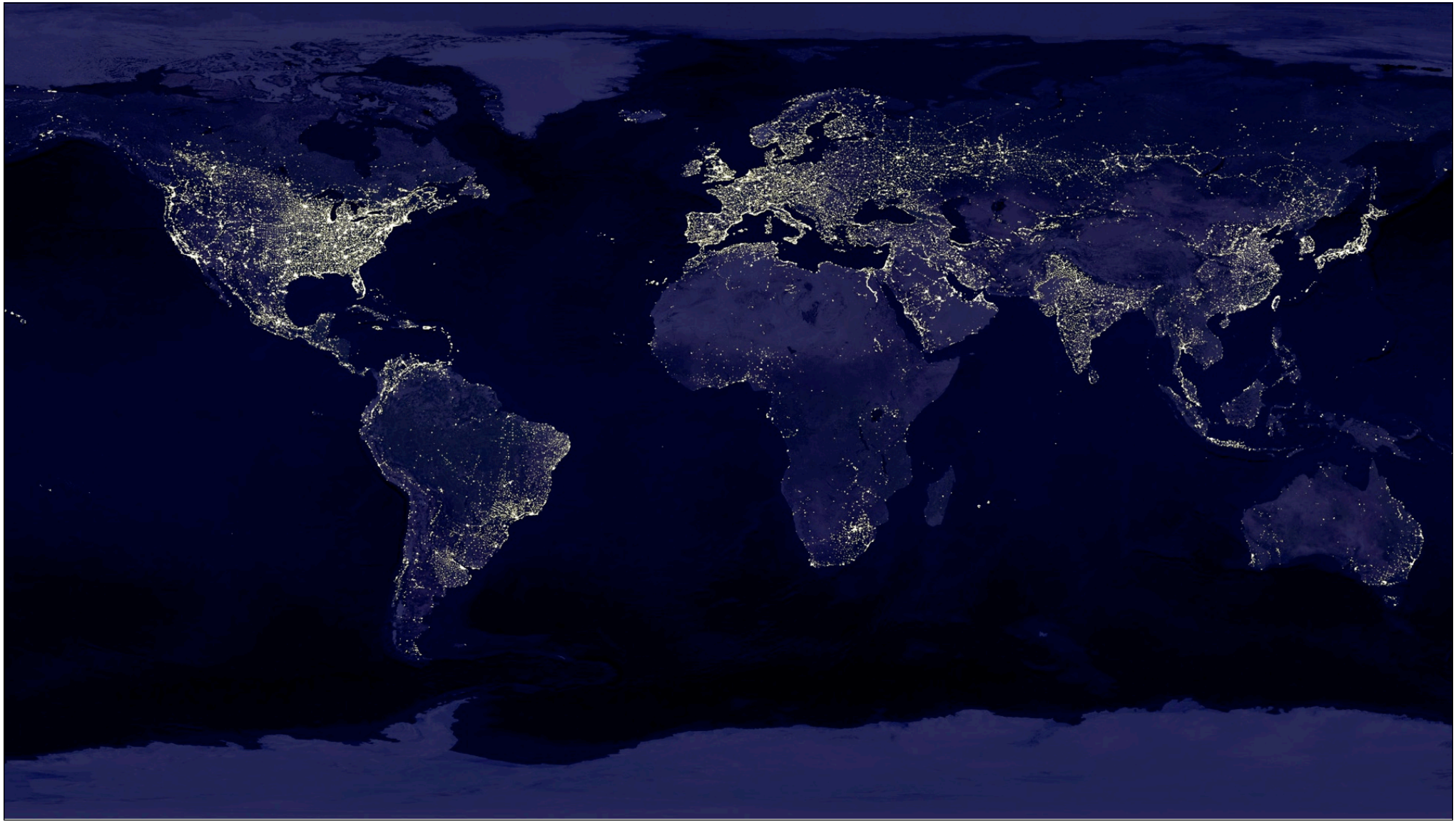




ROCKY
MOUNTAIN
INSTITUTE®



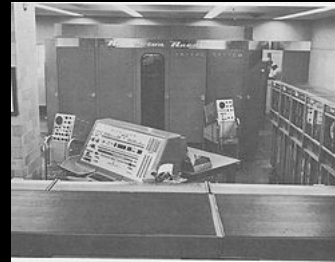


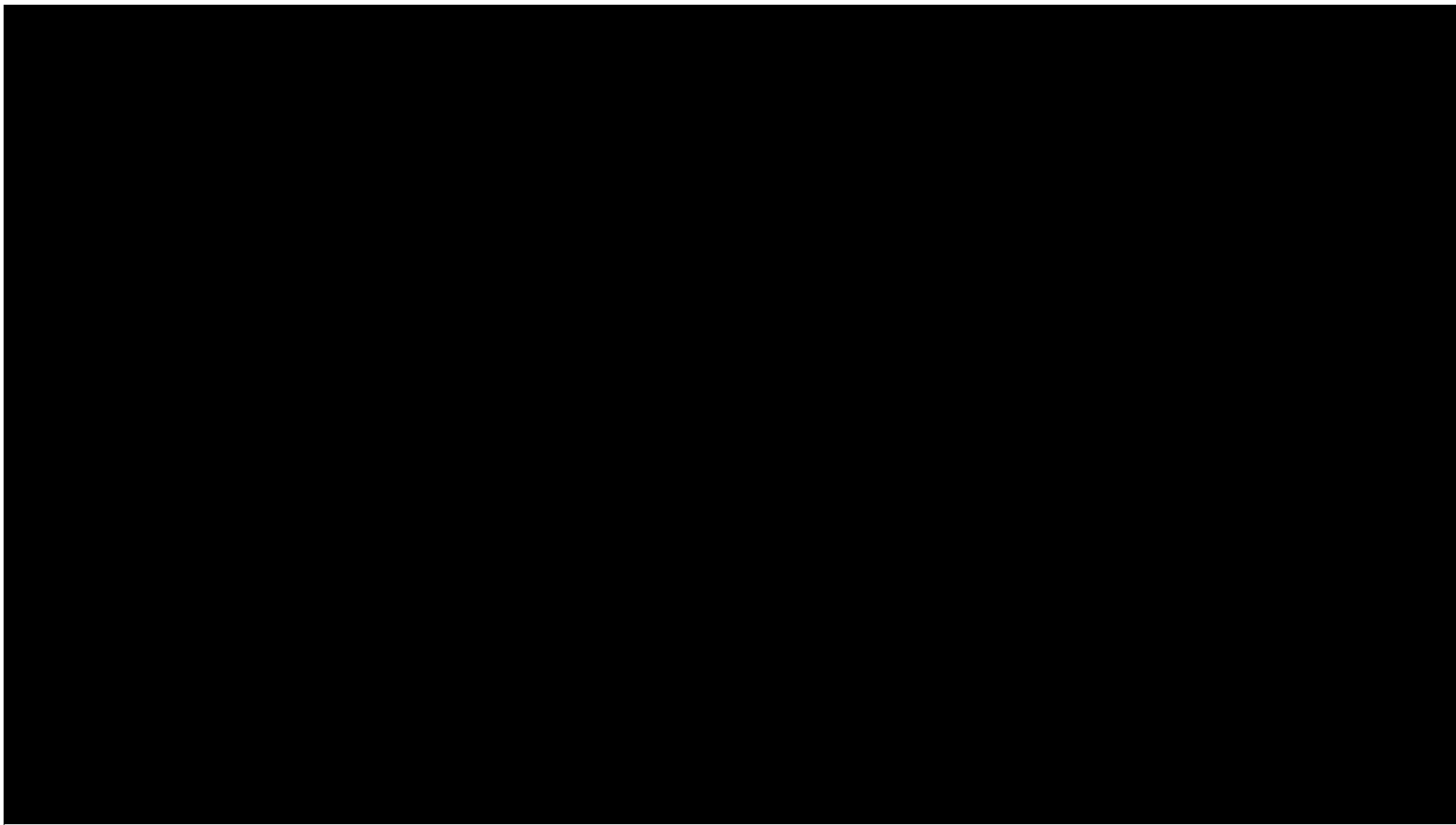










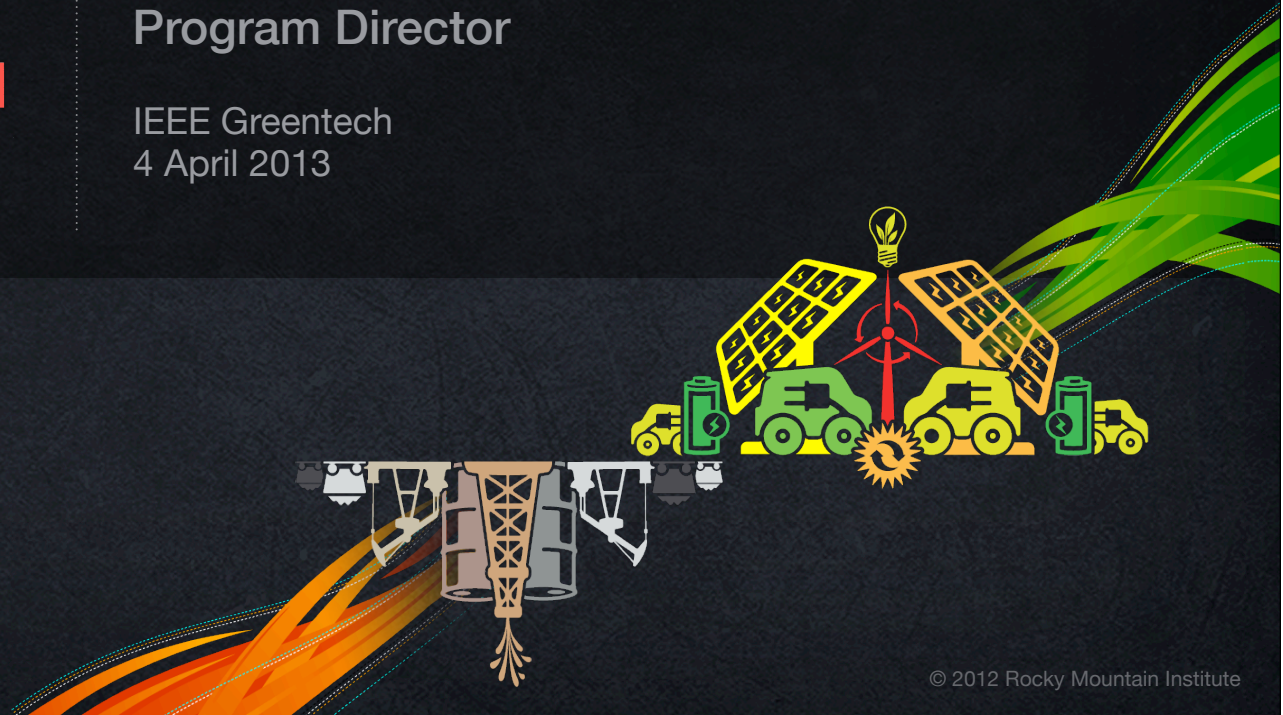


REINVENTING FIRE[®]

**BOLD BUSINESS SOLUTIONS
FOR THE NEW ENERGY ERA**

Jon Creyts
Program Director

IEEE Greentech
4 April 2013



