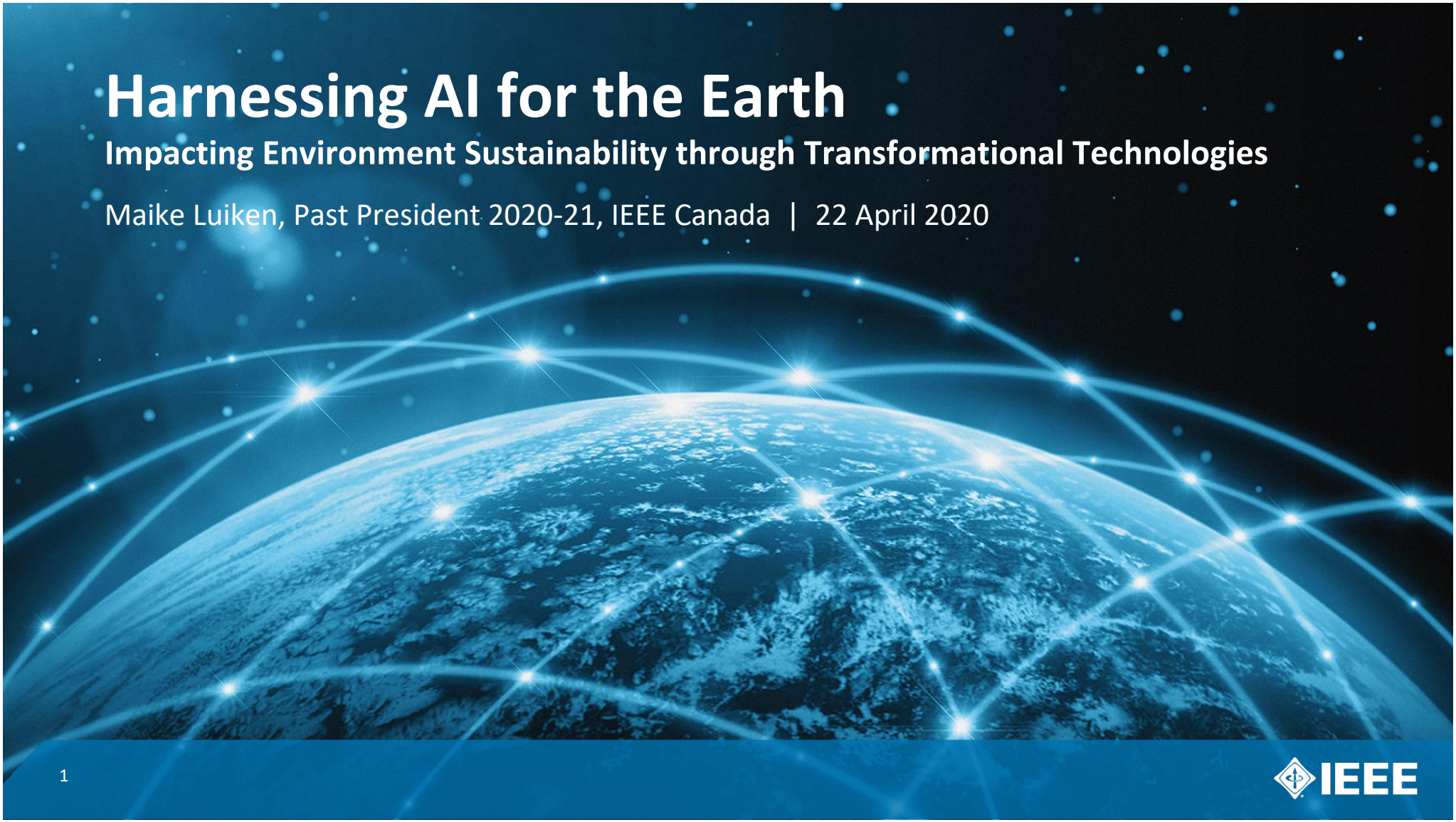


Harnessing AI for the Earth

Impacting Environment Sustainability through Transformational Technologies

Maike Luiken, Past President 2020-21, IEEE Canada | 22 April 2020

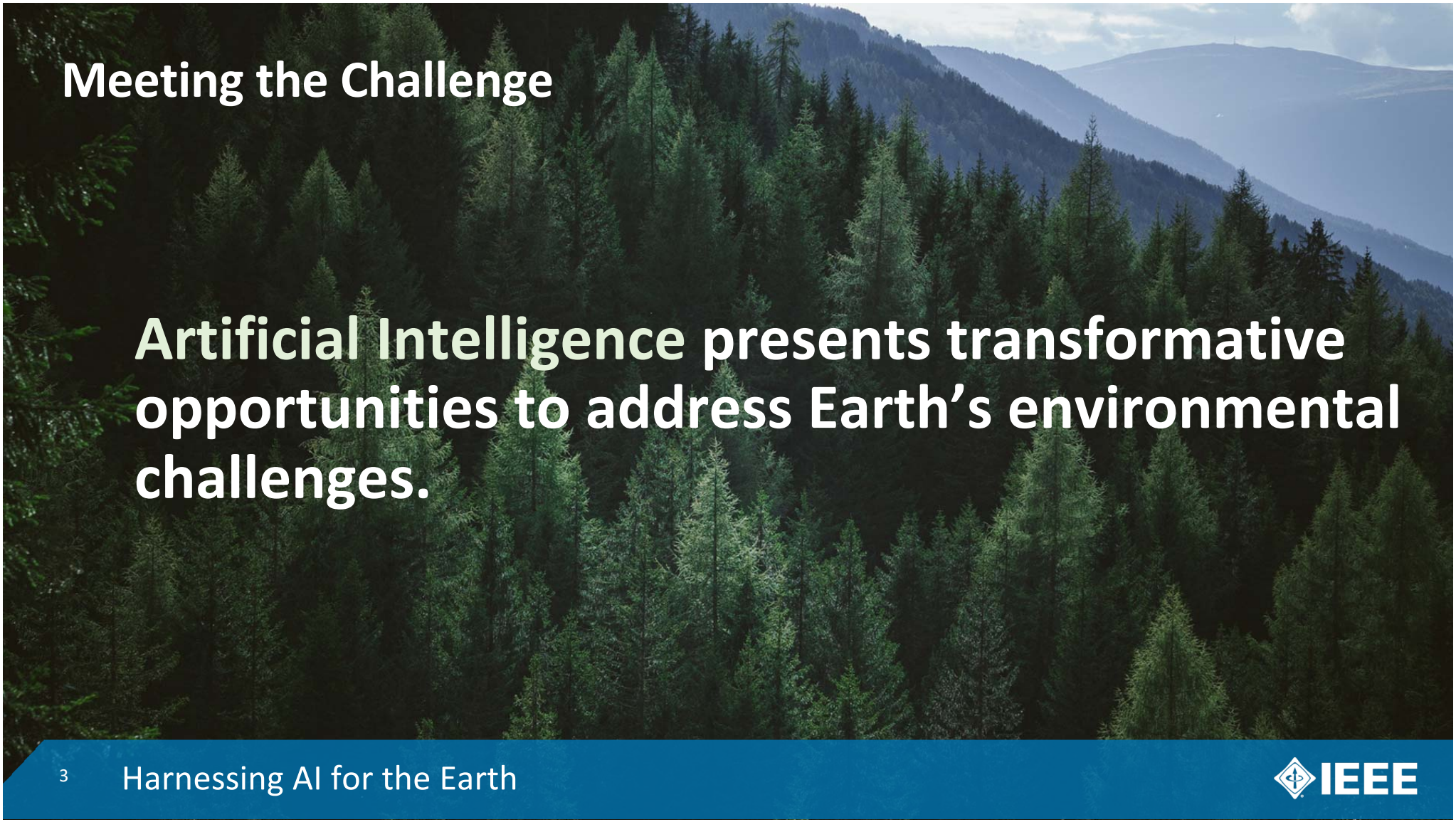
IEEE

Meeting the Challenge

Climate change remains one of the most important challenges facing humanity. It affects every country and disrupts national economies and affects lives. Consequences for food production, economic output & human wellbeing.

Extreme weather events, wildlife trafficking, rising sea levels, increased agricultural and urban development demands, higher global temperatures and increased ocean acidity are among the threats to the natural systems and biodiversity we rely on.

Our planet is ready to address these challenges through responsible technological transformation. From building alternative energy solutions to developing new approaches to growing and cultivating agricultural crops, technology and innovation continue to transform the way we live and how we protect the planet.


