Cities & the grid
MIT 11.165/477, 11.286J

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When we talk about the 'grid' . . .

For the first 150 years or so, *electricity* could not be stored (easily, yet):

- electricity will be the basis of clean energy scenarios going forward
  - this assessment is based on *technology*
  - past electric 'modernity': clean, quiet, smokeless, relatively safe
  - clean resources like solar, wind, nuclear: all make electricity
  - transformations into other forms of energy like heat, liquid fuels, etc.,
- matching over space (transmission)
  - grid architecture originating in *historical development*
- matching over time (storage)
  - system demand curve created by *learned behaviors & expectations*
- matching supply and demand through costs, prices (markets)
  - markets are created by *politics and economics*
- understanding all of these aspects allows new options:
  - demand response?
  - storage?
  - behavior and social change?

Grid architecture

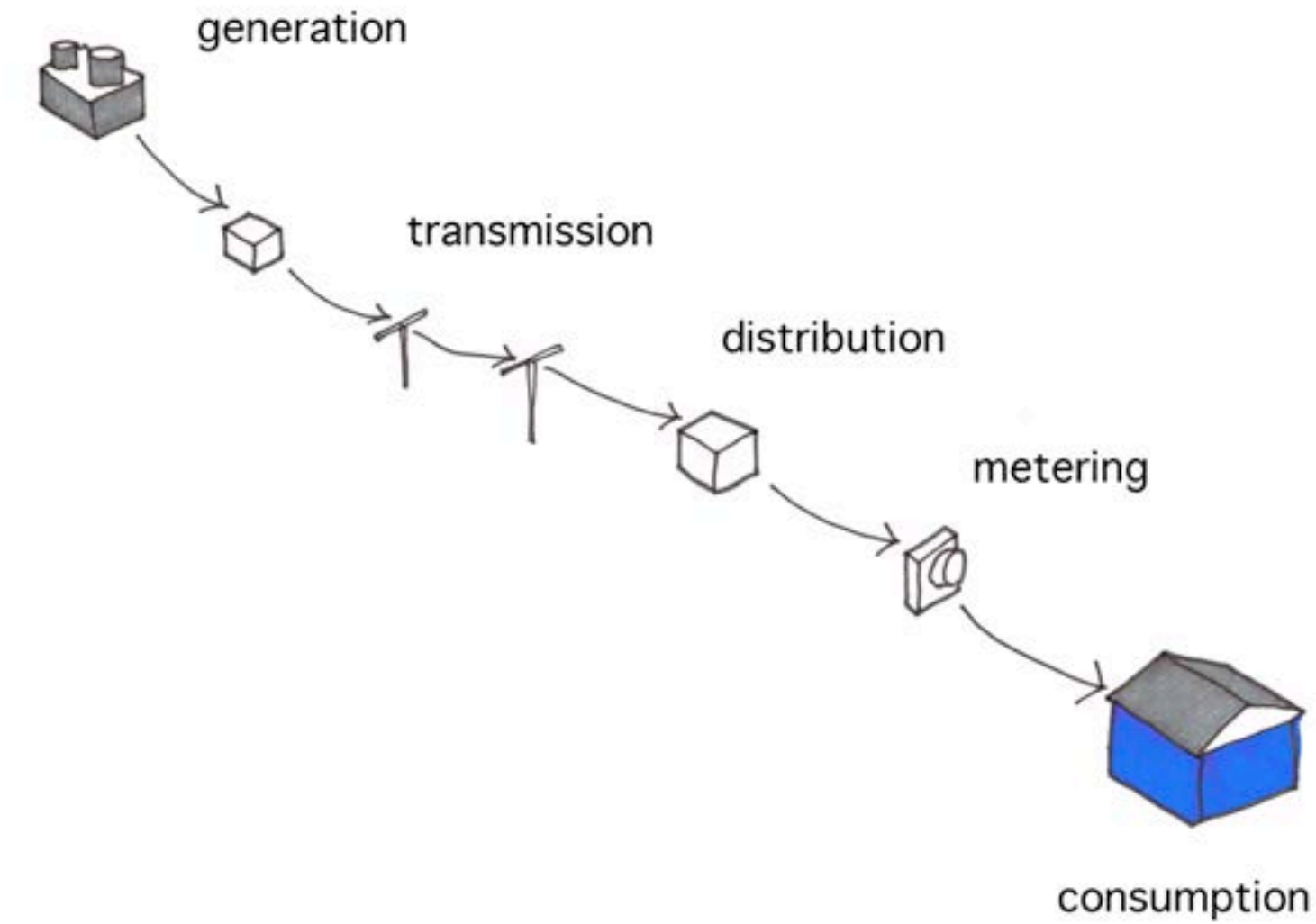
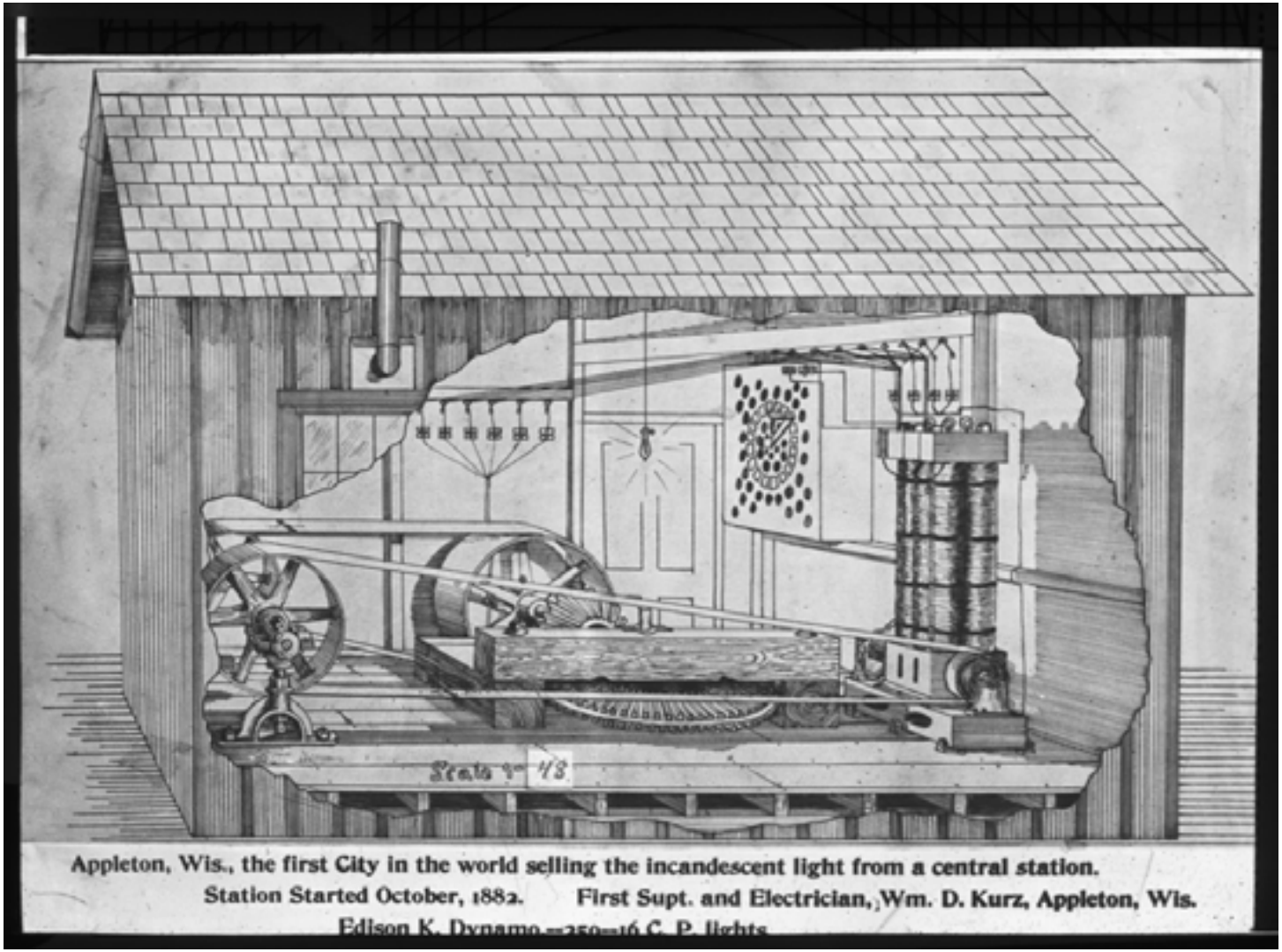


