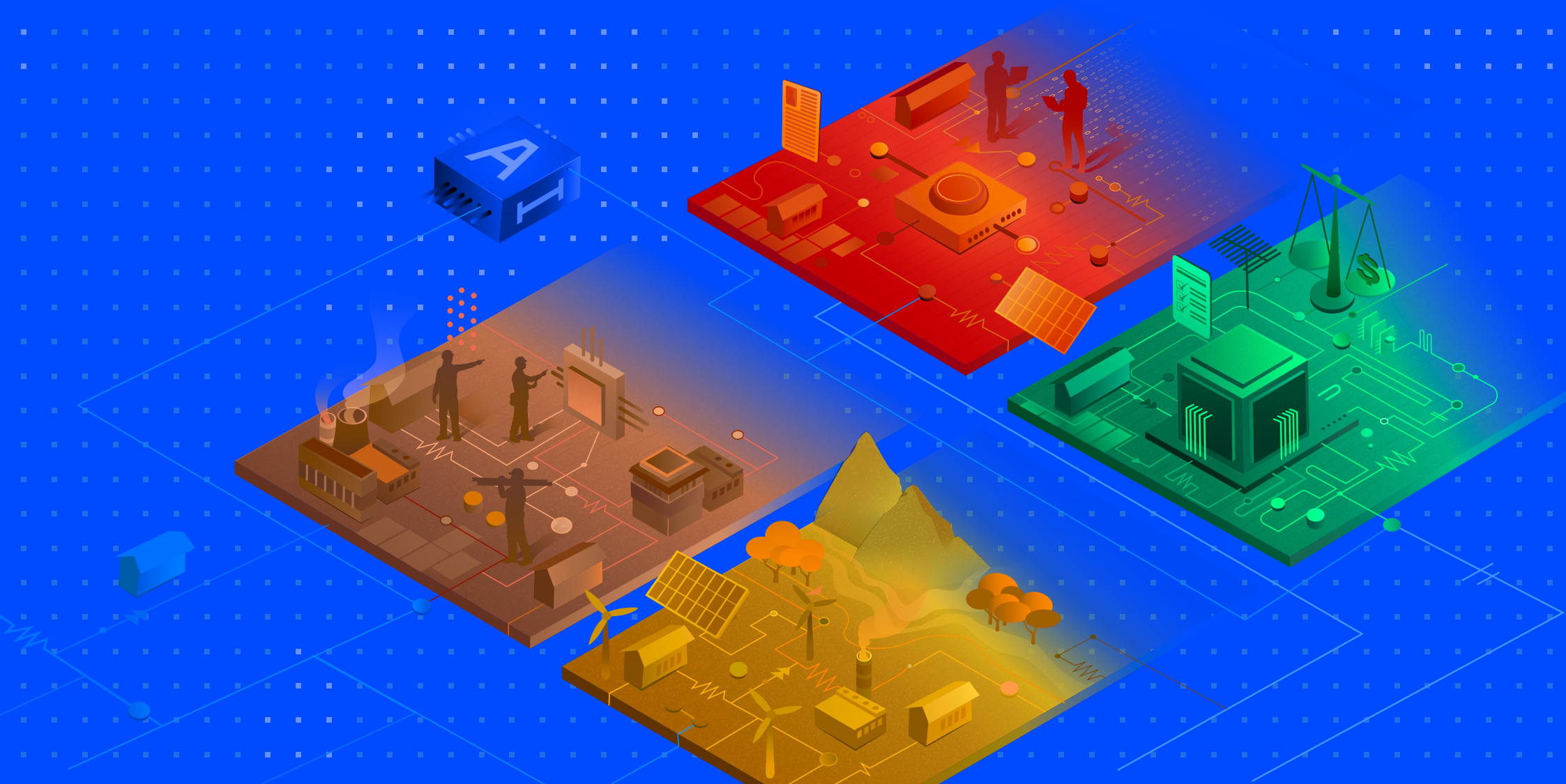
FORUM FOR THE FUTURE

AI AND SOCIAL JUSTICE IN THE ENERGY TRANSITION



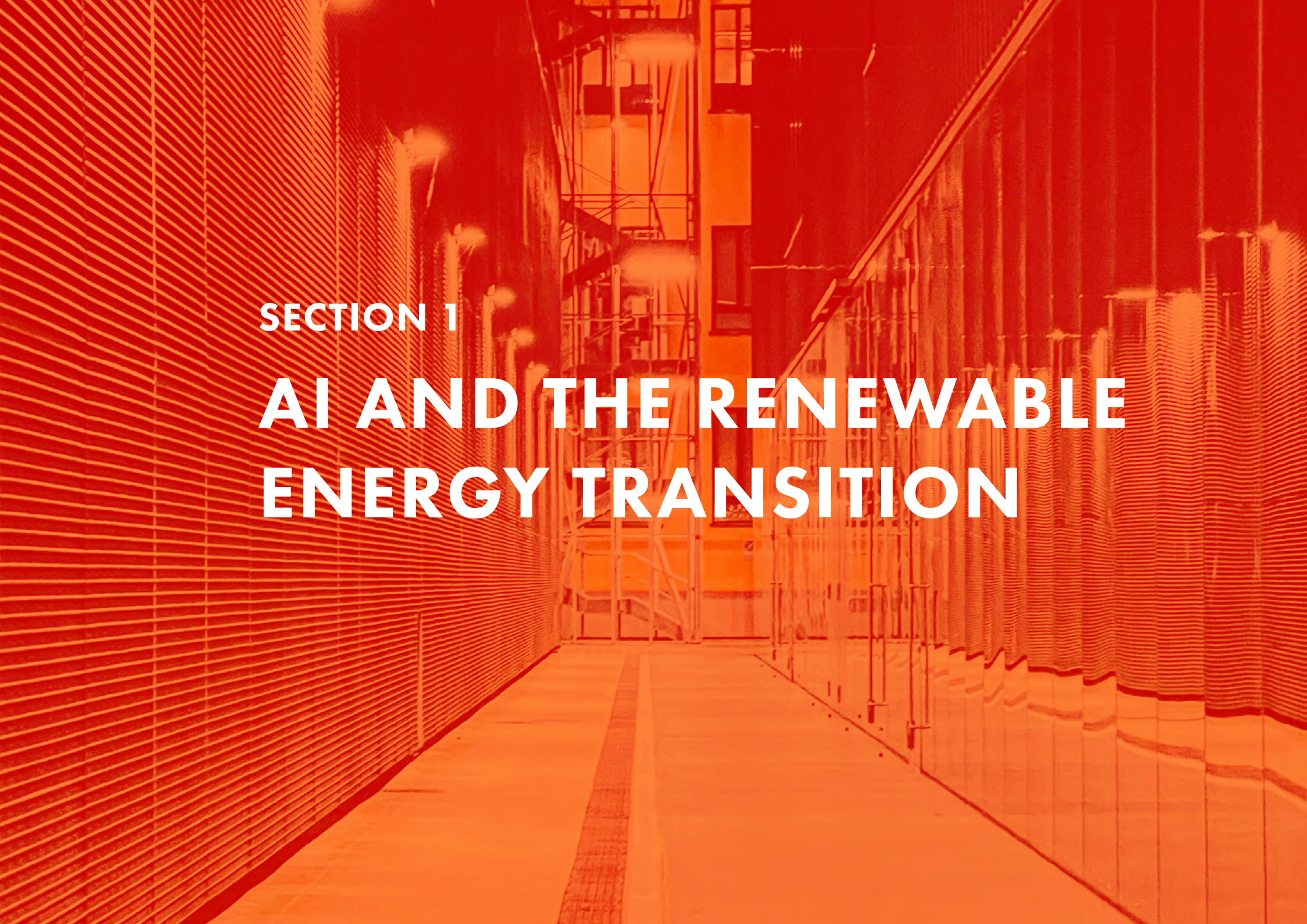
INTRODUCTION

This white paper considers the impact that the deployment of Artificial Intelligence (AI) in the renewable energy transition might have on social justice issues. Through our research, we have found that although there is significant discussion about energy justice and on the ethics of AI deployment, these two topics together are not yet extensively considered or researched in relation to the renewable energy transition. Given the incredible impact that AI is having on the world in all spheres, now is a critical time to consider how AI might make existing social justice issues related to the energy system better, worse, or create entirely new issues.

The research for this paper involved a review of energy justice and AI ethics frameworks. We mapped the insights from these frameworks against AI development and deployment issues and produced a taxonomy of 12 social justice issues that were relevant to both. We then validated the taxonomy by testing it against 70 real-world cases and speaking to nine experts across the energy sector. We considered these issues from both an advanced and developing economy perspective, and spoke to experts from across Forum for the Future's networks in both the UK and the Philippines. The aim is that the taxonomy we have developed will provide a shared language for actors across the technology and energy ecosystem and help them to use a social justice lens to identify risks, accountability and develop policy.

This paper includes the taxonomy, insights into how the 12 issues might impact energy system actors and also how other cross-cutting themes such as intersectionality, geopolitics, intergenerational and epistemic justice impact the issues included in the taxonomy. This is followed by recommendations for different actors on how they could use the taxonomy, and how the thinking in this paper could be taken forward.





SECTION 1

AI AND THE RENEWABLE ENERGY TRANSITION

Forum for the Future's mission is to accelerate the shifts to a just and regenerative society. We can see how AI is fast becoming a key technology in the transition from a fossil-fuel based to a renewable energy system — and like in many other parts of the economy — policy and regulation is struggling to keep up with the pace of innovation and change related to AI applications and associated emerging business models.

RAPID AI DEPLOYMENT IN ENERGY SYSTEMS

AI is no longer experimental, but operational in the energy system. From smart meters managing household energy to algorithms optimising renewable energy integration, AI systems are rapidly embedding into every aspect of our energy infrastructure. Utility companies are deploying AI to forecast demand, balance grids, and automate energy trading. Developers are using AI to inform the siting of renewable energy projects, manage maintenance, and price services. Governments are utilising AI to model policy scenarios and allocate resources.

These have rapidly progressed from pilot projects to live systems making consequential decisions about who gets energy, at what cost, from what sources, and under what conditions. Decisions made now about how we design, deploy, and govern the use of AI in energy will shape systems for decades to come.

JUSTICE AT STAKE

The new AI-enabled system could continue policies and practices that exacerbate social justice concerns currently residing in today's energy system. For instance, people in low-income households are unable to meet their energy needs at affordable prices. Algorithms trained on biased data could continue to make discriminatory decisions that prevent certain demographics or communities from accessing new products and services. Without proactive governance or innovative applications, AI risks becoming a tool that optimises energy systems for efficiency and low emissions while entrenching inequality.

ACCELERATING THE ENERGY TRANSITION

The ongoing climate crisis demands urgent transformation of our energy systems. Countries worldwide have committed to scaling renewables, phasing out fossil fuels, and reaching net-zero emissions. With the decreasing cost of renewables and storage, the energy transition is no longer a question of "if", but "how fast" and "for whom". This transition is already redirecting huge flows of investment and reshaping grids, markets, the labour force, and communities. Long-term, it promises cleaner air, energy security, greater resilience, more affordable energy and climate stability, but achieving these outcomes will involve significant design choices and tradeoffs.