Meeting the Challenge
Artificial Intelligence presents transformative opportunities to address Earth's environmental challenges.

How we can use AI to help

- AI to **IDENTIFY TRENDS** in climate
- AI for **EARLY WARNING** systems, weather and climate **PREDICTIONS**
- AI for **DATA FUSION** to support response strategies and actions to emergencies
- AI to **MANAGE** complexity of systems and for fast analysis and decision
- AI for **TECHNOLOGY OPERATIONS** (Power, ICT and more)

Tech, humanity, well-being & sustainable environment

The use of AI represent a genuine opportunity to provide individuals and communities with the means to meet their needs and develop their full potential.

These transformative technologies can present new and unique ethical and equity-related challenges, which can undermine trust, thereby hindering advances in sustainable environment.

They can also contribute to increased levels of emissions in terms of their production, energy consumption and recycling of electronic waste.

When we use AI for the Earth, we need to ensure reliable, safe and sustainable solutions for the future, and for these solutions to address local, regional and global conditions and circumstances–and recognize end users' values.

IEEE Initiatives

IEEE Technical Committee on Green Communications & Computing

Focused on energy and resource efficient environment sustainable communications, computing & relevant systems.

IEEE Sustainable ICT

A focal point for news, technology updates and information on conferences, publications and educational and standards activities on Sustainable ICT throughout IEEE.

IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems

Working to ensure every stakeholder involved in the design and development of autonomous and intelligent systems is educated, trained, and empowered to prioritize ethical considerations so that these technologies are advanced for the benefit of humanity.

IEEE Sustainability Standards

- **IEEE P1922.1 - Standard for a method for calculating anticipated emissions caused by virtual machine migration and placement** specifies rules to calculate anticipated emissions caused by virtual machine (VM) migration and placement in geographically distributed locations supplied by different electricity sources.
- **IEEE P1922.1 - Standard for a method to calculate near real-time emissions of information and communication technology infrastructure** enables near real-time assessment of ICT infrastructure use phase emissions by taking into account temporal variations of emissions related to electricity generation.
- **IEEE P1923.1 - Standard for computation of energy efficiency upper bound for apparatus processing communication signal waveforms** evaluates communication signal waveforms potential for energy efficiency.
- **IEEE P1924.1 - Recommended practice for developing energy efficient power-proportional digital architectures** provides a set of guidelines for the designers and developers of digital architectures that ensures that power is only consumed when useful computational work is underway.

IEEE Sustainability Standards

- **IEEE P1925.1 - Standard for Energy Efficient Dynamic Line Rate Transmission System** creates a new energy-efficient transmission system.
- **IEEE P1926.1 - Standard for a Functional Architecture of Distributed Energy Efficient Big Data Processing** improves the energy efficiency of data networks involved in the processing and transmission of big data.
- **IEEE P1927.1 - Standard for Services Provided by the Energy-efficient Orchestration and Management of Virtualized Distributed Data Centers Interconnected by a Virtualized Network,** provides energy efficient networked data center service through joint network and data center virtualization.
- **IEEE P1928.1 - Standard for a Mechanism for Energy Efficient Virtual Machine Placement** enables energy efficient processing of information considering processing requirements and network power consumption.
- **IEEE P1929.1 - An Architectural Framework for Energy Efficient Content Distribution** creates a framework for design of energy-efficient content distribution mechanisms for various service and networking scenarios.

