

Electrical Engineers

AI enhancing design, simulation, power systems, and electronics development.

EXPOSURE	WINDOW	ADOPTION TODAY	READING
35 Moderate exposure	5–10 yrs until change lands	Medium-High	Augmented more than re-placed. Exposure is the share of today's work AI can plausibly take on within the window.

§ 01WHAT IS HAPPENING

What is happening to electrical engineers

Impact	AI is automating repetitive design tasks, optimizing complex circuit simulations, enhancing predictive maintenance for electrical infrastructure, and assisting in the development of smart grids and IoT devices. This allows Electrical Engineers to focus on conceptual design, critical problem-solving, validation, and strategic innovation in complex electrical systems.
Risk	Significant augmentation; focus on complex problem-solving, validation, and AI tool mastery. The Electrical Engineer role will be profoundly augmented by AI. AI will handle data processing, iterative design, and predictive analysis, shifting engineers' focus to critical validation of AI outputs, complex systems architecture, ethical considerations in autonomous electrical systems, and ensuring reliability in safety-critical applications. Human creativity and nuanced judgment for complex system integration remain paramount.
Sector readiness	Progressive Integration & High Investment The electrical engineering sector, especially in areas like power grids, electronics design, and automation, is making substantial investments in AI for R&D, smart infrastructure, and operational efficiency. Given the high-stakes nature of energy reliability and electronic component performance, integration is progressive, with emphasis on validation and certification.

§ 02 POSITION

Where you stand

- i The Electrical Engineer role is undergoing a significant transformation, with AI becoming a fundamental tool across design, simulation, and operational optimization.
- ii AI will automate iterative tasks and provide powerful analytical insights, allowing engineers to focus on complex systems architecture, strategic innovation, and ensuring the reliability and safety of next-generation electrical systems.
- iii Success in this field will increasingly depend on mastering AI tools, critically validating their outputs, and developing deep interdisciplinary skills to navigate the complexities of AI-enabled electrical engineering.

§ 03 ACTIONS

15 POINTS

What this means for you

Concrete changes to how the work gets done, in the order you are likely to meet them.

- 01 **AI-Accelerated Circuit Design & Layout.** Electrical Engineers are leveraging AI-powered tools to rapidly generate and optimize circuit designs, PCB layouts, and integrated chip architectures. This capability allows for the exploration of a vast number of design alternatives and faster iteration cycles, leading to more efficient and compact electronic systems.
- 02 **Enhanced Simulation & Performance Modeling.** Electrical Engineers will utilize AI to significantly improve the speed and accuracy of complex electrical simulations, such as electromagnetic compatibility (EMC) or power integrity analysis. This involves AI learning from previous simulations to predict performance and optimize parameters with unprecedented speed, reducing physical prototyping cycles.
- 03 **Predictive Maintenance for Electrical Grids & Equipment.** AI is transforming the maintenance of large-scale electrical infrastructure and critical equipment. Electrical Engineers are deploying and managing AI systems that analyze vast sensor data from power lines, transformers, and industrial machinery to predict potential failures, enabling proactive repairs and minimizing downtime and blackouts.
- 04 **AI-Driven Power Systems Optimization & Smart Grids.** Electrical Engineers are instrumental in designing and implementing AI-driven smart grids that dynamically manage energy flow, integrate renewable sources, and optimize distribution. AI optimizes load balancing, predicts demand fluctuations, and identifies faults, enhancing grid stability and efficiency.
- 05 **Automated Testing & Quality Assurance for Electronics.** AI-powered computer vision systems and test automation platforms are performing rapid, highly accurate inspections of electronic components and assemblies for defects. Electrical Engineers are responsible for validating these AI systems, setting precise inspection criteria, and analyzing AI-flagged anomalies to ensure high quality.