© 2012 Rocky Mountain Institute

Oil



Natural gas



Coal



Nuclear



Biomass



Hydroelectricity



Other
renewables



TODAY:

90%

of America's energy comes from
non-renewable energy sources

Oil



Natural gas



Coal



Nuclear



Biomass



Hydroelectricity



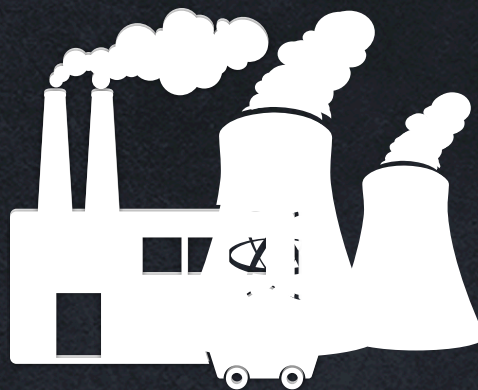
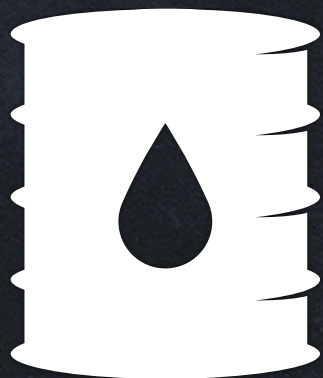
Other
renewables