Diagram by David Hsu, 2009

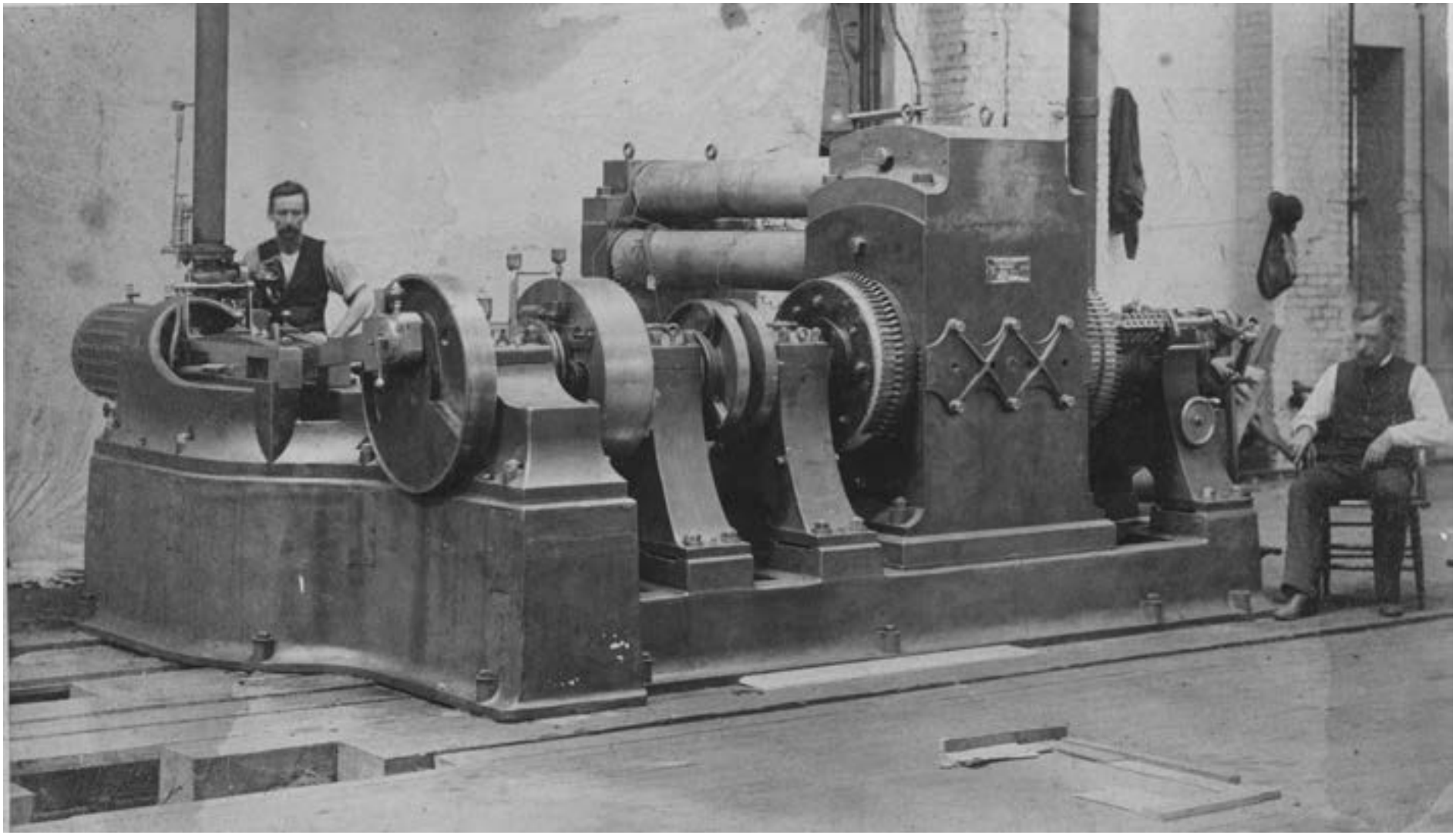
Historical development of the grid



Lawrence University, Artstor

This image is in the public domain.

