Polish Digital Resilience Agenda 2040
a model of strategic preparedness
for the antinomies of digitalisation.

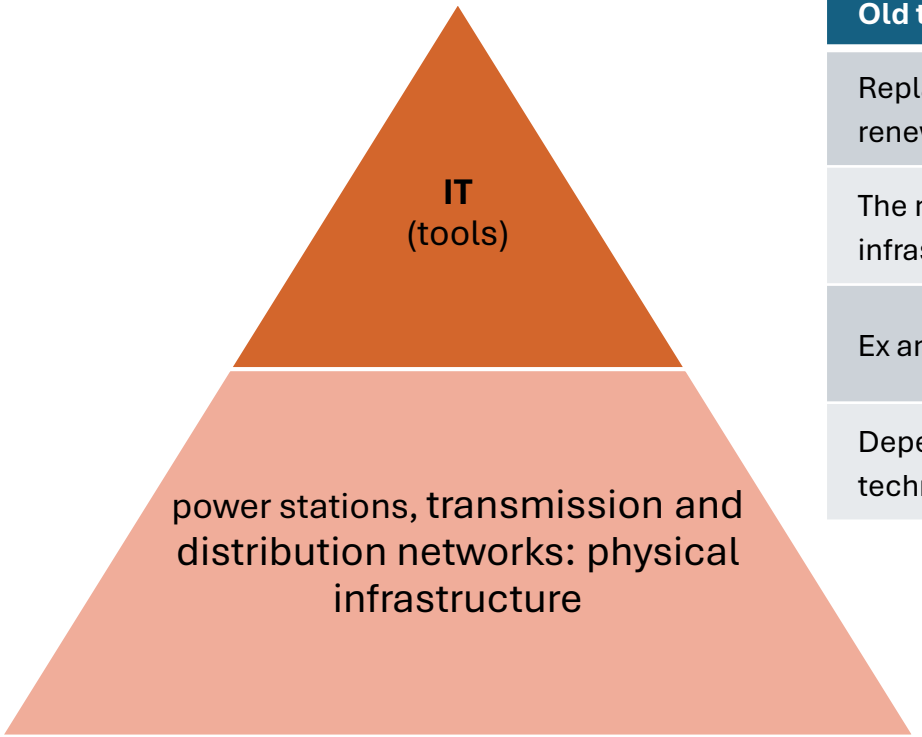
Scenario: Digital foundation of development