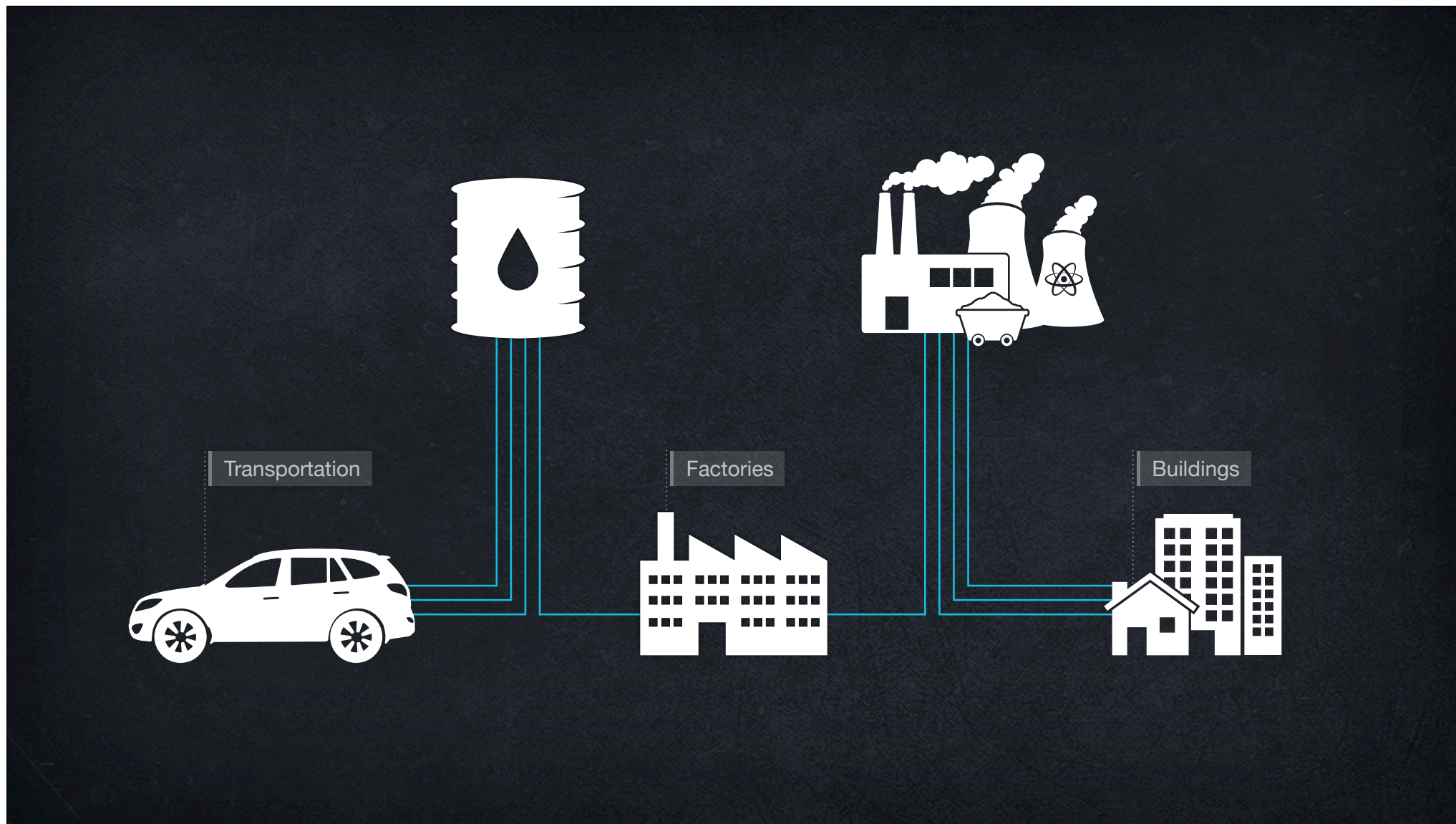


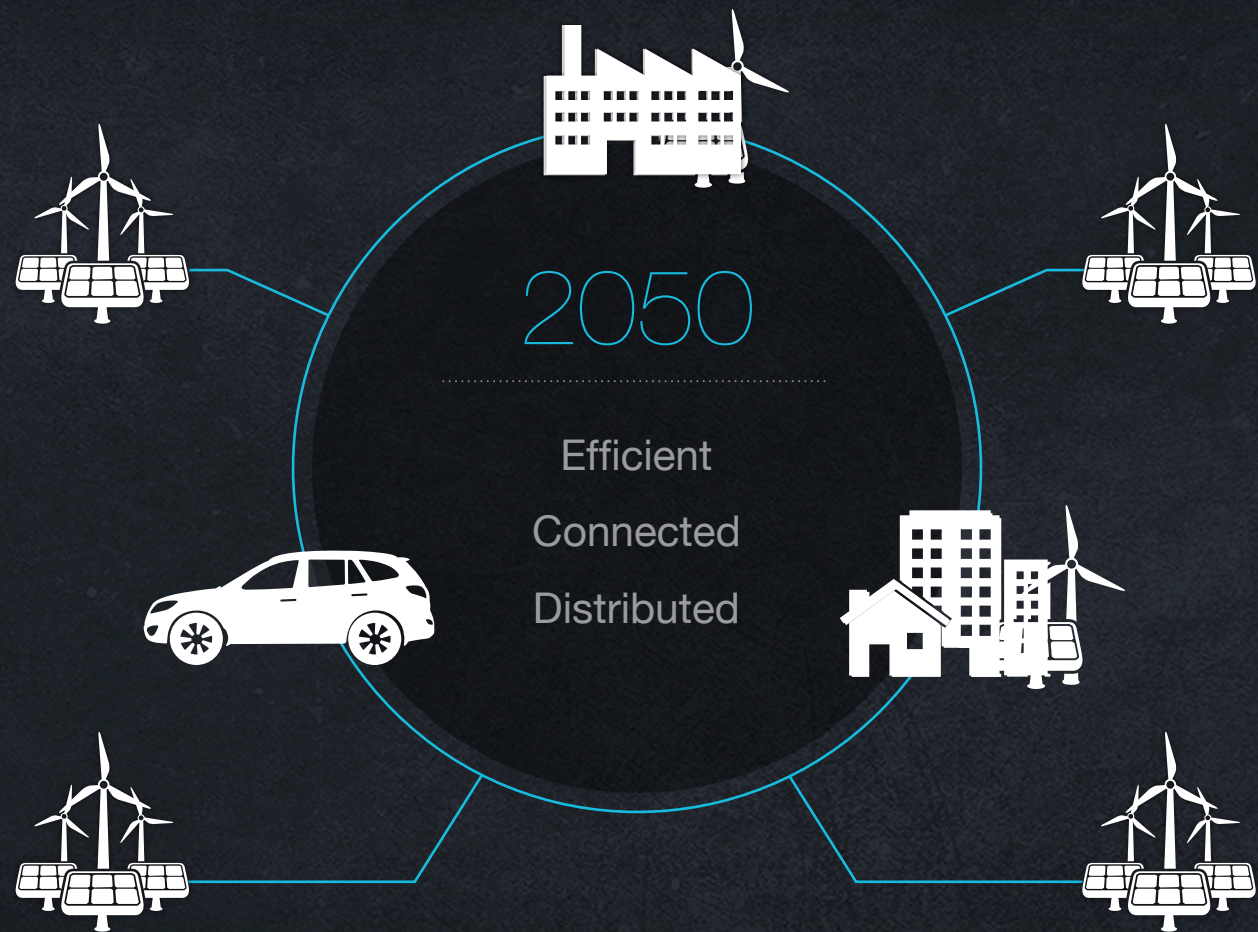
TODAY:

90%

of America's energy comes
from non-renewable sources









TODAY:

90%

of America's energy comes from
non-renewable energy sources



TODAY:

90%

of America's energy comes from
non-renewable energy sources



TODAY:

90%

of America's energy comes from
non-renewable energy sources

Hydro



Hydrogen



Biomass



Natural gas



Other renewables



TODAY:

24%

of America's energy comes from
renewable energy sources

\$5T

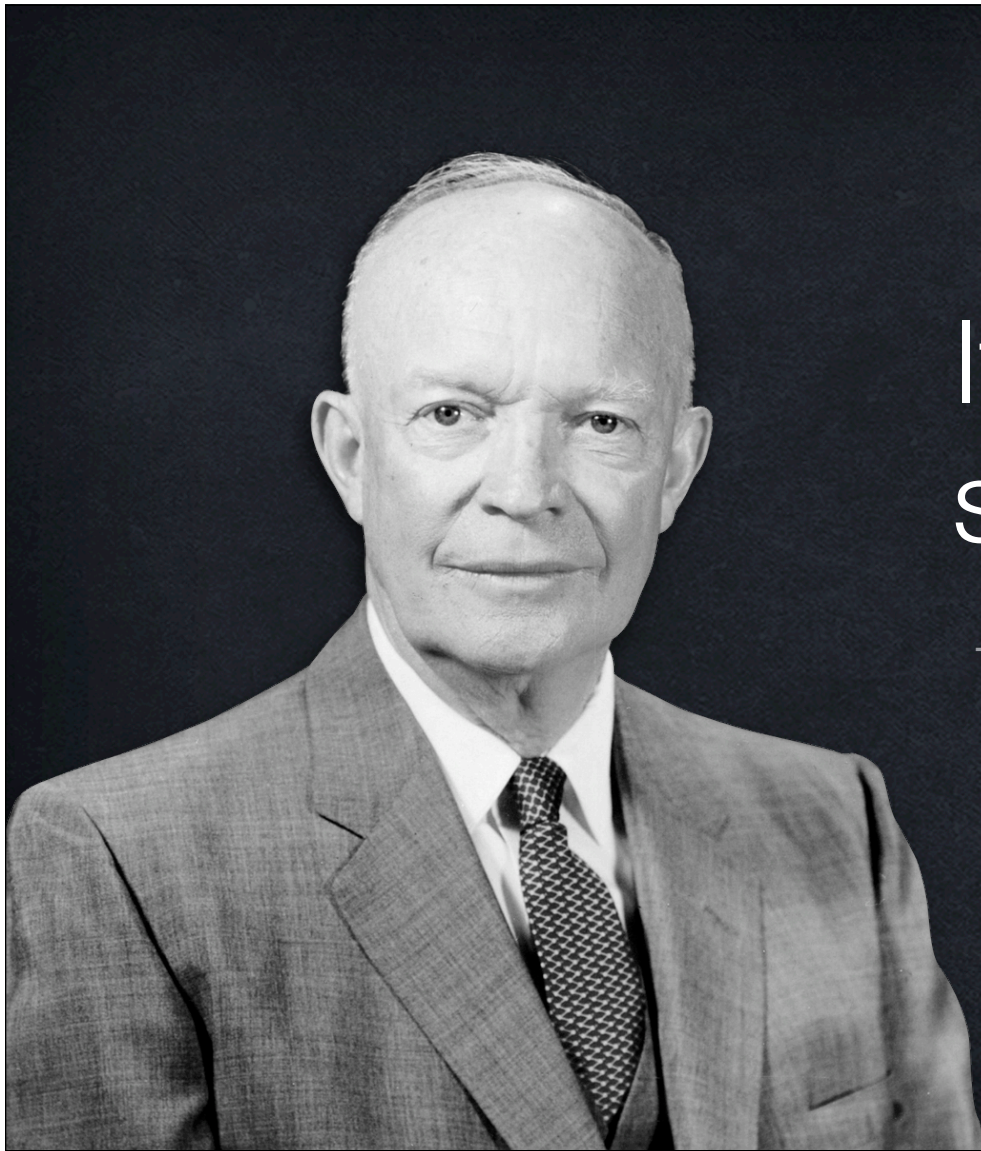
in savings

+158%

bigger economy

0

oil, coal, nuclear



If a problem can't be
solved, **enlarge** it.

—attributed to Dwight Eisenhower



Weight

1985

1990

1995



Weight

1985

1990

1995





Weight

2005

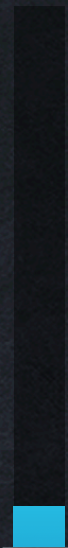
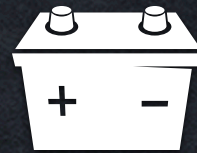
2010

2015

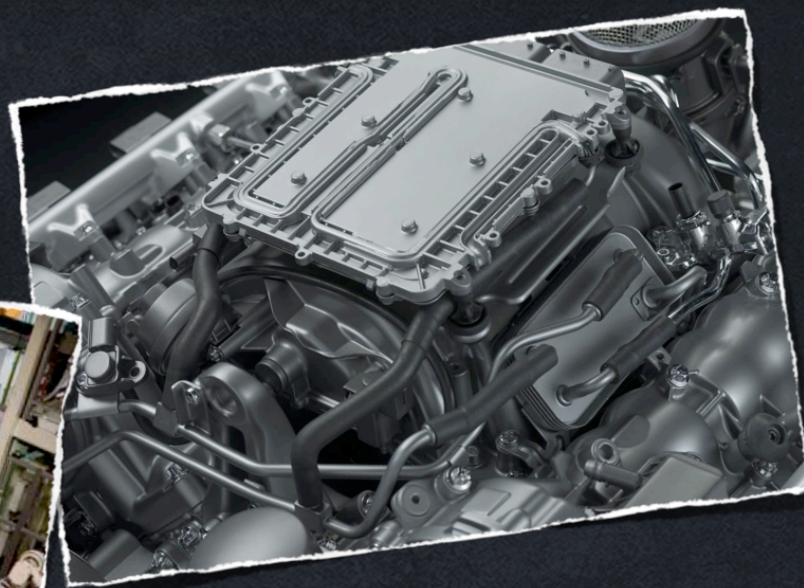




Weight



Efficiency





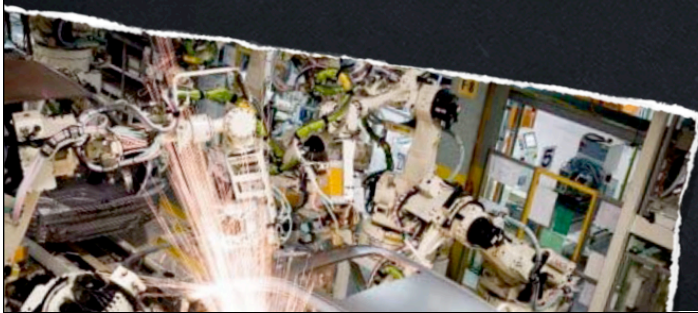
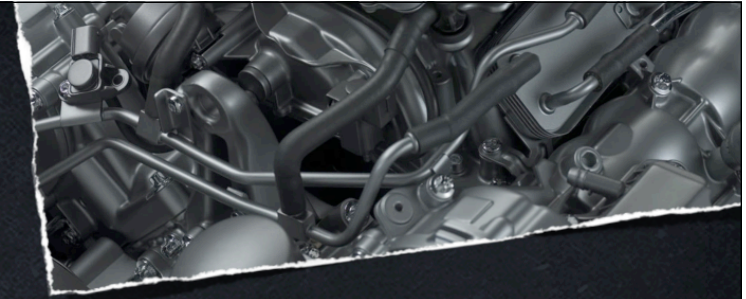
Advanced materials