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- 06 **AI-Assisted Signal Processing & Communication Systems.** Electrical Engineers are employing AI for advanced signal processing in communication systems, enhancing noise reduction, optimizing data transmission, and developing more intelligent wireless networks. This contributes to more robust and efficient data exchange in various applications, from IoT to aerospace.
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- 07 **Robotics & Automation Control Systems Integration.** Electrical Engineers are designing and integrating AI into control systems for advanced robotics, industrial automation, and autonomous vehicles. This includes developing intelligent control algorithms, ensuring sensor-motor integration, and optimizing robotic movements for precision and efficiency in manufacturing and other sectors.
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- 08 **AI for Materials Science in Electronics.** AI is accelerating the discovery and development of new high-performance materials for electronic components by simulating molecular structures and predicting properties. Electrical Engineers are leveraging these AI insights to select, apply, and optimize advanced materials for semiconductors, sensors, and energy storage devices.
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- 09 **Cybersecurity for Electrical Infrastructure & IoT.** With increasing AI integration and connectivity in smart grids and IoT devices, the cybersecurity of these systems is paramount. Electrical Engineers are involved in designing robust cyber defenses for AI-enabled electrical components, protecting against data manipulation and ensuring system integrity.
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- 10 **AI in Semiconductor Design & Manufacturing.** Electrical Engineers are employing AI to optimize various stages of semiconductor design and fabrication, from optimizing chip layouts for performance and power efficiency to controlling complex manufacturing processes in cleanrooms. This enables the creation of more powerful and reliable microchips.
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- 11 **Ethical AI & Safety-Critical System Design.** Given the critical nature of electrical systems, Electrical Engineers will be deeply involved in addressing the ethical implications of AI, ensuring transparency, explainability, and rigorous validation for AI-driven components in safety-critical applications like autonomous vehicles or power grid controls.
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- 12 **Power Electronics & Energy Management with AI.** Electrical Engineers are designing AI-enabled power electronics for efficient energy conversion, smart battery management systems, and optimized power delivery in electric vehicles and renewable energy installations. AI helps to maximize energy harvesting and minimize losses.
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- 13 **AI-Driven Fault Detection & Diagnostics.** AI tools are assisting Electrical Engineers in rapidly diagnosing complex electrical faults in intricate systems, analyzing real-time data from various sensors to pinpoint issues and suggest effective troubleshooting steps, significantly reducing diagnostic time.
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- 14 **Continuous Learning & Cross-Disciplinary Skill Development.** The rapid integration of AI requires Electrical Engineers to continuously learn about AI/ML fundamentals, data science principles, and new software tools. This means proactively developing interdisciplinary skills to effectively collaborate with AI specialists and lead AI implementation in electrical engineering.
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- 15 **AI for Design Verification & Compliance.** AI tools are assisting Electrical Engineers in verifying complex designs against industry standards and regulatory compliance requirements more thoroughly and quickly. This accelerates the certification process and ensures adherence to safety and performance benchmarks for new electrical products and systems.
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What is pushing this change

- 01 **Increasing Complexity of Electrical Systems (e.g., IoT, Smart Grids).** Modern electrical systems involve millions of interconnected components and vast data streams, requiring AI for management and optimization.
- 02 **Demand for Higher Efficiency & Performance in Electronics.** AI excels at optimizing designs for power consumption, speed, and miniaturization, crucial for competitive electronics.
- 03 **Advancements in AI/ML Algorithms (e.g., Reinforcement Learning, Generative AI).** New AI techniques enable more sophisticated optimization, autonomous control, and data interpretation for complex electrical problems.
- 04 **Availability of Big Data from Sensors & Networks (IoT in Electrical Systems).** Sensors on power grids, electronic devices, and industrial machinery generate terabytes of data, which AI can process for insights.
- 05 **Pressure for Reduced Development & Operating Costs.** AI-driven design, simulation, and automation reduce development cycles and operational expenditures in electrical engineering.
- 06 **Need for Enhanced Reliability & Safety in Power/Control Systems.** AI can predict failures, detect anomalies, and assist in rigorous testing, enhancing safety in high-consequence electrical environments.
- 07 **Growth of Renewable Energy & Smart Grid Initiatives.** AI is essential for integrating intermittent renewable sources, optimizing grid stability, and managing distributed energy resources.
- 08 **Global Competition & Innovation Race in Electronics/Power.** Nations and companies are investing heavily in AI to gain a technological edge in electronics, power systems, and automation.
- 09 **Digital Transformation Initiatives in Engineering & Manufacturing.** Major engineering firms are undergoing digital transformations, embedding AI into every stage from concept to service.
- 10 **Accelerated Pace of Product Development.** AI accelerates design iteration, simulation, and manufacturing processes, enabling quicker product development and time-to-market.