THE GAP IN CURRENT RESEARCH

Through our research we have found that there is little examination of AI ethics and energy justice together. Extensive literature exists on AI ethics — fairness, transparency, accountability and on issues related to energy justice — who benefits, who decides, whose voices count, and how harms are repaired. We found that few studies examined how AI will specifically impact social justice in the renewable energy transition. This paper looks to help bridge that gap by defining a taxonomy of social justice issues that can be used to further expound this critical intersection of AI and energy.

WHY NOW?

Given the momentum that AI is generating in the renewable energy transition and the gap in the current literature, Forum wanted to better understand: ***how AI might accelerate social justice or exacerbate social injustice in the transition to renewable energy systems.***

We believe there is a need to:

- Acknowledge and mitigate the risk of AI deployment exacerbating and further embedding social injustices; and
- Identify the opportunities that AI presents for centering positive social justice outcomes and redressing inequality in the existing energy system.

The deployment of AI in the energy system presents a range of risks for communities and citizens. Questions on how AI might exacerbate existing social injustices in the energy system include:

- How might the diversion of resources and grid capacity for a massively expanding fleet of AI data centres impact communities?
- What role should communities have in decisions about the siting and subsequent development of data centres, which could create negative social, economic and environmental impacts for them?
- How will jobs in the energy sector be displaced by AI deployment and what compensation or retraining do employees require?
- How might intellectual property and algorithms further entrench existing inequalities within the system such as the concentration of economic and commercial power?

These scenarios are avoidable; however, it will take concerted effort to ensure that the renewable energy system advances social justice through considered and innovative use of AI.

We also identified potential areas where AI could help address or mitigate existing social justice concerns. For instance:

- Could AI create system efficiencies and new capacity that delivers benefits (such as price savings) that can be shared more equitably with citizens?
- How might AI enable the advancement of new ownership models in the system, and support localised and decentralised energy markets?
- Could workers be trained to operate AI systems, providing better skilled and/or better paid jobs?



OUR APPROACH TO CREATING THE TAXONOMY

STEP 1: LITERATURE REVIEW

In the first stage of our research, we conducted an AI-assisted literature review into AI ethics and energy justice frameworks. This research used multiple AI-assisted tools to support the literature review, synthesis, and validation process. More information about which tools were used can be found in the Appendices. All outputs from these tools were reviewed, checked against original sources where possible, and integrated into the analysis by the authors. The use of AI tools in this work is intended as an accelerator for scoping and synthesis, not as a substitute for human judgment, interpretation, and rigour.

We reviewed established frameworks from two domains:

AI Ethics: The analysis drew on widely recognised AI ethics frameworks including the OECD AI Principles (OECD, 2019), which emphasise fairness, transparency, accountability, human-centred values, inclusivity, robustness, and sustainability; the UNESCO Recommendation on the Ethics of Artificial Intelligence (UNESCO, 2021), which establishes human rights-based principles of proportionality, safety, privacy, accountability, and transparency; the EU AI Act (European Commission, 2024) which introduces risk classification and conformity requirements for high-risk AI systems; and the IEEE Ethically Aligned Design (IEEE, 2019), which provides guidelines for ethical governance and human oversight in AI systems.