Manufacturing



Electric propulsion



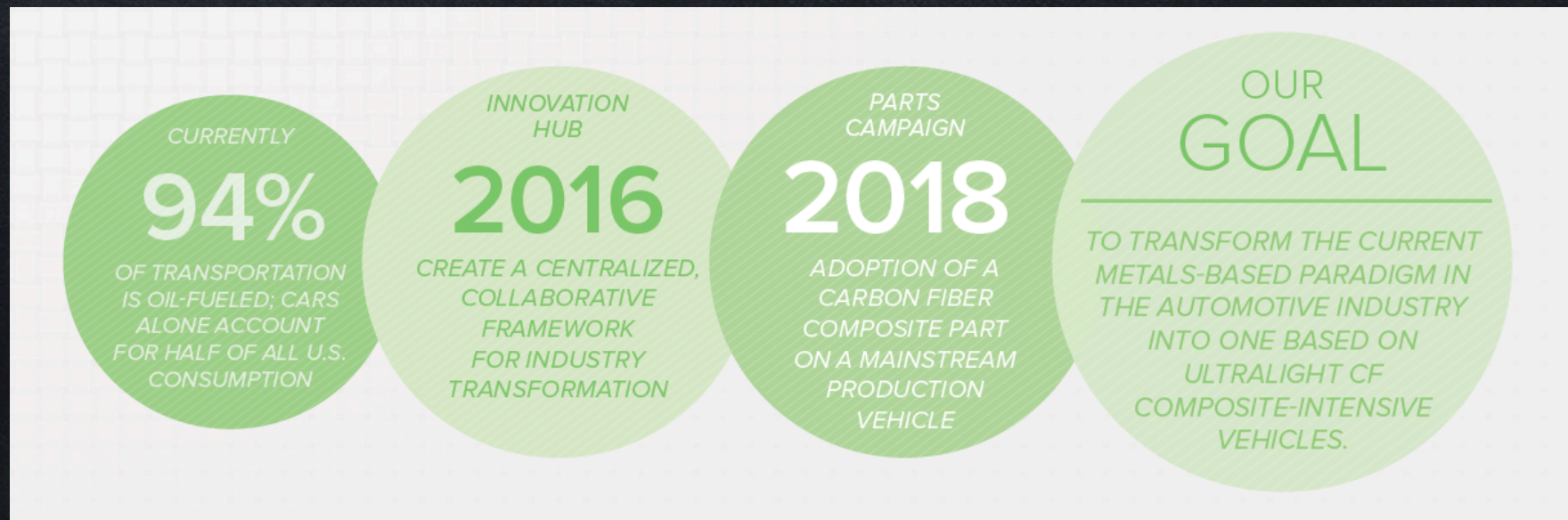
Volume Production of Electrified Carbon-Fiber Cars

Slated to start production in 2013

VW XL1 2-seat plug-in hybrid (2011)
230 mpg (gasoline), 2013 production

BMW i3 4-seat battery-electric hatchback (2011)
with range-extender option, 2013 production

RMI is currently collaborating with a network of leaders to develop a carbon fiber innovation hub and parts campaign



Tripled-Efficiency Trucks and Planes





“We must leave oil
before it leaves us.”

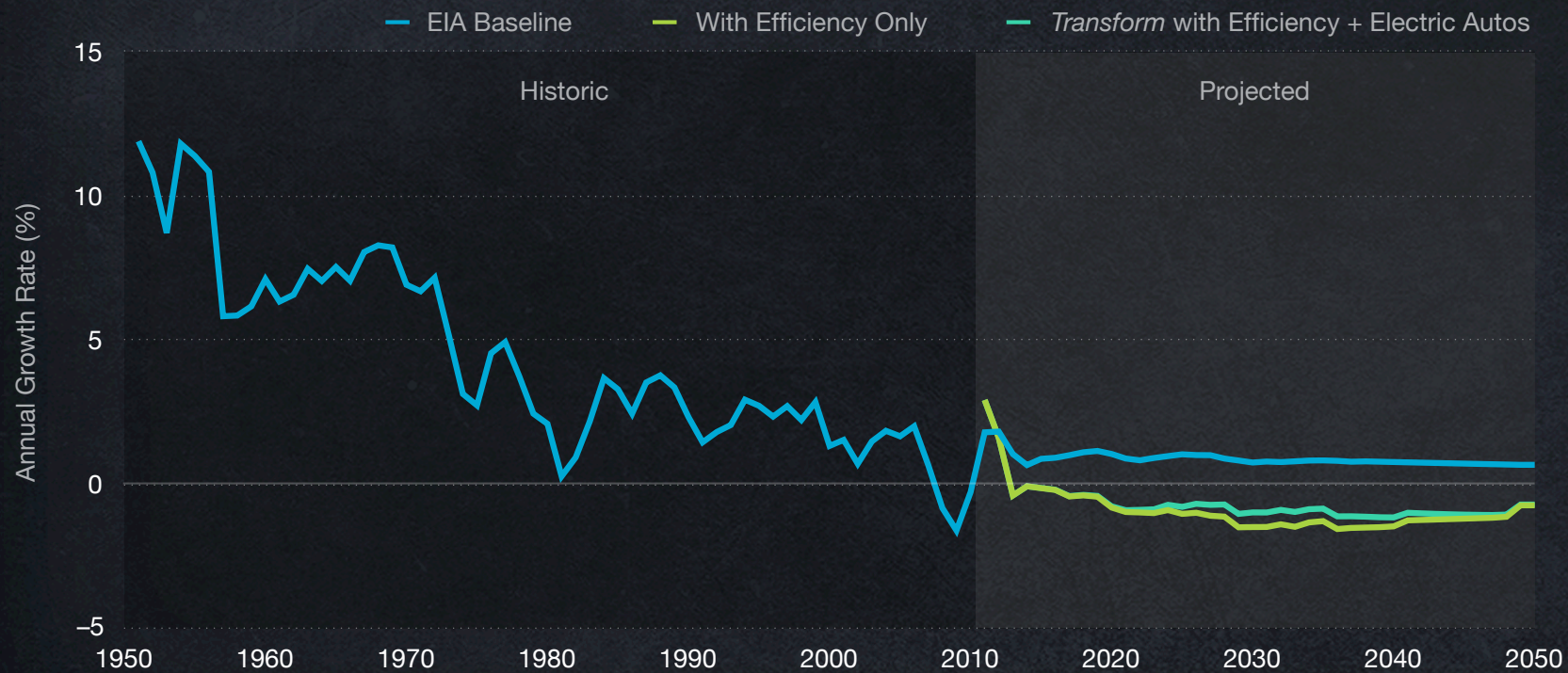
Fatih Birol
Chief Economist
International Energy Agency 2008