Impact by sector

The headline figure is an average. Where you work changes the picture.

Power Systems Engineers (Smart Grid, Renewables)	Heavy use of AI for grid stability, renewable energy integration, load forecasting, and predictive maintenance of power infrastructure. Focus on grid resilience and efficiency.
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Electronics Engineers (Semiconductor, PCB Design)	AI for generative design of circuits/chips, optimized layouts, and automated verification. Focus on performance, power efficiency, and manufacturability.
Control Systems Engineers (Robotics, Automation)	AI for intelligent control algorithms, robotic path planning, and optimizing industrial automation processes. Focus on autonomous operations and human-robot collaboration.
Signal Processing Engineers (Communications, Sensors)	AI for noise reduction, data compression, intelligent filtering, and optimizing data transmission in complex communication systems. Focus on data fidelity and bandwidth efficiency.
Embedded Systems Engineers	AI for optimizing code for resource-constrained devices, intelligent sensor fusion, and on-device machine learning for real-time applications. Focus on performance and power consumption.

Skills to build

The skills that keep the human part of this work valuable as the routine part is automated.

- 01**AI/ML Literacy & Data Science Fundamentals.** Understanding AI/ML concepts, their applications in electrical engineering, and ability to work with large datasets from machinery and operations.
- 02**Advanced Simulation & Modeling (AI-enhanced).** Proficiency in AI-enhanced simulation tools and ability to build/interact with digital twins for electrical system design, test, and operations.
- 03**Systems Integration & Architecture.** Designing and integrating complex electrical systems, including those with AI components, ensuring interoperability and overall system performance.
- 04**Critical Thinking & Validation of AI Outputs.** Ability to scrutinize AI-generated designs, analyses, or predictions for accuracy, biases, limitations, and safety implications in safety-critical contexts.
- 05**Ethical AI & Regulatory Compliance.** Ensuring AI systems comply with electrical safety standards, industry regulations, and addressing ethical concerns like explainability and fairness.
- 06**Generative Design & Optimization.** Knowledge of AI tools that generate and optimize electrical components, circuits, or system layouts based on performance criteria.
- 07**Cybersecurity for Electrical Systems.** Designing and implementing robust security measures for AI-enabled electrical infrastructure and devices, protecting against cyber threats.
- 08**Interdisciplinary Collaboration & Communication.** Effectively communicating complex technical and AI-related information with cross-functional teams (AI specialists, power grid operators, software engineers) and non-technical stakeholders.

Tools in use

KINDS OF TOOL WORTH KNOWING

- 01

AI-Powered EDA (Electronic Design Automation) Software. Software suites that use AI/ML to assist in designing, verifying, and optimizing electronic circuits, PCBs, and integrated circuits (ICs).
- 02

AI-Enhanced Power System Simulation Tools. Simulation tools that leverage AI for faster analysis, optimization, and real-time modeling of complex power grids, including renewable integration.
- 03

Predictive Maintenance Platforms for Electrical Assets. Platforms that analyze sensor data from transformers, generators, and industrial motors to predict failures and optimize maintenance schedules.
- 04

AI-Driven Control System Software. Software that uses AI/ML to develop intelligent control algorithms for robotics, industrial automation, and autonomous electrical systems.
- 05

Generative Design & Topology Optimization Tools. Tools that use AI to rapidly generate and optimize component designs (e.g., electrical enclosures, heat sinks) based on performance and manufacturing constraints.
- 06

AI-Powered Signal Processing Libraries/Platforms. Software libraries or platforms that implement AI algorithms for advanced filtering, compression, noise reduction, and pattern recognition in electrical signals.