Energy Justice: The taxonomy is grounded in energy justice literature that conceptualises fairness across four dimensions: distributive justice (who gains or loses), procedural justice (who has a voice in decisions), recognition justice (whose identities and knowledge count), and restorative justice (how harms are repaired). Foundational works include Sovacool & Dworkin (2015), Heffron & McCauley (2017), and Jenkins et al. (2016), alongside more recent contributions such as Van Uffelen et al. (2024), which incorporate restorative justice and highlight normative uncertainties.

STEP 2: DUAL-STRUCTURE MAPPING

Using the literature review, we produced a dual-structure mapping of the stages of AI development and deployment and justice dimensions against social issues and their roots in both AI ethics frameworks and energy justice frameworks. We applied two complementary lenses:

1. **AI Development and Deployment Stages**
   Data Collection → Model Design → Deployment → Usage and Application → Infrastructure → Governance

2. **Justice Dimensions:**
   Who gains/loses? Who decides? Whose voices count? How are harms repaired?

STEP 3: TAXONOMY SYNTHESIS

This process identified overlapping social justice issues across AI ethics and energy justice literatures. By comparing overlaps and gaps across both structures, 12 key social justice issues emerged at the intersection of AI and the energy transition. The research also identified seven cross-cutting themes, which appear as additional considerations in the application of the taxonomy.

STEP 4: CASE VALIDATION

In our validation of the taxonomy, we reviewed the 12 issues against 70 real world cases. The cases spanned 40 countries between 2016-2025. The cases covered the US, Europe, Asia, Africa and Latin America and are from diverse sectors including AI infrastructure, utilities and grid, critical minerals, renewables, digital access, law enforcement and welfare. All 12 social justice issues were empirically grounded with cross-cutting themes appearing in over 90% of cases.

STEP 5: STAKEHOLDER TESTING

We conducted nine interviews with academics, AI technology experts, energy companies, civil society, and government innovators familiar with the UK and Philippines markets. We took the approach of interviewing experts in both a developed and emerging economy to understand similarities and differences from a regional and economic perspective.

Interviewees were asked to validate the taxonomy's usefulness while highlighting context-specific priorities and blind spots.

LIMITATIONS

We recognise that the taxonomy is not exhaustive. There are gaps such as intersectionality, global power asymmetries, epistemic justice, narrative manipulation, security risks, intergenerational justice, and how to foreground positive futures.
These limitations and stakeholder insights are explored in Section 3 of this white paper. In addition, the taxonomy does not assume the existence of "perfect" or fully realised examples for each of the 12 social justice issues; some are observable today, while others are forward-looking and may emerge as AI-enabled energy systems evolve.





SECTION 2

THE TAXONOMY

A TAXONOMY OF 12 SOCIAL JUSTICE ISSUES

AI's rapid integration into energy systems risks creating new forms of injustice while amplifying old ones. The 12 issues that follow are not just academic categories, but points of friction where AI-driven energy transitions could create winners and losers, reinforce or disrupt power, and expand or restrict access.

The issues are organised into four thematic clusters, each addressing a distinct dimension of justice:

- **ACCESS AND PARTICIPATION**
  Who can use AI-enabled energy systems, and who has a voice in making decisions about them?
- **FAIRNESS AND GOVERNANCE**
  Are algorithms fair, markets competitive, and are accountability mechanisms robust?
- **WORK AND BENEFITS**
  How are efficiency gains distributed, and what happens to workers and jobs within the system?
- **ECOLOGY AND SYSTEM**
  What are the environmental costs, and who bears them?



ACCESS AND PARTICIPATION

1. ACCESS AND AFFORDABILITY

AI-enabled energy solutions may exclude lower-income users through high costs and technology barriers.

2. DIGITAL DIVIDE AND INCLUSION

Communities without digital infrastructure or literacy risk exclusion from AI-enabled energy systems.

3. DATA RIGHTS AND CONSENT

Granular energy data collection raises risks of surveillance, profiling, and commercial exploitation without adequate consent.

4. COMMUNITY PARTICIPATION AND CONSENT

AI deployment in the energy sector often occurs top-down, without community voice in design or decision-making about systems that affect their lives.

WORK AND BENEFITS

8. LABOUR AND JUST TRANSITION

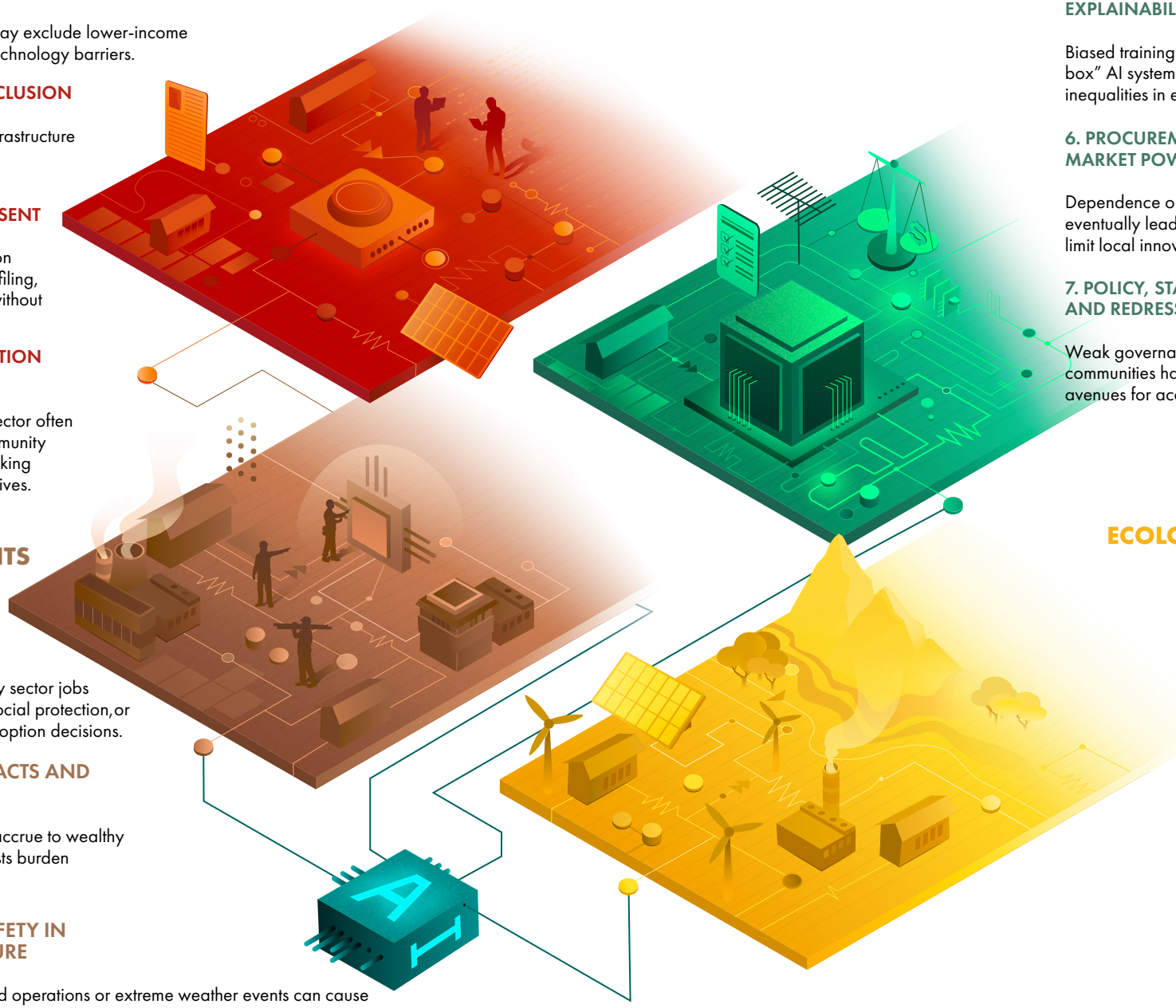
AI automation reshapes energy sector jobs without adequate retraining, social protection, or worker voice in technology adoption decisions.