Electricity:
Key to the New
Energy Era



Electric Needs Will Decline as Efficiency Gains Speed

Annual changes in U.S. electricity consumption



3-4x Energy Productivity in Buildings, 2x in Industry

Same or better services





Integrative Design in Retrofitting the Empire State Building



ESB Approach





World Electricity Use ⚡



World Electricity Use ⚡



60%

Motors





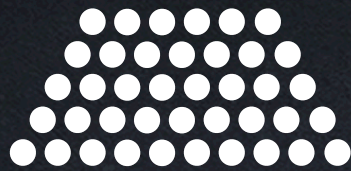
Saving Electricity

motors, pumps, *and* pipes

Less Capital Investment

smaller equipment





100
Energy units

-70%

Power Plant



-9%

Power Grid



-12%

Motor/Drivetrain



-55%

Pump/Throttle



-20%

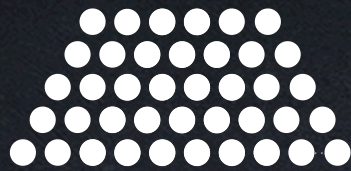
Pipe



10%

Delivered flow





160
Energy units

-70%

Power Plant



-9%

Power Grid



-12%

Motor/Drivetrain



-55%

Pump/Throttle



-20%

Pipe



5%

Delivered flow



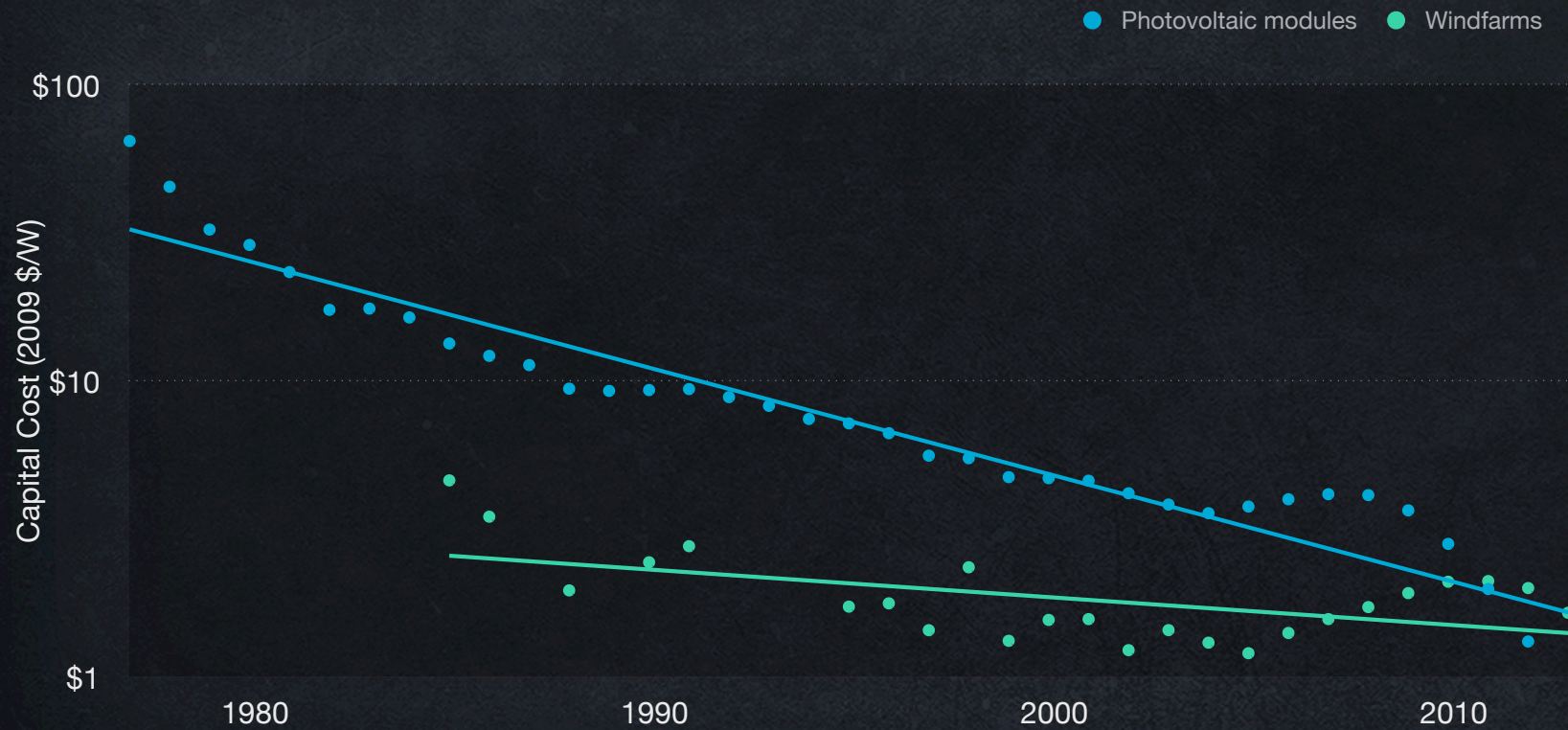


Billions in Savings

from radically efficient industrial redesign

Renewable Energy's Costs Continue Downward Trend

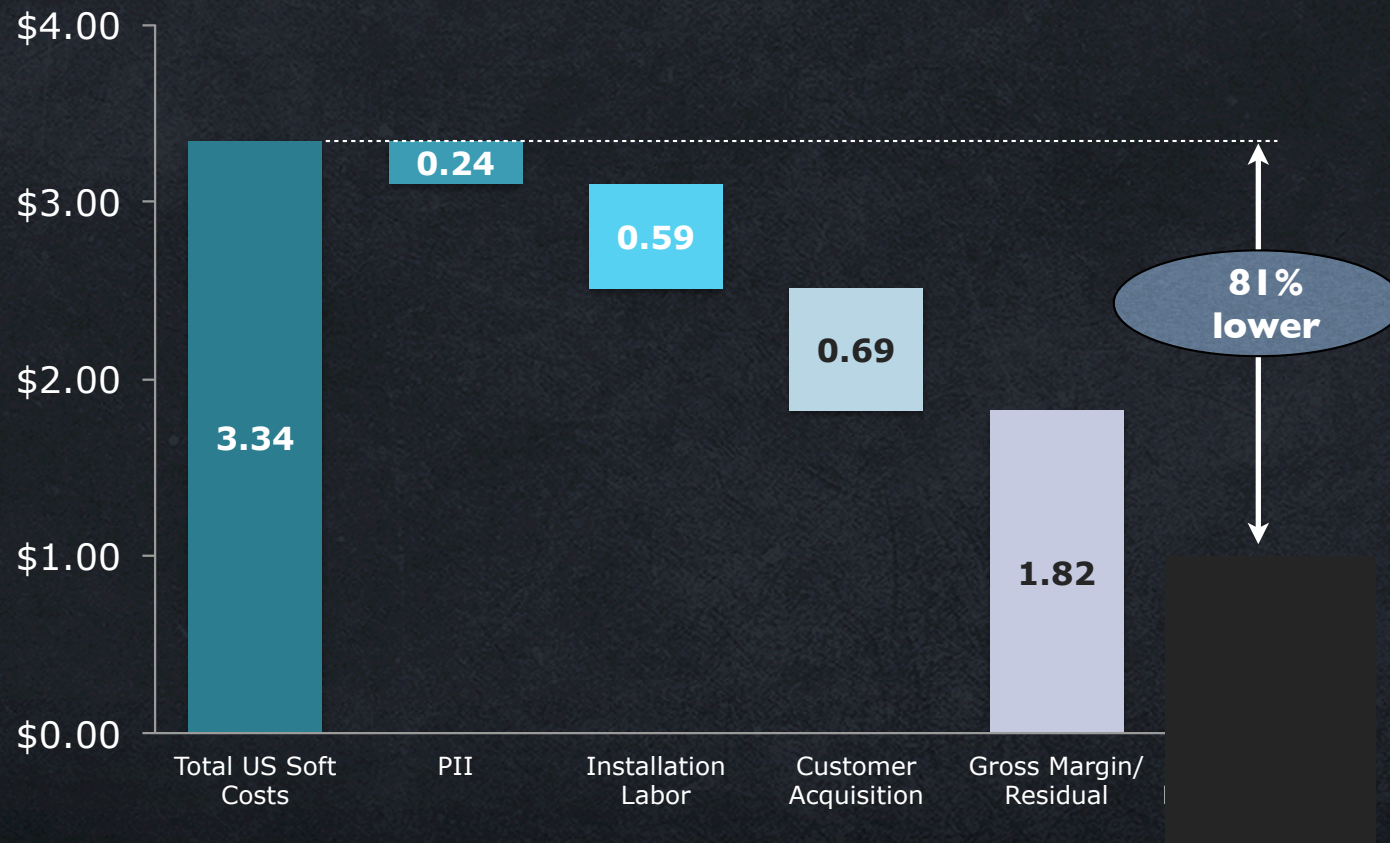
Wind and photovoltaics: U.S. real capital cost trends

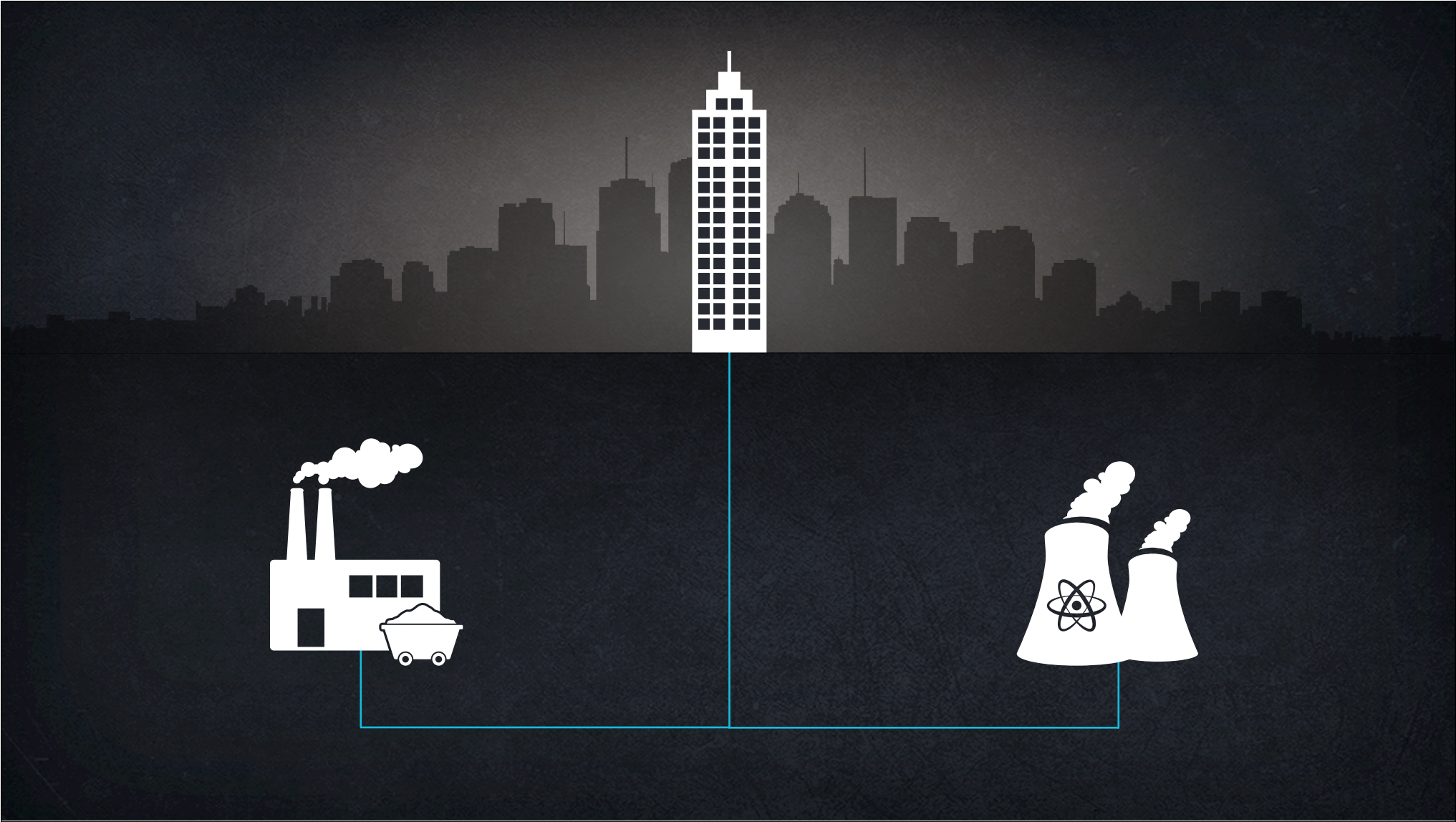



There is still room to compress “soft costs” in U.S.

