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Solar energy: What's next?

by

Hayk Hovhannisyan
Trade Representative of Armenia to Switzerland

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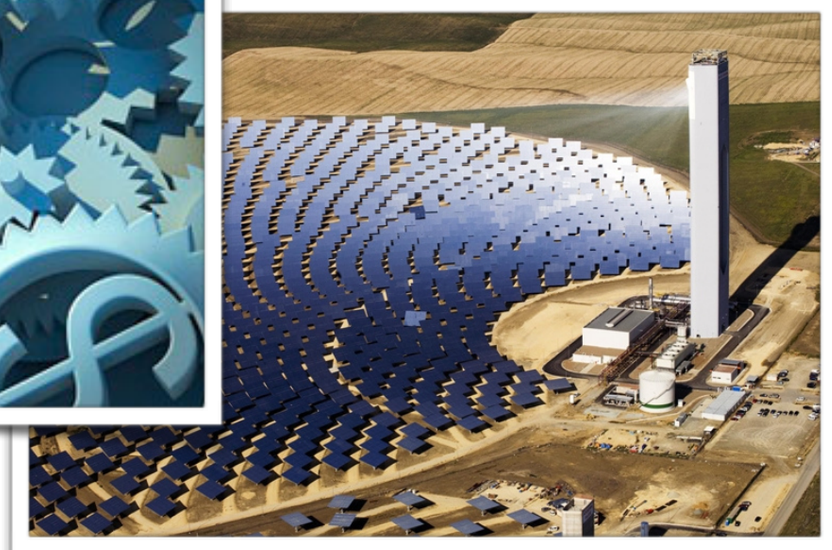
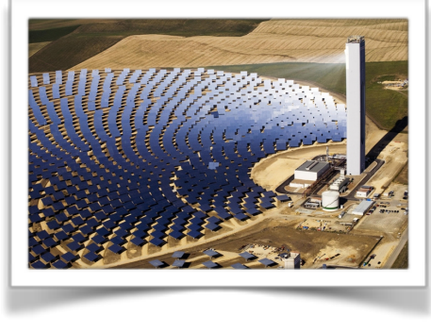
- Solar energy supplies only 2% of the global electricity mix
- This has to increase 10-15-fold to limit global warming to 2Cº by mid-century
- In the last decades solar energy has achieved:
  - technological efficiency growth
  - cost decrease
  - explosive investments
- The road for solar to achieve a higher share in global electricity mix:



- Financial Innovation
- Technological Innovation
- Systemic Innovation
  (Sivaram, 2018)

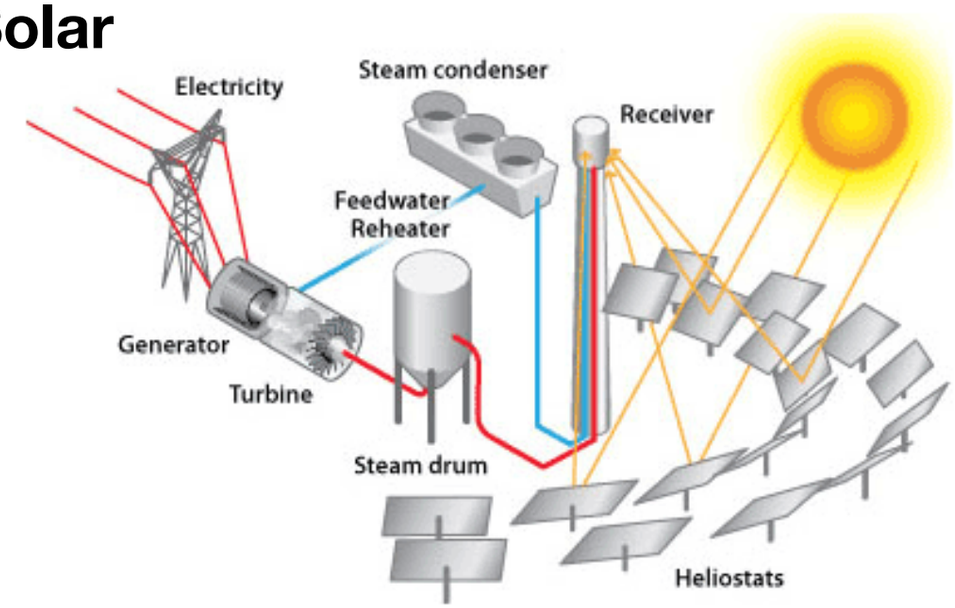
- Established incentive schemes (Green Rhino Energy):
  - Premium feed-in tariffs
  - Tax credits
  - Quotas
- Large investments needed for solar to reach 1/3 of global electricity mix
- Institutional investors manage over $100tn (OECD, 2016), but solar violates two important requirements (Sivaram 2018):
  - Liquidity
  - Preference for few large-chunk projects
- Value Deflation of solar energy:
  - Value of solar falls by half, if solar reaches 15% penetration, and by two-thirds if reaches 30% (Sivaram, 2018)
  - Solar traded at zero cents for more than a 100 days in Chile in 2016 (Bloomberg, 2016)
  - 146 hours of negative power prices in Germany in 2017 (Clean Energy Wire, 2018)
- More than 1 billion people in the world lack electricity supply (IEA, 2017; WEF, 2018)

- **Solutions:**
  - **Copy real estate and automotive industries for securitisation of solar loans and leases - data collection and analysis crucial (Sivaram, 2018)**
  - **Off-Grid solar and Pay-As-You-Go payment mechanisms (Global Opportunity Explorer, 2018; Sivaram, 2018)**
  - **Micro-Grid expansion (IEA, 2017; WEF, 2018, Sivaram 2018)**
  - **Government policies**
    - **Currency hedging can add 7p.p. to the cost of debt (Climate Policy Initiative, 2015)**
    - **“Green Bonds”, $600bn+ climate aligned bonds (Climate Bonds Initiative, 2016, World Bank Group, 2015)**
    - **MLP legislation, YieldCo (Sivaram, 2018)**
  - **MDB credit enhancement mechanisms (International Renewable Energy Agency, 2016; Sivaram 2018)**
    - **Loan and other guarantees**
    - **Loan syndication**
    - **Support with feasibility studies and due-diligence**



- Low corporate R&D spending by solar industry, but growing government spending (Sivaram 2018; BNEF, 2019)

- Achieving 1/3 in electricity mix by mid-century will require (Sivaram, 2018):
  - cheap solar technologies
  - cost-effective storage
  - converting solar to fuel
- Solution: evolutions rather than revolution
  - Cheap solar coatings that could be printed
  - Solar-to-fuel: artificial leaf hydrogen
  - Already at commercial scale: Concentrated Solar Power Plants



- Systemic Innovation - physical infrastructure, economic markets, public policies (Sivaram, 2018)
  - The grid - bigger or more decentralised?
    - Bigger, smaller, smarter - all at once
    - A hybrid grid
  - Intermittency - is energy storage the answer?
    - 37.8bn Tesla Powerwall 2.0 units required to fully power the US with renewables (Energy Innovation Reform Project, 2017)
    - Hybrid solution, connect:
      - energy storage
      - diverse energy sources
      - electricity system with other sectors - transport, heat, water, production, agriculture
- Supporting other sources (nuclear, natural gas) to go hand-in-hand with solar:
  - Obligate utilities to sign long-term contracts with reliable generators
  - Capacity markets, which pay reliable generators to sit idle until needed
  - Very high instantaneous price for kWh at peak demand moments

SOURCES

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