IEEE AIS Impact Standards

IEEE P7000™ - MODEL PROCESS FOR ADDRESSING ETHICAL CONCERNS DURING SYSTEM DESIGN

IEEE P7001™ - TRANSPARENCY OF AUTONOMOUS SYSTEMS

IEEE P7002™ - DATA PRIVACY PROCESS

IEEE P7003™ - ALGORITHMIC BIAS CONSIDERATIONS

IEEE P7004™ - STANDARD ON CHILD AND STUDENT DATA GOVERNANCE

IEEE P7005™ - STANDARD ON EMPLOYER DATA GOVERNANCE

IEEE P7006™ - STANDARD ON PERSONAL DATA AI AGENT

IEEE P7007™ - ONTOLOGICAL STANDARD FOR ETHICALLY DRIVEN ROBOTICS AND AUTOMATION SYSTEMS

IEEE P7008™ - STANDARD FOR ETHICALLY DRIVEN NUDGING FOR ROBOTIC, INTELLIGENT AND AUTONOMOUS SYSTEMS

IEEE P7009™ - STANDARD FOR FAIL-SAFE DESIGN OF AUTONOMOUS AND SEMI-AUTONOMOUS SYSTEMS

IEEE P7010™ - RECOMMENDED PRACTICE FOR ASSESSING THE IMPACT OF AUTONOMOUS AND INTELLIGENT SYSTEMS ON HUMAN WELL-BEING

IEEE P7011™ - STANDARD FOR THE PROCESS OF IDENTIFYING & RATING THE TRUST-WORTHINESS OF NEWS SOURCES

IEEE P7012™ - STANDARD FOR MACHINE READABLE PERSONAL PRIVACY TERMS

IEEE P7014™ - STANDARD FOR EMULATED EMPATHY IN AUTONOMOUS AND INTELLIGENT SYSTEMS

IEEE P2863™ - RECOMMENDED PRACTICE FOR ORGANIZATIONAL GOVERNANCE OF ARTIFICIAL INTELLIGENCE

IEEE AIS Technical Standards

P3652.1™ - GUIDE FOR ARCHITECTURAL FRAMEWORK AND APPLICATION OF FEDERATED MACHINE LEARNING

P2807™, P2807.1™ - KNOWLEDGE GRAPHS (FRAMEWORK, EVALUATION)

P1872.2™ - STANDARD FOR AUTONOMOUS ROBOTICS (AUR) ONTOLOGY

P2040™ - STANDARD FOR CONNECTED, AUTOMATED AND INTELLIGENT VEHICLES: OVERVIEW AND ARCHITECTURE

P2040.1™- STANDARD FOR CONNECTED, AUTOMATED AND INTELLIGENT VEHICLES: TAXONOMY AND DEFINITIONS

P2660.1™ - RECOMMENDED PRACTICES ON INDUSTRIAL AGENTS: INTEGRATION OF SOFTWARE AGENTS AND LOW LEVEL AUTOMATION FUNCTIONS

P2418.4™ - STANDARD FOR THE FRAMEWORK OF DISTRIBUTED LEDGER TECHNOLOGY (DLT) USE IN CONNECTED AND AUTONOMOUS VEHICLES (CAVS)