strategic area: Energy

Energy paradigm inversion scenario - Poland by 2040

The reverse paradigm_x000B_great inversion

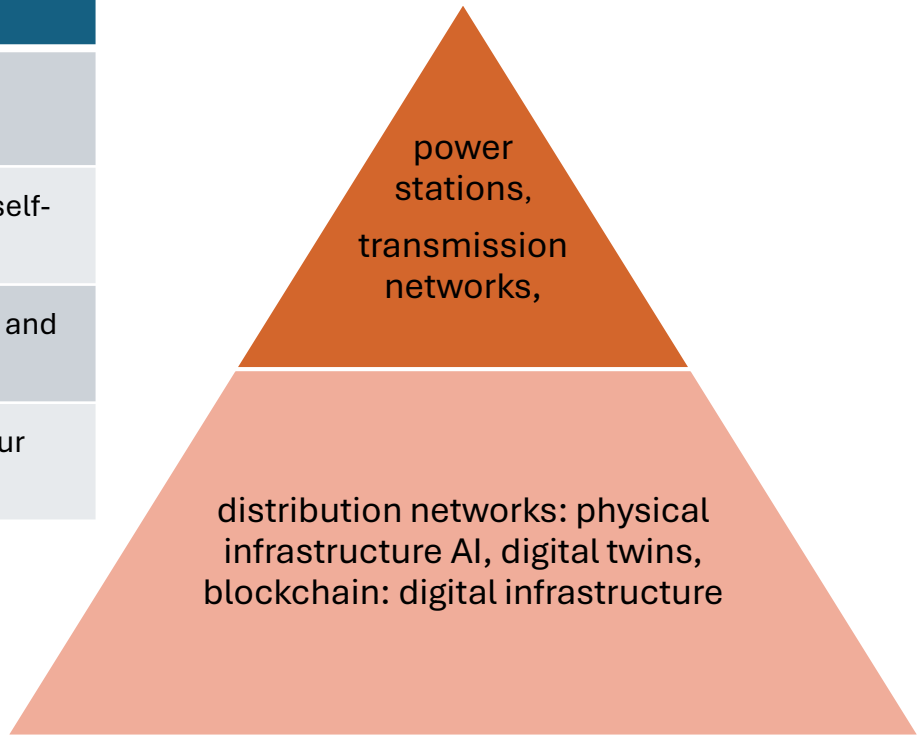
Traditional model



Old thinking	New thinking
Replace coal with renewable energy	Build a digital, adaptive ecosystem
The network as a static infrastructure	The network as a living, self-organizing organism
Ex ante regulations	Algorithmic surveillance and technical protocols
Dependence on technology imports	Sovereignty based on your own resources

A paradigm shift

Model 2040



"Automation and digitalisation are not ancillary tools - they are a condition for achieving energy sovereignty."

The digital nervous system: how it works

Digital Twins

Virtual replicas of every physical asset
Predictive maintenance – downtime reduced by 35–50%
Asset lifespan increased by 15–25%,
Maintenance costs reduced by 20–30%

AI Autonomous Neural Network

Dynamic pricing updated every 5–15 minutes – peak demand reduced by 15–25%
Real-time automatic balancing of millions of prosumers' micro-decisions
Detection of cybersecurity anomalies in OT

P2P + Blockchain platforms

Direct energy trading between neighbours without intermediaries
Transaction costs: from 15–25% → 2–5%
Smart Contracts executed automatically

V2G (Vehicle-to-Grid)

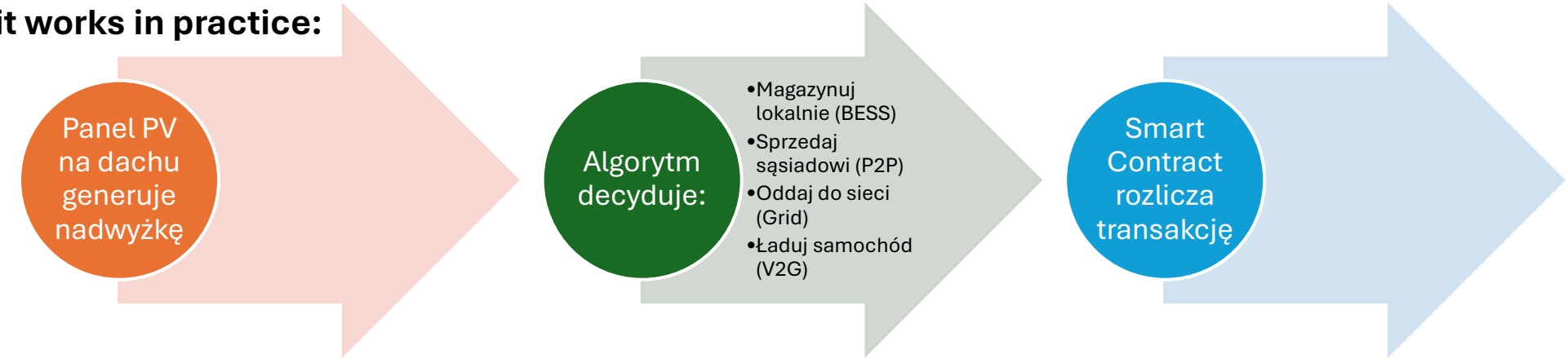
Electric cars as mobile energy storage units
Every vehicle connected to the grid = a component of a virtual power plant

Four layers of intelligence

Prosumer and P2P market: democratization of energy

"Millions of distributed prosumers transformed into a disciplined resource of flexibility"

How it works in practice:



Effects:

- Transaction costs reduced from 15-25% to 2-5%
- Peak power demand reduced by 15-25%
- Target energy price: EUR 40-50/MWh (one of the lowest in the region)