9. DISTRIBUTIONAL IMPACTS AND BENEFIT SHARING

Efficiency gains from AI often accrue to wealthy or urban populations while costs burden marginalised groups.

10. RELIABILITY AND SAFETY IN CRITICAL INFRASTRUCTURE

AI errors or cyberattacks in grid operations or extreme weather events can cause cascading failures with severe consequences for vulnerable populations.



FAIRNESS AND GOVERNANCE

5. ALGORITHMIC FAIRNESS AND EXPLAINABILITY

Biased training data and opaque "black-box" AI systems can reinforce structural inequalities in energy services and access.

6. PROCUREMENT AND MARKET POWER

Dependence on powerful AI vendors could eventually lead to oligopolistic control and limit local innovation.

7. POLICY, STANDARDS AND REDRESS

Weak governance frameworks mean communities harmed by AI have no avenues for accountability or remedy.

ECOLOGY AND SYSTEM

11. ENVIRONMENTAL FOOTPRINT OF AI

Data centres supporting AI consume vast amounts of electricity and water, stressing ecosystems and undermining sustainability claims.

12. CRITICAL MINERALS AND SUPPLY CHAINS

AI hardware and energy infrastructure relies on minerals extracted under conditions of severe social and environmental harm, particularly in low-income countries.

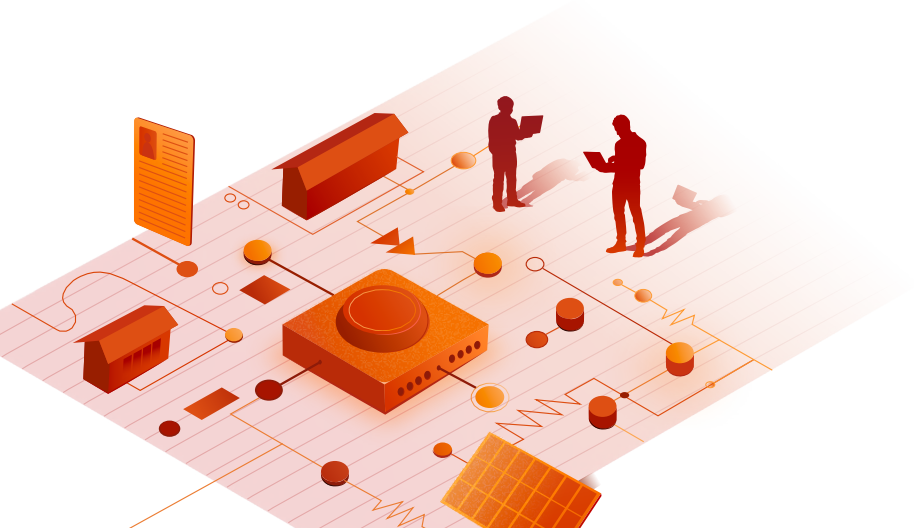
ACCESS AND PARTICIPATION

1. ACCESS AND AFFORDABILITY

DEFINITION: AI-enabled energy solutions may exclude low-income users through high costs and technology barriers.

RISK: Access and affordability highlight the risk that AI-enabled energy solutions, while efficient and innovative, may exacerbate existing inequalities in who can access reliable and affordable electricity. Prepaid meters, AI-driven dynamic tariffs, and automated credit scoring systems often benefit utilities and middle- to high-income households but can unintentionally burden low-income communities, daily wage earners, or rural residents.

EXAMPLE: In the UK, energy suppliers forcibly installed prepayment meters that automatically cut off electricity when households could not afford to top up. This disproportionately affected the elderly and families with children until regulators intervened and mandated compensation (The Guardian, 2023).



2. DIGITAL DIVIDE AND INCLUSION

DEFINITION: Communities without digital infrastructure or literacy risk exclusion from AI-enabled energy systems.

RISK: AI-driven services typically rely on access to smartphones, apps, Internet connectivity, and smart meters. Communities without digital literacy or infrastructure risk being excluded from participation in new energy markets or excluded from the benefits of efficiency gains. This divide is especially acute in rural or remote communities, where connectivity is weak or absent. Without addressing these barriers, AI may deepen existing socio-technical inequalities, leaving marginalised groups behind in the transition to smart and sustainable energy systems.

EXAMPLE: In the Philippines, students in remote regions trek for hours to hilltops just to access mobile signals for online classes, revealing how AI-enabled services are meaningless without the basic digital infrastructure that millions in lower-income economies lack (Reuters, 2021).

3. DATA RIGHTS AND CONSENT

DEFINITION: Granular energy data collection raises risks of surveillance, profiling, and commercial exploitation without adequate consent.

RISK: AI in energy systems generates and processes highly granular data on households, businesses, and communities, often down to appliance-level usage patterns. While these datasets allow for better demand forecasting and energy efficiency, they also pose risks of surveillance, profiling, and commercial exploitation. In many jurisdictions, consumers are not adequately informed or empowered to control how their energy data is collected, stored, or shared. The challenge lies in ensuring robust consent frameworks, transparent data governance, and accountability mechanisms so that the deployment of AI in energy respects individual rights and collective privacy.

EXAMPLE: In the UK, regulatory changes allowed third-party companies to access granular smart meter data — revealing when households wake, cook, and sleep — without individual consent, raising concerns that privacy rights are being eroded as consent frameworks failed to keep pace with technology (Home Building & Renovating, 2025).

ACCESS AND PARTICIPATION

4. COMMUNITY PARTICIPATION AND CONSENT

DEFINITION: AI deployment in the energy sector often occurs top-down, without community voice in design or decision-making about systems that affect their lives.

RISK: Projects that monitor, optimise, or automate energy use can profoundly affect local communities. Without mechanisms for consultation, free prior informed consent (FPIC), and ongoing involvement, these technologies risk reproducing top-down models of decision making. By contrast, participatory design ensures that communities have a voice in shaping how AI is deployed, what data is collected, and how its benefits are shared. This strengthens legitimacy, avoids conflict, and aligns technology with local needs and values.

EXAMPLE: In Surigao del Norte, Philippines, it has been alleged that nickel mining for batteries needed in energy infrastructure has polluted waters and destroyed coral reefs that fishing communities depend on. Local communities have argued that they have been excluded from decision-making, suffering environmental injustices as a consequence (MindaNews, 2016).



FAIRNESS AND GOVERNANCE

5. ALGORITHMIC FAIRNESS AND EXPLAINABILITY

DEFINITION: Biased training data and opaque "black-box" AI systems can reinforce structural inequalities in energy services and access.