NAMED TOOLS ALREADY IN USE

- Cadence Design Systems (Virtuoso, Spectre) / Synopsys (Fusion Design Platform)**

VISIT

Leading EDA software suites heavily integrating AI for design, verification, and optimization of semiconductors and complex electronic circuits.
- ETAP (Operational Technology Solutions) / Siemens PSS®SINCAL (Power System Analysis)**

VISIT

Comprehensive software platforms for power system analysis, simulation, and optimization, increasingly incorporating AI for grid management and renewables.
- GE Digital APM / IBM Maximo (for Enterprise Asset Management with AI)**

VISIT

Enterprise Asset Performance Management platforms that leverage AI/ML for predictive maintenance and operational optimization of electrical assets.
- MathWorks (MATLAB & Simulink with AI Toolboxes)**

VISIT

A widely used platform for numerical computing and control system design, now with specialized AI toolboxes for developing intelligent control algorithms.
- Ansys (Discovery, OptiSlang for Generative Design/Optimization)**

VISIT

A leading simulation software suite that is integrating AI for generative design exploration and multi-objective optimization across engineering disciplines.

In practice

Ways people in this role are already using AI, and what they get from it.

Optimize Power Grid Stability EXAMPLE 1	HOW Implement AI algorithms within a smart grid system to dynamically adjust power flow, balance loads, and reroute electricity in real-time in response to demand fluctuations or fault conditions. This ensures continuous power supply and grid stability. GAIN Enhances grid reliability, reduces blackouts, optimizes energy distribution, and seamlessly integrates intermittent renewable energy sources.
Accelerate Semiconductor Chip Design EXAMPLE 2	HOW Utilize AI-powered EDA (Electronic Design Automation) software to rapidly explore and optimize chip layouts, transistor sizing, and interconnections for performance, power consumption, and thermal management. This accelerates the design cycle for new microprocessors. GAIN Significantly reduces design time, improves chip performance and power efficiency, and accelerates time-to-market for new electronic devices.
Predict Electrical Equipment Failure EXAMPLE 3	HOW Deploy AI models that analyze sensor data (e.g., temperature, vibration, current) from critical electrical components like transformers or circuit breakers. The AI predicts impending failures, triggering proactive maintenance before an outage occurs. GAIN Minimizes unplanned downtime, reduces maintenance costs, extends equipment lifespan, and enhances the overall reliability of electrical infrastructure.
Design an Intelligent Control System EXAMPLE 4	HOW Develop intelligent control algorithms using AI (e.g., reinforcement learning) for complex robotic arms or industrial automation systems. The AI learns optimal movements and decision-making for tasks like precision welding or automated assembly. GAIN Improves the precision, adaptability, and efficiency of robotic systems, enabling them to perform more complex tasks in dynamic environments.
Automate PCB Layout Generation EXAMPLE 5	HOW Use AI features within EDA software to automatically generate complex multi-layer PCB (Printed Circuit Board) layouts based on component placement, connectivity requirements, and design rules, optimizing for signal integrity and manufacturability. GAIN Drastically speeds up PCB design, reduces errors, and optimizes board space, leading to more compact and cost-effective electronic products.

§ 09

CONTEXT

How this role compares

Three neighbouring roles chosen to show the direction of travel.

Electrical Technicians (Routine Testing/Assembly) / Manual PCB Layout Designers MORE EXPOSED	AI IMPACT High (AI can automate routine testing and analysis of results; AI-powered EDA tools automate basic PCB layout generation.) WORK MOVES TO Shift towards overseeing AI-driven test equipment, troubleshooting complex issues, or validating AI-generated designs.
AI/ML Engineers (Specializing in Electrical/Power Systems AI) DIFFERENT SKILLS, GROWING	AI IMPACT Foundational (They build and deploy the AI algorithms and systems that Electrical Engineers will utilize.) WORK MOVES TO Deep expertise in AI/ML algorithms, data science, software engineering, and specific electrical engineering domain knowledge.
Electricians (Field Installation/Repair) COMPLEMENTARY, LESS EXPOSED	AI IMPACT Lower (Fewer AI-specific diagnostic tools or systems to install currently, though smart water systems are emerging) WORK MOVES TO Primarily manual skills, less immediate pressure for AI-specific upskilling compared to engineers dealing with smart grids/electronics.