Poland as an EnergyTech center in the region

Endogeniczne algorytmy sterowania

- Autorskie systemy OT dostosowane do **polskiej topografii sieci** (przesył północ - południe)
- Eliminacja ryzyka „tylnych furtek" w zagranicznym oprogramowaniu
- **Suwerenność technologiczna** jako element obronności narodowej

Potencjał eksportowy

- Setki milionów EUR rocznie ze sprzedaży rozwiązań EnergyTech do regionu CEE
- Centra kompetencji łączące cyberbezpieczeństwo OT z inżynierią energetyczną

Reindustrializacja dzięki taniej energii

- Przyciąganie energochłonnych inwestycji: **centra danych AI, fabryki wodoru**
- Niska cena energii - **40–50 EUR/MWh** jako przewaga komparatywna nad Niemcami i Francją

"Poland is redirecting IT and outsourcing potential to building endogenous solutions for the energy industry"

Systemic tensions: three dilemmas

Fix	Pole A	Pole B	Solution
Sovereignty vs. Foreign technology	Backdoor security	Speed of modernization	Endogenous OT algorithms
Digitalization vs. Cybersecurity	Efficiency of decentralization	Surface attack increases with each node	IT+OT integration, AI anomaly detection
State vs. Market	Central planning = control	Regulatory minimalism = innovation	The state as a "market architect", not a micromanager

Key geopolitical threat: OT systems (control of physical infrastructure) become the battlefield of hybrid warfare - a cyber attack on the network is a strategic act of aggression

HR challenge: the scale of competence transformation

- 150,000–200,000 specialists

Skills gap

Profile of the skills gap

- energy expertise
- Data Science
- OT cybersecurity

- National Institute of Energy Technologies

Institutional proposal

Funding philosophy

- Shift from social transfers to ‘knowledge transfers’ and reskilling

- IRR > 12% as a prioritisation criterion

Required rate of return on investment

Transformation milestones

BY 2028 - FOUNDATIONS

- Smart metering — nationwide coverage
- P2P and blockchain regulatory sandboxes
- First digital twins of critical infrastructure
- Deregulation of energy prices (with protection for the most vulnerable)

BY 2035 - SCALING

- Smart Grid as the national standard
- Active P2P markets in major urban areas
- Offshore renewables: first farms in the Baltic Sea fully operational
- National Institute of Energy Technologies — first graduates

BY 2040 - AUTONOMY

- 60–70% renewable energy in the mix
- Endogenous OT algorithms — full digital sovereignty
- Poland = regional EnergyTech hub for CEE
- Energy price: 40–50 EUR/MWh

What does Poland gain in 2040?

Climate
- Share of renewables in the energy mix – 60–70%

Economy
- Target energy price – €40–50/MWh

Operations
- Reduction in unplanned downtime – 35–50%

Grid
- Reduction in peak demand – 15–25%

Market
- Reduction in P2P transaction costs – from 15–25% to 2–5%

Industry
- Reindustrialisation of energy-intensive sectors – AI centres, H_2 plants

