy and resource demand through better infrastructure, technology and service provision while supporting human well-being. Lower environmental impact and better services need not be competing objectives, although achieving both requires choices about how those services are delivered.

The ambition should therefore be to preserve and improve valuable human opportunities with less environmental harm, while acknowledging that some activities and behaviours must change.

That requires alternatives that work.

When the Technology Works but the System Doesn't

Electric mobility has passed an important industrial threshold.

More than 20 million electric cars, including plug-in hybrids, were sold worldwide in 2025, according to the International Energy Agency. They represented approximately one-quarter of global new-car sales.

Yet a technically excellent electric vehicle does not automatically create an excellent transport system.

A commercial fleet operator needs charging infrastructure that matches operating schedules, sufficient electrical capacity, predictable energy costs, reliable maintenance and vehicles available when required.

In 2025, I encountered an autonomous-shuttle project that demonstrated just how misleading the phrase *“the technology is ready”* can be.

The vehicles had been delivered and approved. The charging infrastructure worked, the booking app processed reservations and payments, and the necessary permits were in place. Each participant had delivered its assigned part of the project.

Yet the shuttles remained parked.

The difficulty lay in the interfaces between the systems. The dispatch operation depended on reliable information about charging status, battery levels and vehicle availability. The necessary information existed, but the parties had different assumptions about who would provide it, validate it and take responsibility for its reliability.

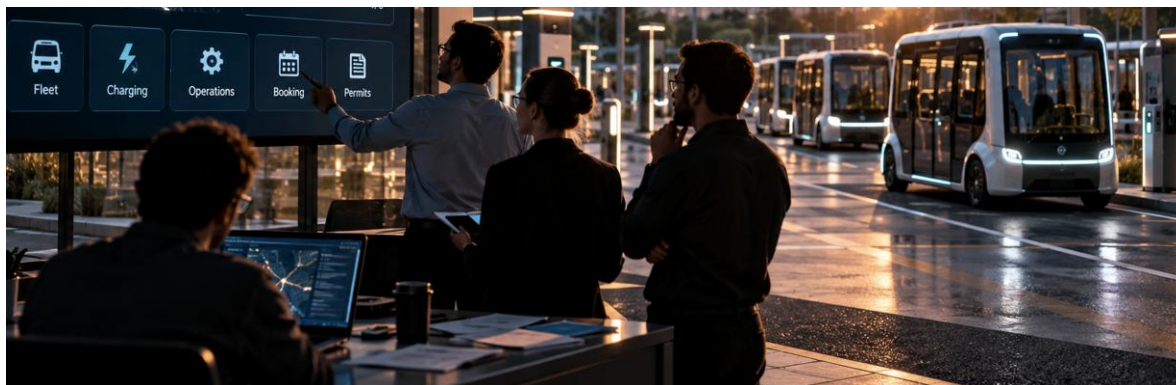
The vehicle supplier and mobility operator had also worked to different assumptions about who would communicate vehicle availability to the systems responsible for dispatching and booking.

What was missing was an accountable owner of the end-to-end service, someone with both the authority and responsibility to define the interfaces and make the complete system operational.

A system can fail even when every participant is doing their job correctly.

The problem was not that autonomous-driving technology had failed to perform its intended function. It was that nobody had taken responsibility for making all the technologies work together.

That distinction extends far beyond mobility.



In September 2026, the IEA reported that at least 1,700 gigawatts of advanced-stage renewable energy projects and 600 gigawatts of utility-scale battery projects had been awaiting grid connection worldwide in 2025.

Not every project in those queues will ultimately be built. Nevertheless, the figures reveal a substantial gap between the development of energy technologies and the infrastructure required to deploy them.

The difficulty is no longer simply whether we know how to generate or store electricity. It is whether our networks, institutions and investment processes can accommodate the technologies we already possess.

Electricity networks must operate within strict safety and reliability limits. Meeting those obligations requires coordination between physical infrastructure, operating procedures, regulation and investment decisions. The difficulty often lies in how those responsibilities interact.

Grid-enhancing technologies provide a useful illustration.

Dynamic line ratings can identify additional thermal capacity under favourable operating conditions. Advanced power-flow control can redirect electricity towards less-congested parts of a network, while topology optimisation can help operators make better use of existing infrastructure.

These are established engineering approaches, although their deployment and suitability vary considerably.

Increasing the permissible capacity of a transmission line achieves little if the next transformer becomes the limiting component. Redirecting electricity is useful only if another route has capacity available. And operating closer to thermal limits still requires compliance with voltage, stability, protection and reliability requirements.

In its 2026 report *Modernising Grids in the Age of Electricity*, the IEA explains that making additional capacity technically available is not the same as being able to use it safely. An intervention may simply shift the bottleneck elsewhere.

Improving one component is not necessarily an improvement to the system. A logistics operator can acquire more efficient vehicles without improving delivery performance if loading operations remain the constraint. An industrial facility can install advanced equipment without achieving the expected savings if its processes are poorly coordinated.

The individual technologies may perform exactly as specified. The anticipated benefits fail to materialise because the surrounding system cannot exploit them.

This is where much of the difficult work of industrial transformation takes place: at the interfaces between equipment, infrastructure, organisations and economic interests.

The manufacturer can demonstrate that a device works. The infrastructure operator can explain its operating limits. The investor can calculate a return under specified assumptions. The regulator can confirm compliance with the applicable rules.

But who is accountable for establishing whether all these elements will work together?

That responsibility cannot always be divided neatly along existing contractual or institutional boundaries.