§ 10

VERDICT

Closing judgement

For Electrical Engineers, AI is a powerful force of augmentation, not replacement. It automates complex analysis and iterative optimization, allowing engineers to focus on higher-level conceptualization, strategic problem-solving, and ensuring the safety and ethical implementation of intelligent electrical systems. Mastering AI tools and cultivating an interdisciplinary mindset will be crucial for leading innovation in the electrified and interconnected future.

Evidence and revisions

What the exposure figure rests on, what changed when it was last revised, and the published work cited for this role.

SCORE

35 (held)

WINDOW

5-10 years (unchanged)

The 4 October 2026 review held the score.

Microsoft's AI applicability score for the matching occupation is 0.11, in the lower half of 785 US occupations; Anthropic's observed exposure (the share of the occupation's tasks already being done with Claude) is 0.06, which is modest by the standards of the 756 occupations measured; the US Bureau of Labor Statistics places it in the 'high' AI-exposure tier; BLS projects employment to grow 9.9% over 2025–35. Taken together this is consistent with our previous figure of 35, which we have held.

MEASURES BEHIND THE SCORE

US Bureau of Labor Statistics · *Employment Projections 2025–35 and AI Exposure Categories* (27 August 2026)
AI-exposure tier: High. Projected employment change 2025–35: +9.9%. Matched to Electrical engineers.

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Microsoft Research · *Working with AI: Measuring the Applicability of Generative AI to Occupations* (10 July 2025)
AI applicability score 0.11 (percentile 37 of 785 occupations) for SOC 17-2071.

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Anthropic · *Anthropic Economic Index report: Cadences* (26 June 2026)
Observed exposure 0.06 for SOC 17-2071 (percentile 68 of 756 occupations).

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UK Department for Science, Innovation and Technology · *Assessment of AI capabilities and the impact on the UK labour market* (28 January 2026)
UK context: around 70% of UK workers are in occupations with tasks AI could perform or enhance, above the US average; a one-standard-deviation rise in exposure was associated with a 3.9% fall in UK job postings.

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<https://www.careerguard.ai/sources>

Method and sources

Each report was written from a large body of published research and then, in October 2026, re-scored against occupation-level evidence: the US Bureau of Labor Statistics AI-exposure classification and 2025–35 projections, Microsoft Research's AI applicability scores and Anthropic's observed-exposure data, cross-checked against the reports listed in the Evidence section above. The organisations and publications below are the standing literature behind the narrative sections. Every source, with dates, licences and archived copies where we are permitted to hold them, is catalogued in the research library.

Scores are revised by blending the previous editorial figure (60%) with a composite of the three occupation-level measures (40%), capped at fifteen points per revision and rounded to the nearest five. The window shifts one notch when a score moves ten points or more. Hand adjustments are recorded with their reason in the revision log.

I GLOBAL AND MACROECONOMIC IMPACT OF AI ON WORK

World Economic Forum

The Future of Jobs Report series — Employer survey of expected job growth and decline, skill shifts and technology adoption (2020, 2023 and 2025 editions); Artificial Intelligence and the Future of Entry-Level Work (2026).

AI governance and transformation reports — Frameworks on ethical AI, talent strategy and industry transformation.

McKinsey Global Institute

AI, Automation and the Future of Work series — Research quantifying automation potential by task, sector and demographic, from "Jobs Lost, Jobs Gained" to "Agents, robots, and us" (2025).

Industry-specific reports — Financial services, healthcare, manufacturing and others.

PwC

Global AI Jobs Barometer — Annual analysis of job postings and productivity by AI exposure (2024–2026 editions).

Upskilling Hopes and Fears survey — Employee perceptions and readiness.

Microsoft Research and Anthropic

Working with AI (2025); Anthropic Economic Index (2025–2026) — Occupation-level usage data from Copilot and Claude conversations, the two observed-usage measures behind the 2026 revision.

Stanford Digital Economy Lab and Stanford HAI

Canaries in the Coal Mine? (2025–2026); AI Index Report (annual) — Payroll evidence on early-career employment in exposed occupations; annual measurement of AI capability, investment and adoption.