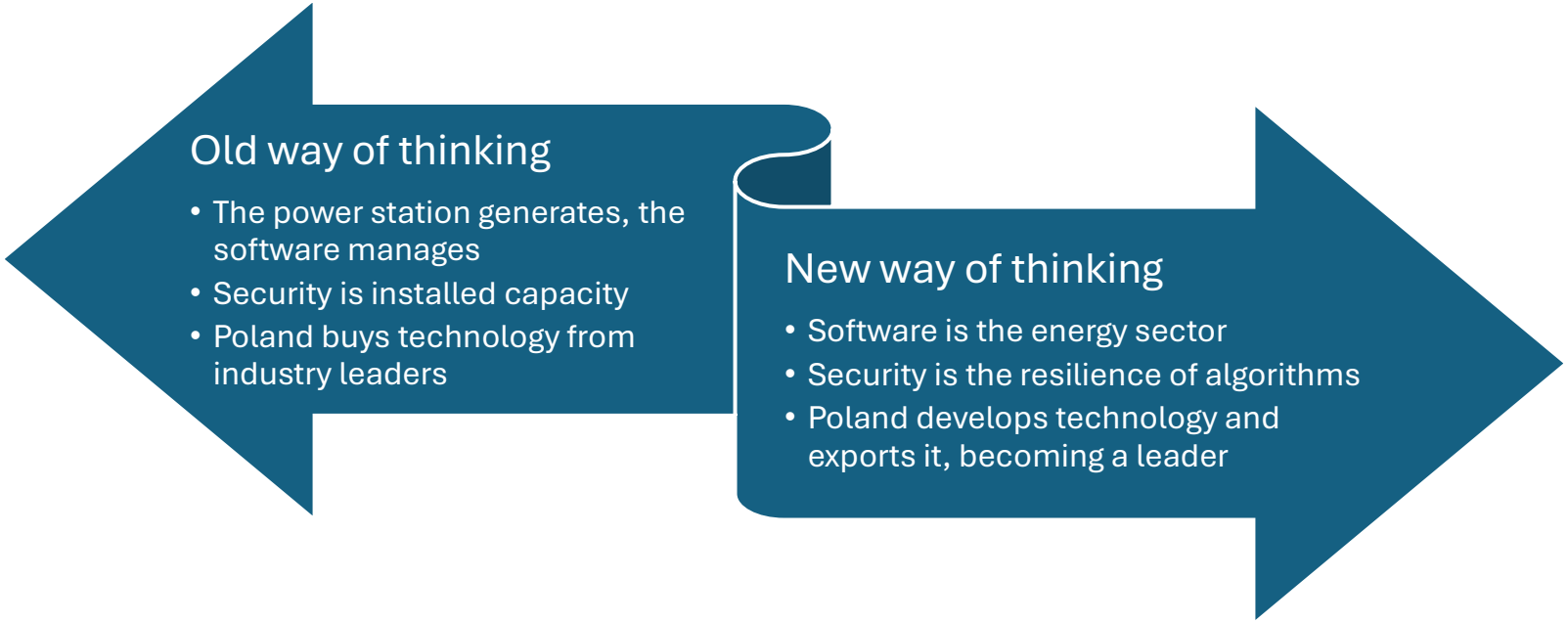
Region
- EnergyTech exports – Hundreds of millions of EUR per year

Strategic recommendations

- **Regulatory sandboxes** — a testing ground for P2P, dynamic pricing and smart contracts
- **Regulatory minimalism** — the state as a ‘market architect’, not a micromanager of technology
- **IRR > 12% criterion** — strict prioritisation of investments, not political
- **National Institute of Energy Technologies** — a talent factory for EnergyTech + OT cybersecurity
- **Endogenous OT algorithms** — digital sovereignty as a national security priority
- **Reskilling instead of benefits** — shifting funds from passive to active transfers
- **Baltic offshore + PV** — an investment priority of Pillar II

Conclusion: why paradigm matters

"This is not modernization of the energy industry. It is a change of what the energy industry is."



Let's stop thinking only about immediate problems. Let's create variant solutions now.

Ministerstwo Nauki i Szkolnictwa Wyższego
NAUKA DLA SPOŁECZEŃSTWA
PTC
Polish Digital Society
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Postscript: one-page script

This scenario of a paradigmatic revolution says something more radical: "the digital layer IS energy - the physical power plants are just the applications running on top of it."

The inversion of the infrastructure paradigm in the title is the climax of the entire narrative. In the old world: you have a power plant, you manage it with software. In the new world: You have a digital nervous system, and power plants, turbines, and transmission lines are merely its peripheral devices. It's like saying the internet isn't a tool for companies - companies are applications that run on the internet. This change in perspective changes everything: what to invest, what to regulate, who is the strategic actor.

Practical consequence: Poland can integrate 60-70% renewables into its mix – not because it builds enough physical storage, but because algorithms will balance millions of distributed prosumers, VPPs, electric cars and industrial consumers into one virtual power plant in milliseconds. The system becomes intelligent like a swarm, not like a pyramid.

The ambition goes further: Poland as a regional EnergyTech hub in Central Europe – exporting not coal, but code. Endogenous control algorithms, without backdoors from the West or East, are becoming an element of technological sovereignty on a par with the armed forces.

The scenario's central dilemma: The deeper the digitalisation, the greater the surface attack for hybrid cyberwarfare. OT (operating systems) security is becoming a matter of national defense.