End-to-end responsibility must come with the authority to define interfaces, coordinate integration, allocate resources and approve the complete system as operational. Contracts must establish who makes decisions when responsibilities overlap, who bears the associated risks and who is accountable for the final result. Otherwise, accountability exists on paper while the gaps between individual obligations remain exactly where they were.

Nor does this mean every proposed project should proceed. Some should be redesigned; others should be rejected. Delay, however, is not automatically the safer or cheaper option. Keeping an inefficient system operating can impose additional costs, emissions and lost opportunities that deserve the same scrutiny as the proposed investment.

A serious industrial proposition must therefore answer questions considerably less exciting than those found in a technology presentation: Where will it operate? Which physical constraints determine its performance? Who owns the interfaces? What additional infrastructure is required? What will it cost throughout its working life, and how will its benefits be verified?

They are nevertheless the questions on which industrial investments succeed or fail.

Announcing another ambitious target is comparatively straightforward. Electricity networks remain unimpressed by press releases.

The next major improvement may therefore come not from inventing another technology, but from connecting existing capabilities more intelligently and organising the institutions responsible for delivering them.

The Problem Doesn't End at the Factory Gate

Artificial intelligence presents a related challenge, although its consequences extend into the organisation of work and the distribution of economic opportunity.

The International Labour Organization estimated in 2025 that roughly one in four workers worldwide was employed in an occupation with some degree of potential exposure to generative AI. Exposure is not equivalent to displacement; many occupations combine tasks that can be automated with responsibilities that continue to require human involvement.

An ILO review published in 2026 found uneven productivity gains, limited evidence of widespread employment displacement so far, and emerging concerns about inequality and opportunities for younger workers.

Those findings hardly justify either complacency or predictions of inevitable mass unemployment.

Higher productivity creates economic possibilities. It does not determine how their benefits will be distributed.

A hospital that uses intelligent systems to reduce administrative work could improve patient care and relieve pressure on medical professionals. It could also use the resulting efficiencies mainly to reduce expenditure. Both outcomes are conceivable, and the technology might perform equally well in either case.

Whether productivity becomes higher wages, lower prices, better services, additional investment or increased profits depends on decisions about competition, ownership, employment and public policy.

The results should therefore be measured beyond productivity statistics: changes in service quality and affordability, wages and working conditions, and whether younger employees retain credible opportunities to develop professional expertise. A company may save thousands of working hours through AI. That tells us remarkably little about how much better off its employees or customers have become.

There is a less obvious problem as well, one that may prove important for the next generation.

Many professions depend on a gradual progression from routine tasks to complex judgement.

A young engineer learns by performing calculations, reviewing designs, checking assumptions and discovering why seemingly minor details matter. A junior lawyer, financial analyst or medical professional develops expertise through a comparable accumulation of practical experience.

Increasingly capable AI systems can perform parts of this introductory work.

That offers potential advantages. AI may help less-experienced people complete more demanding tasks, provide feedback and broaden access to knowledge.

But organisations also need to consider what happens when the tasks through which professional judgement was traditionally developed are no longer performed by beginners.

An experienced engineer may use AI to accelerate work precisely because years of practice have taught that engineer which assumptions to question and which results deserve closer inspection.

How does the next generation acquire comparable judgement if much of the work that once developed it is automated?



This is not an argument for preserving inefficient tasks merely because previous generations had to perform them. Professional education and training should evolve with technology.

It is an argument for recognising that immediate efficiency and long-term competence are different objectives. Pursuing the first without planning for the second may create a problem that becomes visible only years later.

Businesses could find themselves enjoying the productivity gains of experienced employees using AI while gradually weakening the pathways through which future experts are developed.

That outcome is not inevitable. Nor can it be prevented simply by offering another generic training course.

It requires deliberate decisions about how people learn, how responsibility is transferred and how professional competence is developed in organisations where intelligent systems increasingly perform routine work.

The physical infrastructure of an energy transition and the human institutions of an AI-driven economy are not interchangeable. But they expose a common limitation in the way we evaluate innovation.

Technical performance does not establish the quality of the final outcome.

What Counts as Progress?

An investment announcement is not an operating asset. A renewable energy project awaiting connection is not electricity delivered. A charging station that cannot serve its intended users is not a functioning mobility service.

Similarly, an AI system that completes a task faster has demonstrated a capability. It has not necessarily improved working conditions, increased purchasing power or strengthened the organisation that uses it.

These distinctions require us to follow impressive announcements through to their less impressive practical details. That is where results can be measured.

Scientific integrity matters. So do competent engineering, economic viability, appropriate regulation and the ability to coordinate investments across institutions.

We should be demanding about the evidence behind technological claims and equally demanding about the systems those technologies are intended to replace. Familiar costs do not disappear because we have learned to live with them.

Ultimately, progress should be assessed by what people can actually do better, more affordably, more reliably and with less environmental harm.

The answer will not always favour the newest technology, the largest investment or the most ambitious political target.

That is precisely why it is worth asking.

What We Leave Behind

Climate change will require difficult choices. Automation will disrupt some forms of employment. Infrastructure investment will continue to involve competing interests, environmental constraints and limited resources.

There will be failures, compromises and occasions when a restriction is necessary because no better alternative is yet available.

But necessity in the present should not automatically become the limit of our ambition for the future.

We have invested considerable effort in understanding what could go wrong. The scientific knowledge behind many of those warnings is among humanity's most valuable achievements.

What remains is the harder obligation to translate that knowledge into functioning alternatives.

No generation can decide whether its children will face problems.

It can decide whether they inherit only our warnings, or also the means to do something about them.

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