P2751™ - 3D MAP DATA REPRESENTATION FOR ROBOTICS AND AUTOMATION

PC37.249™ - GUIDE FOR CATEGORIZING SECURITY NEEDS FOR PROTECTION AND AUTOMATION RELATED DATA FILES

P2672™ - GUIDE FOR GENERAL REQUIREMENTS OF MASS CUSTOMIZATION

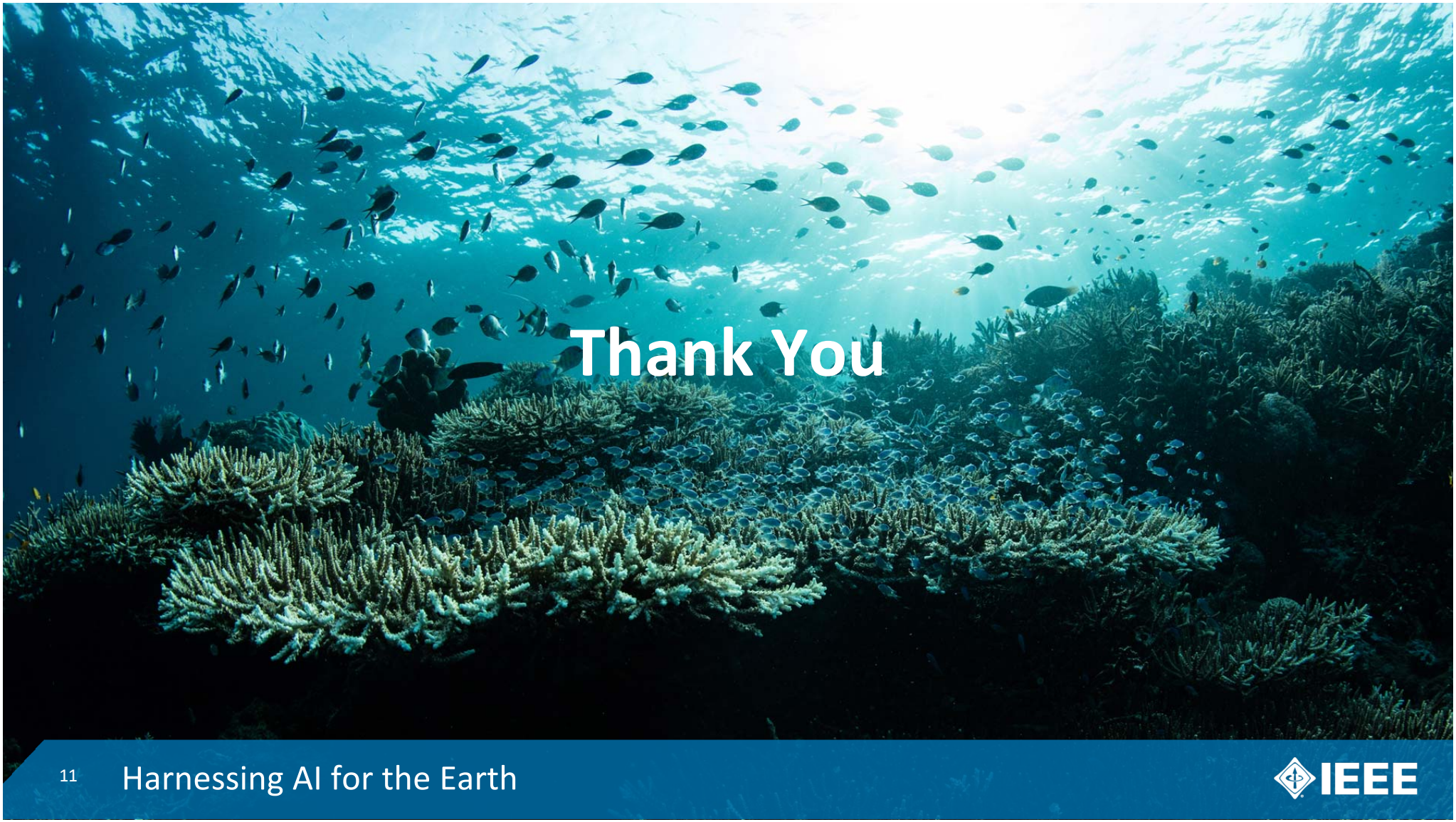
P2812™ - GUIDE FOR MINOR GUARDIANSHIP SYSTEM FOR ONLINE MOBILE GAMING

P1589™ - STANDARD FOR AN AUGMENTED REALITY LEARNING EXPERIENCE MODEL

P2247.1™, P2247.2™, P2247.3™ - ADAPTIVE INSTRUCTOINAL SYSTEMS (CLASSIFICATION, INTEROPERABILITY, AND EVALUATION)

P2830™ - STANDARD FOR TECHNICAL FRAMEWORK AND REQUIREMENTS OF SHARED MACHINE LEARNING

P3333.1.3™ - STANDARD FOR THE DEEP LEARNING-BASED ASSESSMENT OF VISUAL EXPERIENCE BASED ON HUMAN FACTORS


Thank You

A Use Case: AI and Energy

THE AUTONOMOUS GRID

With grids now gathering energy from different sources, including wind, solar, and electricity, operating these systems has become more complex.

Artificial intelligence's ability to analyze massive datasets can bring stability and efficiency to these new information sources.

Energy Forecasting

Industry data is used to train AI algorithms to make accurate forecasts, helping to inform power supply and demand.

Energy Efficiency

AI is used to track and optimize how energy efficiency.

Energy Accessibility

AI is used to model utility cost savings and provide recommendations for smart home investments.

A Use Case: AI and Weather and Climate Prediction

USE CASE "CLIMATE INFORMATICS"

An emerging field that uses AI to fundamentally transform weather forecasting and improve our understanding of the effects of climate change.

Deep-learning networks can allow computers to run much faster and incorporate more complexity of the 'real-world' system into the calculations.

To prevent disasters, it is absolutely important that weather data is collected and analyzed in real-time.

Globally, extreme weather and climate disasters pose a threat to public health, economic well-being and geopolitical stability.

Predicting extreme weather is a complex science and an area where AI and machine learning, specifically the pattern-recognition capabilities of deep learning, can make a difference in forecasting accuracy.