Deloitte

Human Capital Trends series — Workforce, talent and HR technology trends.

Tech Trends series — Emerging technologies and their business implications.

Accenture

Technology Vision series — Forward-looking analysis of emerging technology, with emphasis on AI.

Fjord Trends — Design, innovation and human experience in a digital world.

Boston Consulting Group

AI/ML insights and industry solutions — "The AI Revolution in the Workplace" and related research.

EY

AI and workforce reports — Adoption, talent strategy and ethics.

IBM Institute for Business Value

AI and automation studies — Business models, workforce evolution and leadership.

OECD

AI Policy Observatory — International data and policy on AI, labour markets and skills.

Employment Outlook — Labour-market trends including technological impact (2023–2026 editions).

International Labour Organization

Generative AI and Jobs: A Refined Global Index of Occupational Exposure (2025) — Task-level exposure gradients for every ISCO occupation; successor to the 2023 global index.

International Monetary Fund

Staff Discussion Notes on AI and work (2024, 2026) — Complementarity framing: where AI augments and where it substitutes.

UK Department for Science, Innovation and Technology

Assessment of AI capabilities and the impact on the UK labour market (2026) — UK occupational exposure and job-posting evidence.

Brookings Institution

AI and automation research — Economic and social implications, displacement and skills.

Yale Budget Lab and Goldman Sachs Research

Tracking the Impact of AI on the Labor Market; AI and the US labour market (2026) — Aggregate labour-market monitoring; macro displacement estimates.

Oxford University (Oxford Martin School)

The Future of Employment — Frey & Osborne and subsequent research on susceptibility to automation.

MIT Technology Review

AI & Work — Reporting on AI research and its implications for industries and jobs.

Gartner

Hype Cycle for Artificial Intelligence — Maturity and adoption of AI technologies.

Future of Work reports — Workplace models and talent strategy.

U.S. Bureau of Labor Statistics

Employment Projections 2025–35; AI Exposure Categories; Occupational Outlook Handbook — Ten-year employment projections and, from the 2025 cycle, an AI-exposure tier for every detailed occupation.

Indeed Hiring Lab

AI at Work Report (2025) and posting-market updates — Skill-level transformation estimates and job-posting trends by occupation.

II CORE AI AND MACHINE-LEARNING RESEARCH

OpenAI

Research papers, blog and API documentation — Large language models, generative AI, safety and societal impact.

Google DeepMind

Research papers and blog — Reinforcement learning, AI for science, AGI and ethics.

Meta AI

Research papers and blog — Large language models, computer vision, AI for social good.

Hugging Face

Transformers library and model hub — Open-source state-of-the-art NLP models.

TensorFlow and PyTorch

Documentation and community forums — Core frameworks illustrating practical capability.

arXiv

cs.AI, cs.LG, cs.CV, cs.CL — Pre-print research.

NeurIPS and ICML

Conference proceedings — Top-tier academic research.

ACM and IEEE

Journals and proceedings — ACM Computing Surveys; IEEE Transactions on AI.

Kaggle

Datasets and competition solutions — Applied machine learning on real-world problems.

The Alan Turing Institute

Research and reports — Responsible and applied AI.

III ETHICAL AND RESPONSIBLE AI DEPLOYMENT

NIST

AI Risk Management Framework — Voluntary framework for managing AI risk.

European Commission

AI Act — Risk-tiered legal framework for AI.

Ethics Guidelines for Trustworthy AI — Principles for responsible development.

Partnership on AI

Research and best practice — Responsible AI development.

AI Now Institute

Annual reports — Social implications: power, inequality, rights.

ACM FAccT

Proceedings — Fairness, accountability and transparency.

Data & Society

Publications — Social implications of data-centric technology.

WIPO

Conversation on IP and AI — Intellectual-property implications of AI.

IEEE Global Initiative on Ethics of AI/IS

Ethically Aligned Design — Recommendations for ethical AI design.

Center for AI and Digital Policy

Policy briefs — Accountable AI policy.
