Energy Web Foundation (EWF) is the energy sector’s largest blockchain community

Developing a blockchain purpose-built for the energy sector
What is blockchain technology?

A combination of software, behavioral economics, and cryptography that allows people, organizations, and devices to exchange value

① without trusting each other, and

② without a centralized entity being in charge
Blockchain example: transfer of ownership (1/3)

Case 1: residential real estate transaction

Title to a house

Alice

Bob

Typical issues to address

**Representation**
- Does the actual house fit its description?

**Proof of ownership**
- Does Alice actually own the house?
- Does Bob have the money?

**Safe execution**
- Will either Alice or Bob leave the closing room with both the house and the money?

**Information ownership**
- Can third parties monetize the information Bob generated by buying the house?

Key takeaways
- Expensive, lengthy, multi-party process (property assessors, title insurers, brokers, notaries, banks)
- Heavily regulated
- Not devoid of abuse
Case 2: e-commerce

Typical issues to address:

**Representation**
- Return policy (not always feasible, not always available, costly)

**Proof of ownership**
- Bob must trust Alice
- Alice doesn’t need to trust Bob

**Safe execution**
- Bob has to trust Alice that the book will be sent once Bob has paid

**Information ownership**
- Alice knows a lot about Bob and can monetize that information

Key takeaways:
- Alice must be trustworthy, not Bob
- Will not work peer to peer without an intermediary
- Alice benefits from information asymmetry
## Blockchain example: transfer of ownership (3/3)

### Case 3: with blockchain

<table>
<thead>
<tr>
<th>Typical issues to address</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Representation</strong></td>
<td></td>
</tr>
<tr>
<td>• Blockchains don’t help but can be linked to secure data source (e.g., smart meter)</td>
<td></td>
</tr>
<tr>
<td><strong>Proof of ownership</strong></td>
<td></td>
</tr>
<tr>
<td>• Guaranteed by platform</td>
<td></td>
</tr>
<tr>
<td><strong>Safe execution</strong></td>
<td></td>
</tr>
<tr>
<td>• Guaranteed by platform (automated, secure, immutable)</td>
<td></td>
</tr>
<tr>
<td><strong>Information ownership</strong></td>
<td></td>
</tr>
<tr>
<td>• Bob owns information on his transaction – he can keep it private, sell it, make it public</td>
<td></td>
</tr>
</tbody>
</table>

**Key takeaways**

- Blockchains paired with IoT can address representation
- Trusted, automated transactions could help scale demand side management
- No need for a central, trusted entity
What does this mean for electric power systems?

The challenge: We need a new architecture capable of managing an increasingly distributed and variable electric system.
What does this mean for electric power systems?

How can a grid operator:
① digitize,
② coordinate, and
③ verify
the behavior of millions of small devices—EVs, water heaters, air conditioners, and batteries?
What does this mean for electric power systems?
Blockchain technology can meet the many requirements of an emerging grid architecture.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Addressed by blockchain</th>
</tr>
</thead>
<tbody>
<tr>
<td>High cybersecurity</td>
<td>✓</td>
</tr>
<tr>
<td>Low transaction costs</td>
<td>✓</td>
</tr>
<tr>
<td>Low latency</td>
<td>✓</td>
</tr>
<tr>
<td>Coordinate autonomous assets</td>
<td>✓</td>
</tr>
<tr>
<td>Reliable measurement and verification</td>
<td>✓</td>
</tr>
<tr>
<td>Secure data sharing capabilities</td>
<td>✓</td>
</tr>
<tr>
<td>Regulatory compliance</td>
<td>✓</td>
</tr>
</tbody>
</table>

Emerging grid architecture
# EWF use cases

Utilities worldwide are running pilots in several domains

<table>
<thead>
<tr>
<th>Application Domain</th>
<th>Value unlocked with blockchain</th>
<th>Ecosystem Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>REC (GOs)</td>
<td>Allow customers to accurately, transparently choose the source and/or attributes of their electricity</td>
<td><a href="#">Origin</a></td>
</tr>
<tr>
<td>EVs + DER management</td>
<td>Enable grid operators to more easily integrate, coordinate, and manage distributed energy resources</td>
<td><a href="#">SHARE</a> &amp; <a href="#">CARGE</a></td>
</tr>
<tr>
<td>Energy + flexibility trading</td>
<td>Increase market efficiency and reduce operational costs for wholesale market trading; enable trading at medium and lower voltage levels of the grid</td>
<td><a href="#">Shell</a> &amp; <a href="#">ELECTRON</a></td>
</tr>
</tbody>
</table>
Thank you

Ian Kelly
ian.kelly@energyweb.org