RISK: AI systems in energy markets are often used in financing, pricing, and demand forecasting — areas where algorithmic bias can reinforce structural inequalities. If training datasets reflect historical inequities, such as "redlining" in housing or uneven service provision, AI outputs risk excluding disadvantaged communities from credit access, infrastructure upgrades, or timely restoration of service during outages. Moreover, the opacity of "black-box" AI makes it difficult for regulators, communities, and users to challenge decisions. Ensuring fairness and explainability means not only checking for bias but also designing AI systems with transparency and accountability built in from the start.

EXAMPLE: In the Netherlands, in an attempt to predict potential tax and benefit fraud, a government AI-enabled system called SyRI used data mining and a secret algorithm to combine and analyse large amounts of personal data from various agencies to generate a "risk score" for individuals. The system was controversial because it was primarily deployed in low-income neighborhoods and disproportionately targeted vulnerable citizens, raising concerns about bias and discrimination. In a landmark ruling in February 2020, the District Court of The Hague declared the law underpinning SyRI unlawful. The court found that its use violated the European Convention on Human Rights (ECHR), due to the system's lack of transparency and the disproportionate intrusion on private life (Human Rights Watch, 2020).

6. PROCUREMENT AND MARKET POWER

DEFINITION: Dependence on powerful AI vendors could eventually lead to oligopolistic control and limit local innovation.

RISK: AI deployment in energy often relies on big tech vendors who provide proprietary software, platforms or algorithms. This creates risks of vendor lock-in and system vulnerability, where utilities and governments become dependent on a few powerful suppliers. Such dependencies can lead to monopolistic pricing, limited bargaining power, and restricted local innovation. Smaller utilities and developing countries are particularly vulnerable, as they often lack the capacity to develop in-house AI solutions. Building open access, interoperable standards and fostering local ecosystems are crucial to preventing concentration of market power and ensuring fair competition.

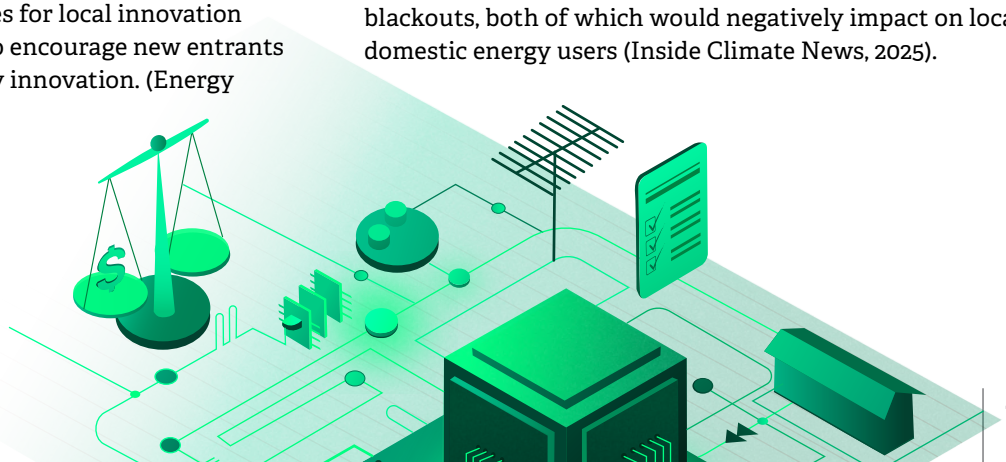
EXAMPLE: In the PJM region (an electric power transmission system operator) of the US covering 13 states, it is alleged that utilities are blocking third-party access to smart meter data by limiting requests to 10 accounts and providing data in unusable PDFs. It is argued that such practices concentrate power, reduce opportunities for local innovation and undermine attempts to encourage new entrants into the market and energy innovation. (Energy Changemakers, 2025).

7. POLICY, STANDARDS AND REDRESS

DEFINITION: Weak governance frameworks mean communities harmed by AI have no avenues for accountability or remedy.

RISK: Robust governance frameworks are critical to ensuring that AI in energy serves the public good and provides avenues for accountability. Without clear policies, standards, and redress mechanisms, communities harmed by AI errors or biases may have no way to seek remedy. The European Union's AI Act has made strides in classifying AI systems used in critical energy infrastructure as "high-risk" requiring conformity assessments and audits. However, many countries lack equivalent rules, leading to inconsistent protection. Establishing inclusive governance structures is essential to prevent AI from undermining rights and to ensure affected populations can hold systems accountable.

EXAMPLE: In Texas, US, the state government passed legislation empowering grid operations to disconnect data centres and other large energy users during periods when there are extreme load expectations. In doing so, the state government is hoping to avoid massive additional infrastructure costs and reduce the risk of significant blackouts, both of which would negatively impact on local domestic energy users (Inside Climate News, 2025).



WORK AND BENEFITS

8. LABOUR AND JUST TRANSITION

DEFINITION: AI automation reshapes energy sector jobs without adequate retraining, social protection, or worker voice in technology adoption decisions.

RISK: The deployment of AI in the energy sector will inevitably reshape labour markets, from utility operations to maintenance and billing systems. While automation can improve efficiency, it can also lead to job displacement, particularly among lower-skilled workers. Ensuring a just transition requires that these workers are not abandoned but instead retrained, reskilled, and included in decision-making processes about technological adoption. Without proactive policies, AI risks deepening precarity and undermining social acceptance of the energy transition. Conversely, well-managed reskilling can create opportunities in new green and digital jobs.

EXAMPLE: In Germany, E.ON SE, a multinational electric utility company, initiated a process dubbed "data evangelisation" to improve its data readiness and organisational structure. E.ON set up a dedicated AI-focused unit and strategy that led to new job roles including data scientists, AI tool managers, software engineers, and energy analysts with significant retraining in data interpretation and AI management skills, transitioning its workforce to new, higher-skilled roles (INSEAD, 2020).

9. DISTRIBUTIONAL IMPACTS AND BENEFIT SHARING

DEFINITION: Efficiency gains from AI often accrue to wealthy or urban populations while costs burden marginalised groups.

RISK: Distributional justice looks at who gains and loses from efficiency and savings enabled by AI. In energy transitions, benefits such as lower costs, reliability improvements, or access to new services often accrue to wealthier or urban populations, while costs and risks disproportionately affect marginalised groups. For example, rooftop solar optimisation may lower bills for affluent homeowners but increase system costs for renters. AI-driven load management may also prioritise industrial customers over residential or rural ones. Ensuring fair distribution requires intentional design of benefit-sharing mechanisms and attention to existing structural inequities.

EXAMPLE: Studies of real-time pricing in European — particularly Spanish — electricity markets show that hourly price fluctuations tend to benefit higher-income households with greater flexibility and access to automation or smart home systems, enabling them to reduce electricity bills. By contrast, low-income households often face higher bills because they lack the ability to shift consumption away from peak periods (VoxEU, 2022).



10. RELIABILITY AND SAFETY IN CRITICAL INFRASTRUCTURE

DEFINITION: AI errors or cyber attacks in grid operations or extreme weather events can cause cascading failures with severe consequences for vulnerable populations.