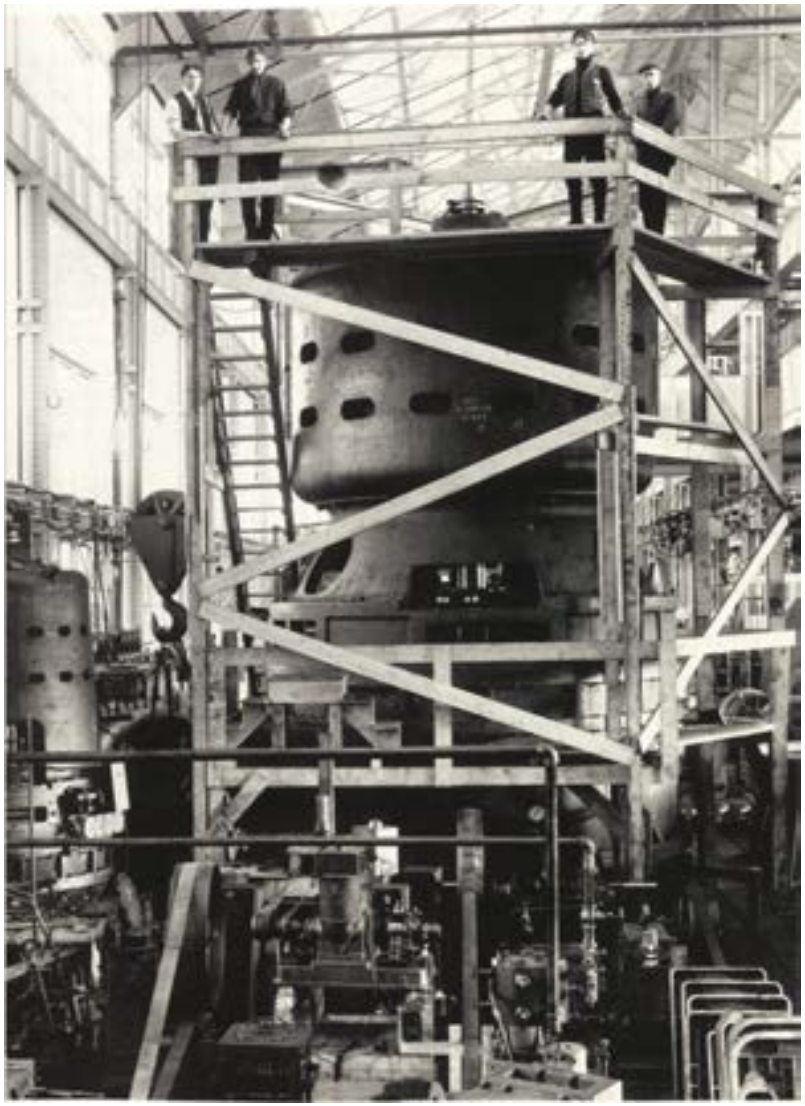
Historical development of the grid



Edison's Pearl Street Station; image from Evans & Lefer, "They Made America"

