

# Quantum Information Science for Fossil Energy Technology Development

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# What is Fossil Energy Technology Development (FETD)?

From a communications perspective, fossil energy is real-time solar power with high latency (~300,000,000 years).

Quantum State == Energy == Quantum Information

# What is Quantum Information Science (QIS)?

Classical information theory came from industry focusing on practical challenges (e.g. Bell Labs) and communications theory

Quantum information theory is largely a derivation of that work.

Real understanding will come from application to practical challenges which has yet to happen.

QKD is commercialized and performs simple quantum processing in the quantum network.

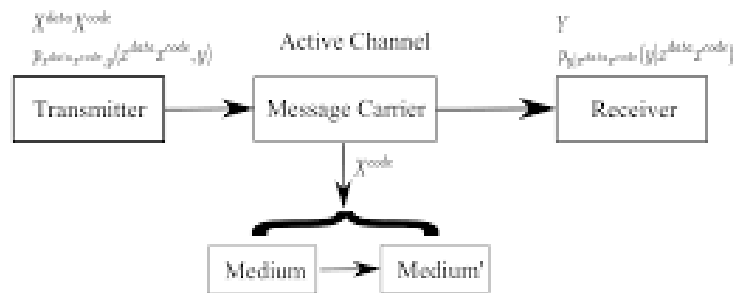
Extend quantum network processing to support fossil energy requirements.

# How does Quantum Networking and QIS help FETD?

- Fossil energy quantum sensors and secure quantum control networks
  - Overcomes time and distance limitations
  - Potential efficiency improvement in all aspects of conversion from fossil fuel to energy

## The network IS the computer

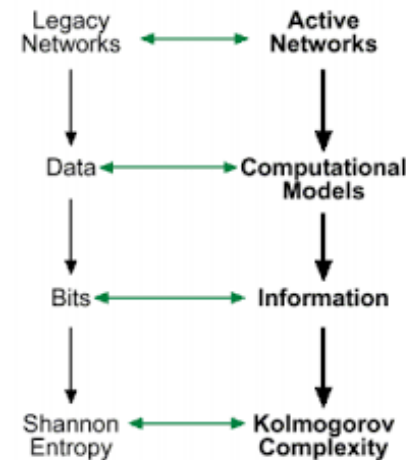
### Active Quantum Network\*



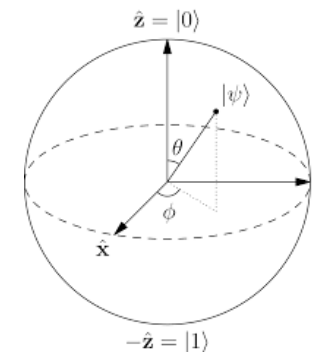
An active network channel uses executable code in the packet to impact the channel controlling the relationship between the transmitted sequence X and the received sequence Y.

## Entanglement Distribution Network

### Software-Defined Quantum Network



### Quantum Network



$$|\psi^+\rangle = \frac{|01\rangle + |10\rangle}{\sqrt{2}}$$

$$|\psi^-\rangle = \frac{|01\rangle - |10\rangle}{\sqrt{2}}$$

$$|\phi^+\rangle = \frac{|00\rangle + |11\rangle}{\sqrt{2}}$$

$$|\phi^-\rangle = \frac{|00\rangle - |11\rangle}{\sqrt{2}}$$

\*[https://en.wikipedia.org/wiki/Active\\_networking](https://en.wikipedia.org/wiki/Active_networking)