RISK: Reliability and safety are paramount when AI systems control critical infrastructure like electricity grids, nuclear plants, or microgrids. While AI can enhance efficiency and responsiveness, errors or cyberattacks can cause cascading failures with severe human consequences. Vulnerable populations often suffer the most during outages because they lack backup options or resilience resources. Ensuring reliability means incorporating redundancy, human oversight, and safety-first principles into AI systems. This also includes planning for extreme weather events and other shocks where automated systems may not be sufficiently adaptive.

EXAMPLE: In Texas, USA, inadequately winterised infrastructure caused grid failures during three severe winter storms, leaving millions without power in subfreezing cold. This caused at least 246 deaths and one reported case of an electricity bill reaching USD 10,000 during the storm and exposed how cost-driven grid management prioritising efficiency over resiliency can lead to lethal consequences for vulnerable populations (Texas Tribune, 2022).

ECOLOGY AND SYSTEM

11. ENVIRONMENTAL FOOTPRINT OF AI

DEFINITION: Data centres supporting AI consume vast amounts of electricity and water, stressing ecosystems and undermining sustainability claims.

RISK: The infrastructure that supports AI — data centres, sensors, and computational power — carries a significant environmental footprint. Training large AI models consumes vast amounts of electricity, while cooling servers requires water and can stress local ecosystems. In regions already facing climate stress, such as drought-prone areas, these tradeoffs can undermine sustainability gains elsewhere. The environmental costs of AI must therefore be assessed alongside its potential energy benefits, ensuring that deployment does not simply shift burdens from one part of the system to another.

EXAMPLE: In Ireland, data centres operated by major tech companies consumed 21% of national electricity in 2023 — more than all urban households — forcing increased fossil fuel reliance and prompting a moratorium on new centers until 2028 (AP News, 2024).



12. CRITICAL MINERALS AND SUPPLY CHAINS

DEFINITION: AI hardware and energy infrastructure relies on minerals extracted under conditions of severe social and environmental harm, often in developing economies.

RISK: AI and energy infrastructure hardware — chips, servers, sensors, solar PV modules, wind turbines, batteries — relies heavily on critical minerals like copper, cobalt, lithium, and rare earth elements. Extracting these resources often involves severe social and environmental costs, from child labour and hazardous working conditions to deforestation and water depletion. Many of these supply chains base their production in developing economies but serve technology companies in affluent economies, raising concerns about global asymmetries of power and benefit.

EXAMPLE: In the Democratic Republic of Congo, which holds over half the world's cobalt reserves, children as young as seven mine cobalt for EV and grid batteries in hazardous conditions, revealing that clean technologies in wealthy nations often depend on child labour and exploitation in the developing economies (Humanium, 2025).



CROSS-CUTTING ISSUES

There are a number of issues that the research uncovered that cut across the 12-issue taxonomy and should be considered when applying or using the taxonomy.

1. INTERSECTIONALITY

While the taxonomy identifies discrete issues (e.g., digital divide, labour, consent), it does not fully capture how inequities overlap across gender, class, ethnicity, and geography. Justice analyses should account for these compounded vulnerabilities.

2. POWER AND GEOPOLITICS

The taxonomy touches on procurement and market power but does not explicitly highlight global inequalities in AI and energy systems. Issues such as data colonialism, technological dependency, and asymmetries of lower income countries as both a consumer of AI tools and in some cases, a supplier of critical minerals, require deeper attention.

3. EPISTEMIC AND KNOWLEDGE JUSTICE

Although recognition justice is included, the taxonomy does not explicitly address whose knowledge systems shape AI in the energy transition. Local and Indigenous knowledge often remain undervalued compared to technical or corporate expertise.

4. NARRATIVE AND POLITICAL MISUSE

AI can be mobilised to shape, distort or amplify narratives in energy debates, for instance, legitimising unjust policies or greenwashing fossil fuel projects. The political dimension of AI's use in energy systems is not fully captured.

5. SECURITY AND MILITARISATION RISKS

Reliability and safety in the taxonomy focus mainly on system resilience, but broader risks on cyberwarfare, surveillance, and militarisation of energy infrastructures remain less visible.

6. INTERGENERATIONAL JUSTICE

The taxonomy accounts for present burdens (e.g. environmental footprint, minerals, water scarcity), but less for potential long-term impacts on future generations.

7. POSITIVE FUTURES

The present taxonomy is weighted toward risks and harms, with less emphasis and examples of how AI could actively support empowerment, flourishing, and regenerative futures.





SECTION 3

VALIDATING THE TAXONOMY

EMERGING THEMES

We validated the 12-issue taxonomy by testing it against 70 cases spanning 40 countries, and in interviews with 9 stakeholders across academia, industry, civil society, and government in the UK and the Philippines.

Through the validation process, we confirmed that there is a clear gap in research into how AI might influence social justice as it is deployed in the renewable energy system. We acknowledge that this research is primarily a qualitative inquiry and could benefit from further quantitative investigation to further validate the taxonomy or identify areas that need refinement.
We also noted the following themes:

1. Prioritisation of social justice issues is context-specific

The social justice issues in the taxonomy were prioritised differently by stakeholders based on their organisational interest and their geography. For instance: access, affordability, the digital divide and inclusion, impact individuals and communities both within and between countries. Even in advanced economies like Germany and Hong Kong, access and affordability are not equitably distributed. We found that this was also reflected in the way in which stakeholders prioritised the issues in the taxonomy.

We found that there were commonalities between the UK and the Philippines with most interviewees considering the following five issues as very relevant to their work and the wider transition:

- Access and Affordability;
- Digital Divide and Inclusion;
- Reliability and Safety in Critical Infrastructure;
- Procurement and Market Power; and
- Policy, Standards and Redress

There were also some notable differences between interviewees in the two regions. In the UK, interviewees highlighted the need for regulation of AI to tackle the potential challenges with AI deployment with some suggesting that there was a role for international governance of AI in a similar way to Modern Slavery legislation and governance. This was not reflected in conversations with those in the Philippines where interviewees highlighted how culturally dependent ethics are. For instance, ethics based on Western individualism does not always align with how social justice is considered in Asia.

For this reason, context should be considered when applying this taxonomy. Interviewees suggested that it could be useful to see the taxonomy as a set of design principles that could be adapted to any specific context.



2. Impacts on communities and the benefits of engaging with community

The physical impacts of AI data centres on local communities were emphasised in both the case studies and the interviews. Three kinds of impacts were noted:

- Direct infrastructure impacts;
- Secondary impacts; and
- Impacts on jobs and skills.

Both the case study review and expert interviews confirmed the vast impact that AI data centres have on local resources and communities. AI infrastructure is often positioned in communities already facing environmental stress. Impacts like water scarcity, grid strain and air pollution fall heavily on local — and often marginalised — communities. The case study review also validated the insight that AI and renewable energy systems are often deployed top-down, without community consultation, free prior informed consent (FPIC), or on-going participation. To make AI deployment more equitable, there was agreement amongst interviewees that genuine community participation, with communities fully engaged and not just consulted, was critical.

The impacts of AI infrastructure, such as data centres, often manifest as secondary effects like higher utility bills, water scarcity, grid instability, rather than direct harms. As these secondary impacts are often hidden, it is easy to overlook them, and for this reason interviewees suggested that energy infrastructure could be given more weight in the taxonomy.