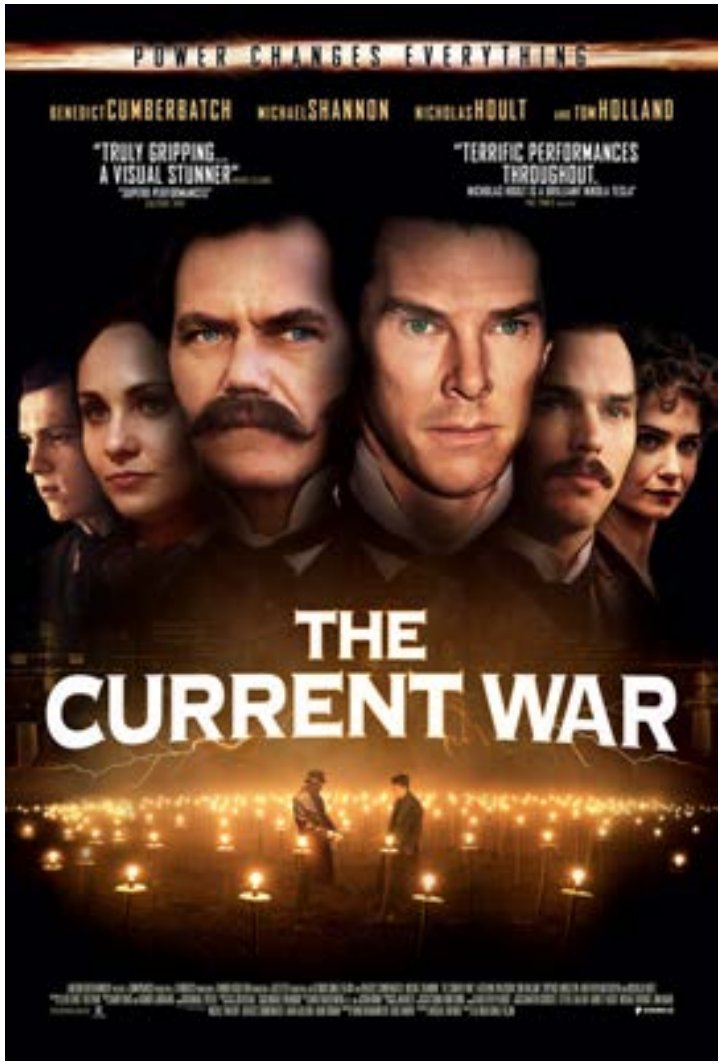
This image is in the public domain.

Historical development of the grid



Evans & Lefer, "They Made America"

Historical development of the grid



Movie poster: 101 Studios, related entities, The Weinstein Company

Debate over utilities regulation

The Oregonian

"Let us consider for a moment the vast importance of the American utilities in our economic life . . . The utility industry in 1931 collected over four billion dollars in one year from the users of electricity, gas, telephone and telegraph. That means an average of $133 from each and every family in the United States."

– FDR in Portland, Oregon, 1932

Transmission lines

Flickr, Nick Page, CC BY 2.0

Public domain image courtesy of user AllAlone89 on Wikipedia.

Transformer yard

Wikipedia

Local distribution

My neighborhood

Local distribution

My house

Local distribution

Santa Marta, RdJ, Brazil by Armando Lobos, Flickr, CC BY-NC-ND 2.0

Local distribution

Rochinha, RdJ, Brazil by David Hsu

Local distribution

Santa Maria, RdJ, Brazil by David Hsu

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Jamshedphur, India by David Hsu

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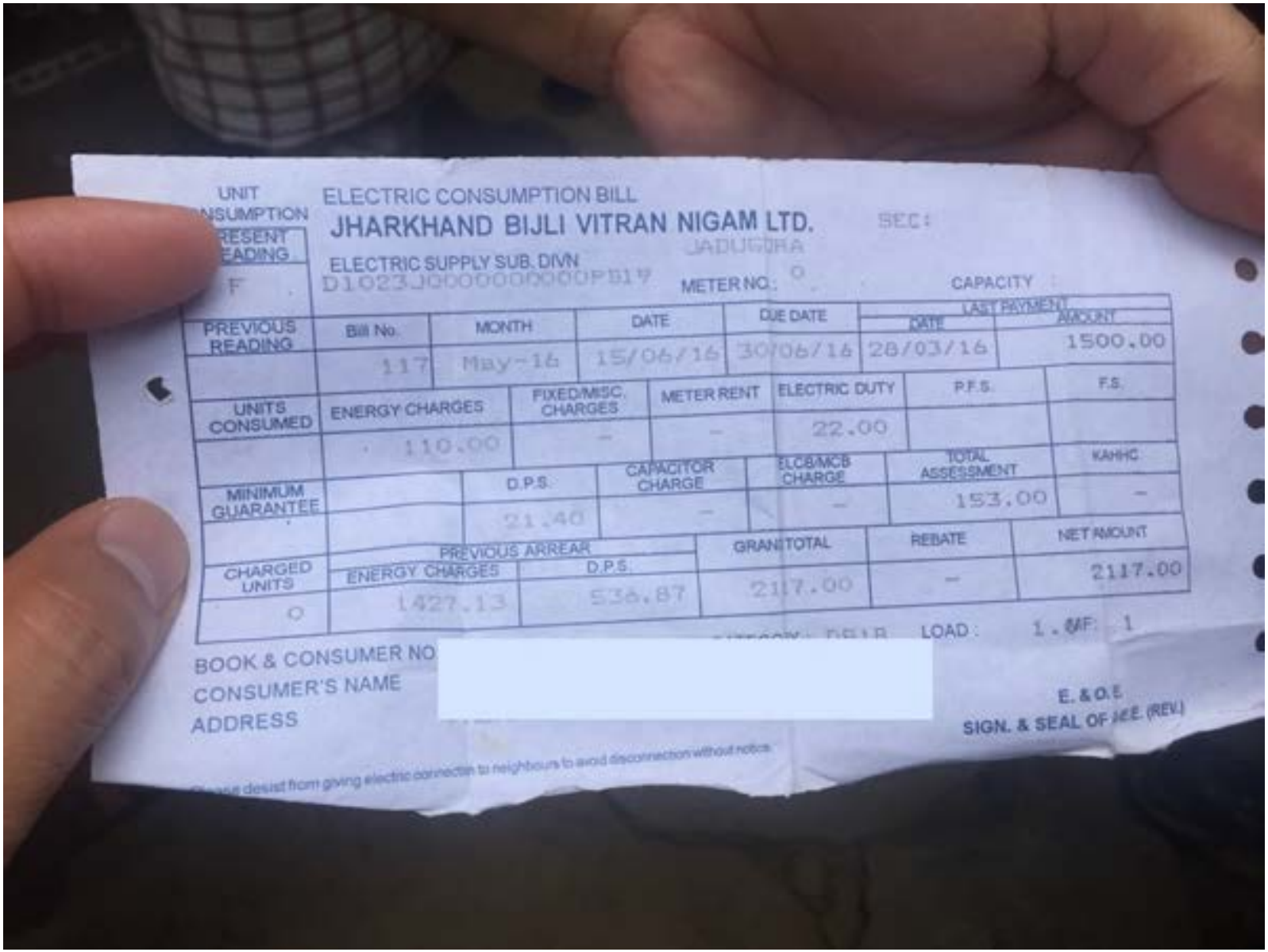