A final impact on communities and workers is the loss of jobs and lack of reskilling as AI is deployed to perform tasks which have been previously done by workers. Interviewees mentioned the experience of past energy transitions, such as the phase out of coal mining in the UK, where miners and mining communities were left without jobs and with skills that were not needed by new industries. This led to economic decay in mining communities and social unrest. As AI displaces jobs in the new energy system, we could see a similar pattern with workers and communities bearing the costs of transitioning, if new skills and jobs are not provided.

3. Algorithmic systems can entrench existing inequalities

AI systems trained on biased or historical data can reproduce and amplify discrimination in policing, employment, welfare, and energy access. Affected individuals often do not know they have been algorithmically flagged, scored, or excluded, and have no way to challenge decisions. The pattern spans wealthy and developing countries alike, revealing that algorithmic bias is a structural problem. For example, interviewees in the UK were concerned about the fact that the algorithms being used for heat pump and retrofit projects have been designed with data that centres higher income homes while excluding those in low-income households.

Interviewees in the Philippines raised the issue of data sovereignty. They highlighted that Southeast Asia could not rely on American or Chinese big tech and data to solve issues specific to their regions. Using existing data and algorithms would likely risk continuing colonial and imperial legacy biases.

Algorithmic bias does not necessarily create new injustices but can exacerbate existing ones. What used to require individual discriminatory decisions now happens instantaneously across millions of transactions, making patterns harder to detect and challenge.

4. A lack of long-term thinking

The current discourse around AI in the energy system has focussed more on the risks than the benefits. There was agreement among our interviewees that there was a lack of foresight, innovation and imagination amongst many stakeholders deploying AI in the energy system. Interviewees welcomed a chance to take a more balanced look at the risks and opportunities around AI and felt that tools which enable this balanced conversation, such as future scenarios, could be useful.



SECTION 4

RECOMMENDATIONS

The question is not whether AI will shape energy transitions — it already is.

The question is whether we will shape AI to serve justice, equity, and regeneration or allow it to entrench existing inequity.

There is a choice before us, but the window to make it is closing.

SUGGESTED ACTIONS

If we are to ensure that AI's deployment in the energy transition is done in a way that addresses the social justice concerns highlighted in this paper, action from all stakeholders across the energy system will be required.

For policy makers and regulators, there is a need to:

- Ensure robust regulation of AI, both the rules around how data is collected, used and shared by companies, and frameworks for how renewable energy and AI infrastructure planning decisions are made.
- National planning needs to acknowledge and consider the secondary and tertiary implications of AI deployment in order to adequately address system-wide impacts. Justice impact assessments could be one vehicle for this type of evaluation.
- Move beyond regulation that sets boundaries and towards policies that encourage innovation and ingenuity, drawing on responsible innovation principles that emphasise anticipation, inclusion, reflexivity, and responsiveness (Stilgoe et al., 2013).
- Foster international cooperation on the governance of AI to ensure that potential negative consequences are acknowledged and proactively managed across borders.

For policy makers, the taxonomy could be used as a checklist of considerations against which they assess the impacts of new policies and plans.

For energy utilities and companies, AI developers and tech companies developing AI or using it in their operations and processes, there is a need to:

- Ensure that the deployment of AI and subsequent realisation of efficiency gains or new forms of business value do not have unintended social justice consequences e.g. by placing additional burdens upon vulnerable or low-income users, or by failing to sufficiently build workforce capacity in less developed economies.
- Ensure that AI tools are not negatively impacting social justice by considering shifting to open, interoperable platforms, supporting open-source alternatives and providing explainability tools.

Energy utilities and companies, AI developers and tech companies can use the taxonomy to inform decisions about how AI is being deployed. For instance, the taxonomy could be used to select the issues that are most material to the smooth running of operations or support justice audits of AI applications.

For research and academia, we encourage:

- Further exploration of this topic with application and refinement of the taxonomy through more research.
- Exploration into whether measurable indicators or assessment matrices could be developed to improve the robustness of the taxonomy and its use as a tool by key stakeholders.

For civil society and communities, we see:

- A critical role in advocating for greater social equity in the energy system, highlighting the social justice related risks and opportunities associated with AI deployment.
- The potential for AI to open up opportunities for better access to information that is digestible and relatable for citizens and communities.

The taxonomy can be used as an organising resource for civil society and communities to push for greater transparency and accountability from others in the energy system across the full spectrum of social justice issues.

FURTHER EXPLORATION

Whether you are conducting AI or energy-related research, assessing the merits of AI deployment, developing policy, organising communities, building new AI technologies or innovating new AI-enabled business models these 12 issues offer a guide to the questions that need to be asked and a sense of the potential unintended impacts that need exploring.

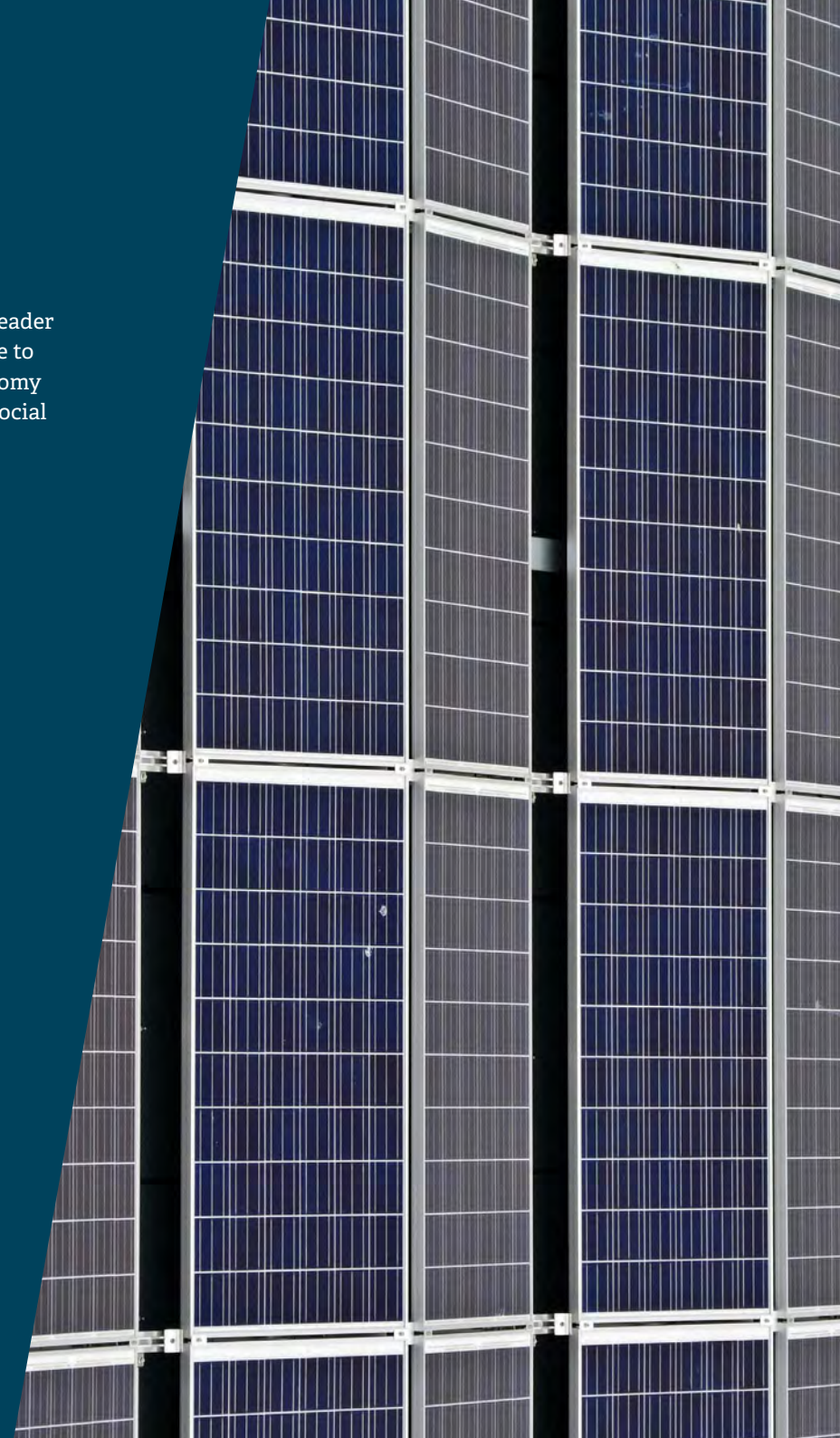
We also recognise that this work could be further advanced by:

- Considering the different perspectives and priorities that stakeholders found in the taxonomy, and ranking the issues either by timeframe or impact;
- Developing the taxonomy into a set of design principles or a practical tool that could better assist stakeholders to build fairness into plans, products and processes;
- Developing a set of measurable indicators for the taxonomy;
- Exploring how the taxonomy might incorporate intersectional analysis across gender, class, ethnicity or geography; and
- Forming the basis of a set of scenarios or pathways that could help stakeholders to explore what AI for a just and regenerative renewable energy system might look like.

CONNECT WITH US

If you are a policy maker, sustainability leader or just transition advocate, we would love to discuss how you would deploy the taxonomy and what potential you see for tackling social justice through the deployment of AI.

If you have found this paper interesting, or would like to know more and work with us to further refine and test the taxonomy, please get in touch at: energy@forumforthefuture.org



APPENDICES

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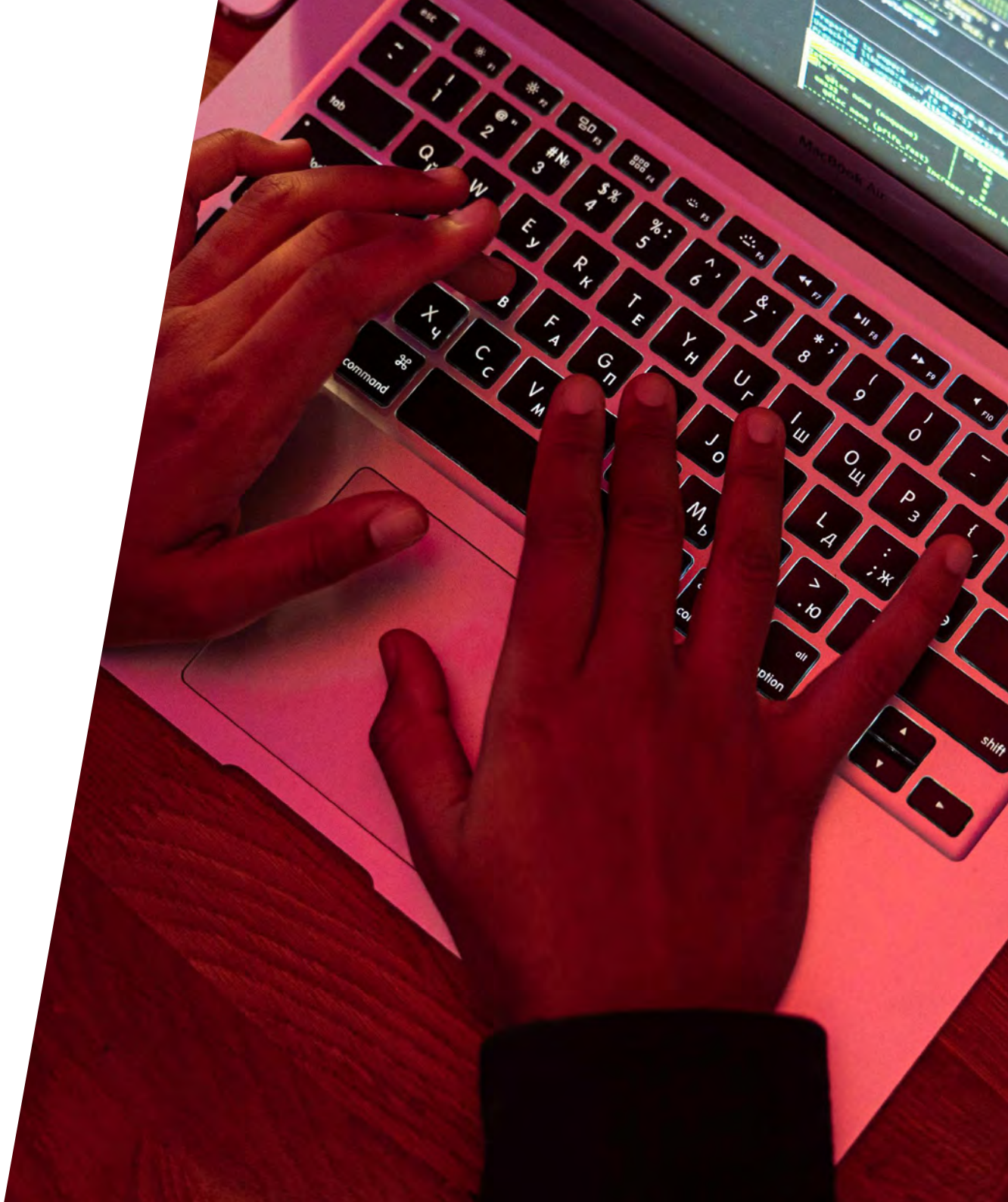
AI TOOLS DISCLOSURE

This research made use of multiple AI-assisted tools to support the literature review, synthesis, and validation process. ChatGPT-5 was used to structure research questions, develop the taxonomy, and draft narrative explanations; Perplexity AI was employed to identify and retrieve recent academic and gray literature; and Elicit was used to surface and rank peer-reviewed journal articles, extracting key summaries of methods and findings. In addition, Claude was used to refine the structure of the taxonomy framework, cross-check references, and ensure coherence in the presentation of sources. All outputs from these tools were critically reviewed, cross-checked against original sources where possible, and integrated into the analysis by the authors. The use of AI tools in this work is intended as an accelerator for scoping and synthesis, not as a substitute for human judgment, interpretation, and scholarly rigour.



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Forum for the Future is a leading international sustainability organisation. For 30 years we've been working in partnership with business, governments and civil society to accelerate the shift towards a just and regenerative future in which both people and the planet thrive. As our environmental, social and economic crises intensify, the world is rapidly changing, with multiple transitions already reshaping how we all live and work. But will we go far enough, and fast enough?

Forum is focused on enabling deep transformation in three game-changing areas: how we think about, produce, consume and value both food and energy, and the purpose of business in society and the economy.

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