Jamshedphur, India by David Hsu

Local distribution

Gumla, India by David Hsu

Local distribution

Gumla, India by David Hsu

Local distribution

Jamshedpur, India by David Hsu

Local distribution

Tanzania, David Hsu

Local distribution

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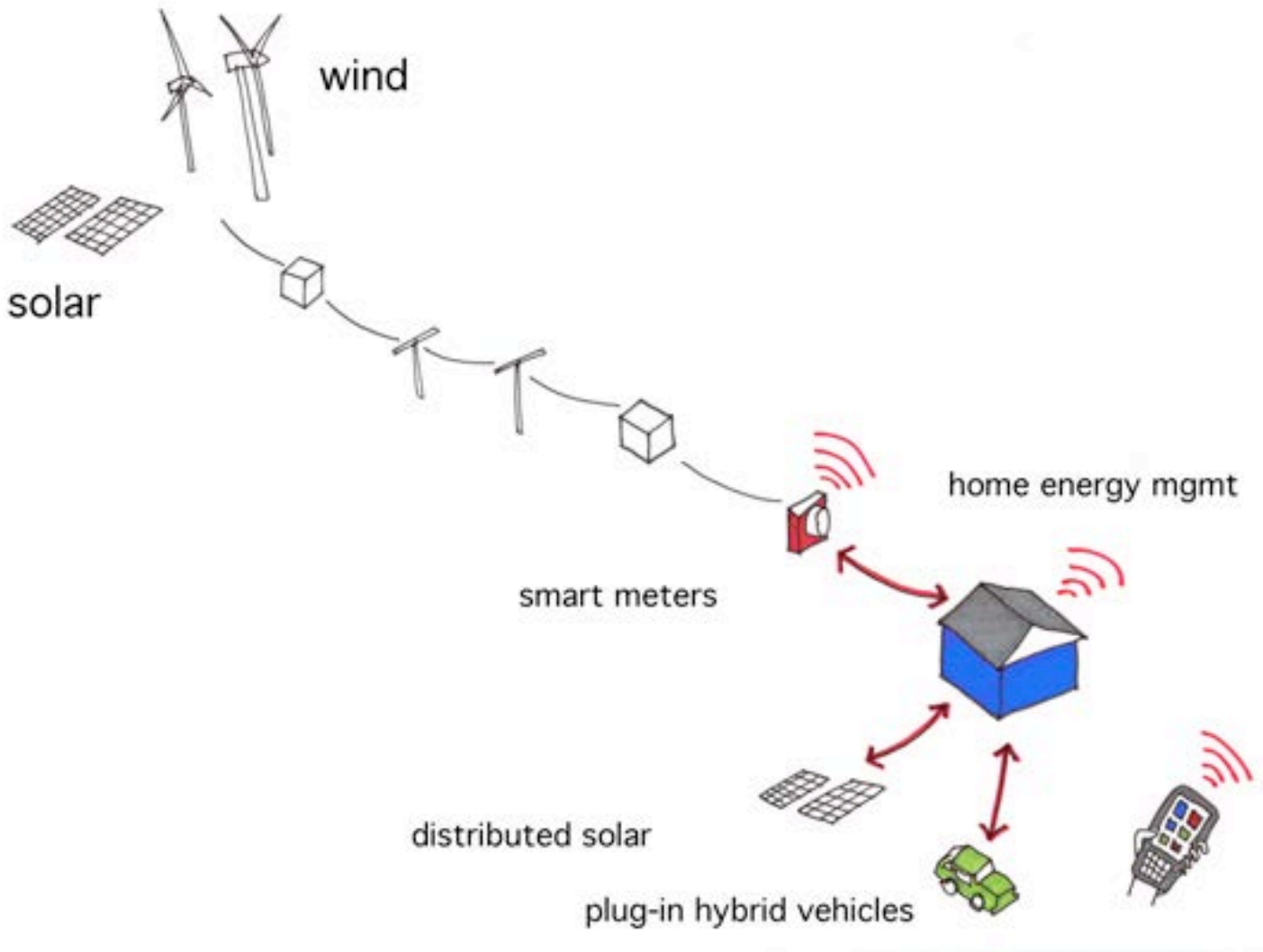
Local distribution

Tanzania, David Hsu

Grid architecture



David Hsu, 2009

Thank you!