2012 U.S. Average Photovoltaic Soft Costs (Residential Rooftop)


\$ per Watt DC



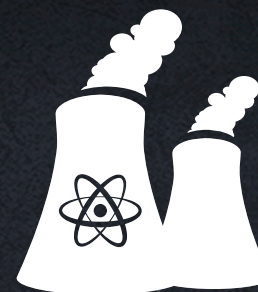


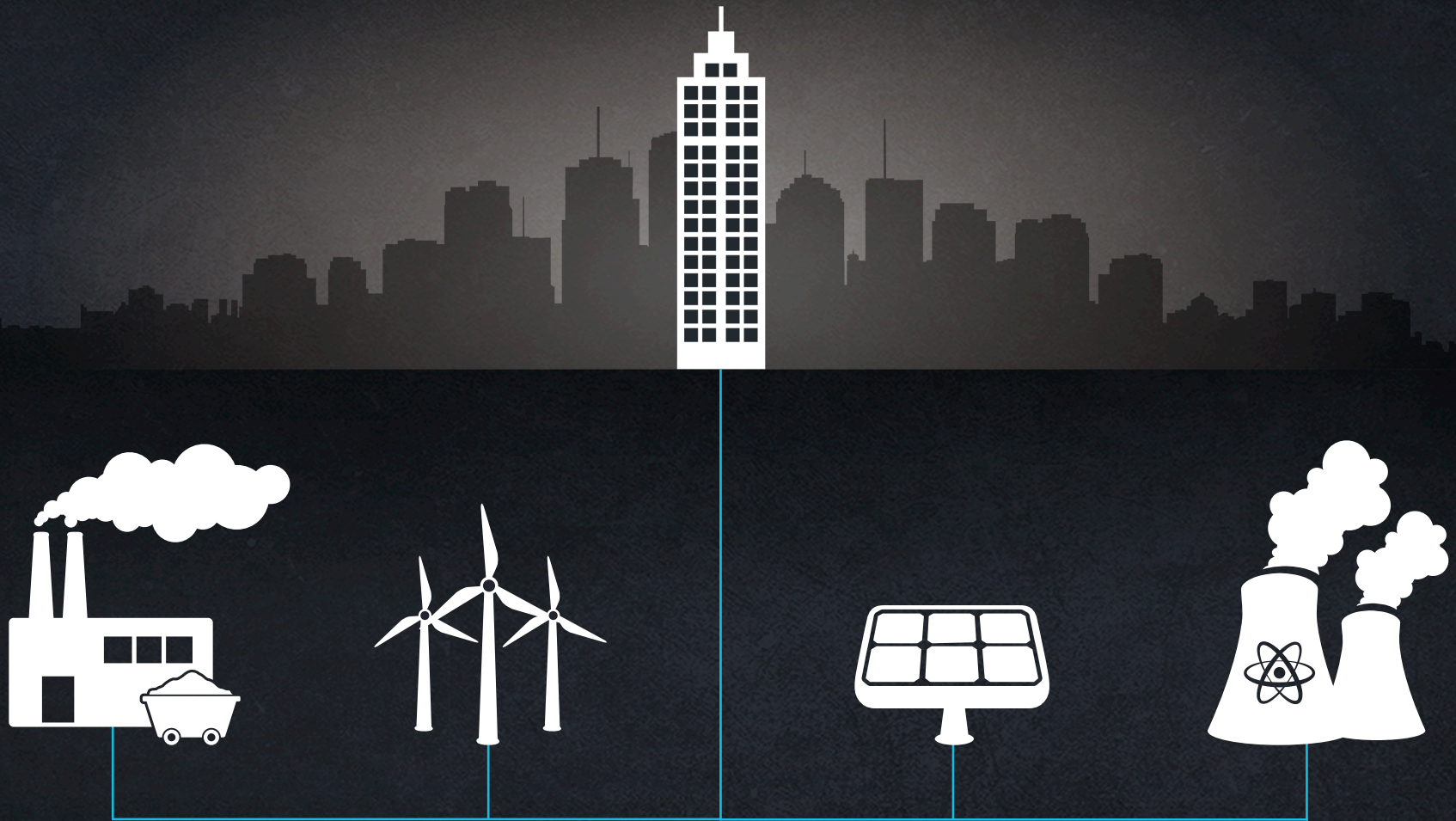


10-20% Downtime



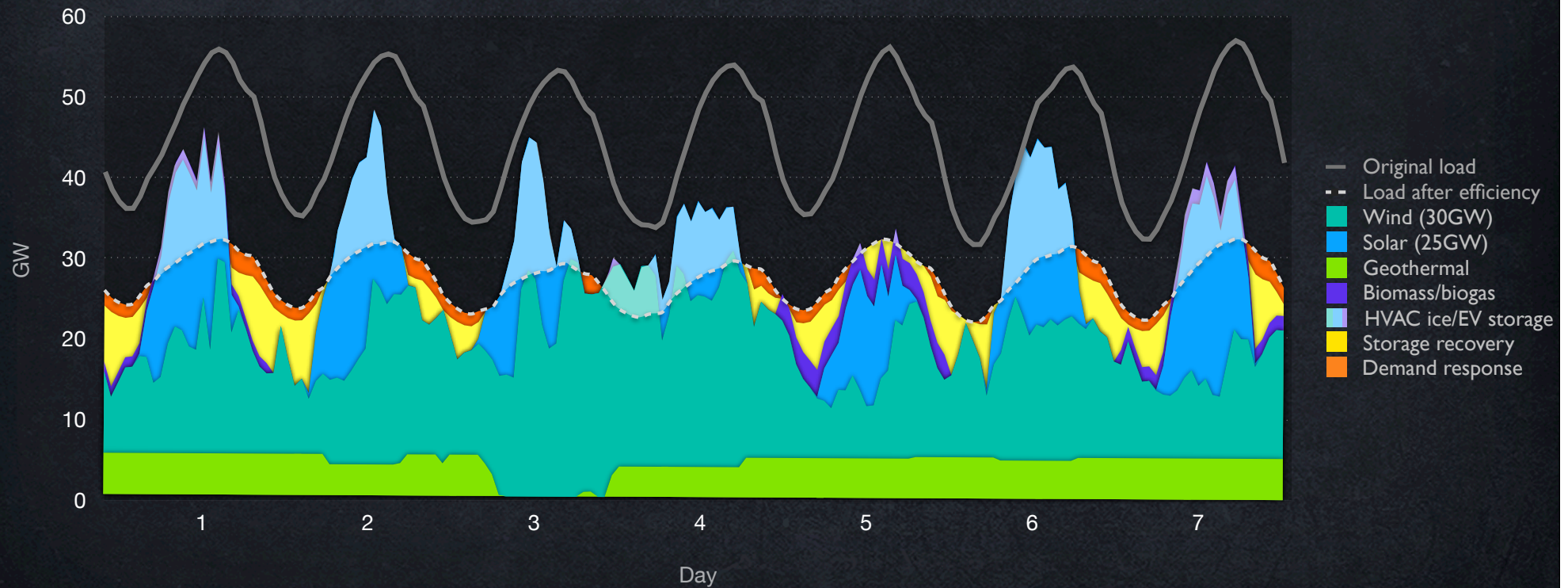
5-15% Downtime





Choreographing Variable Renewable Generation

Texas summer week, 2050



Choreographing Variable Renewable Generation

Europe, 2010 capacity,
average wind year

36%

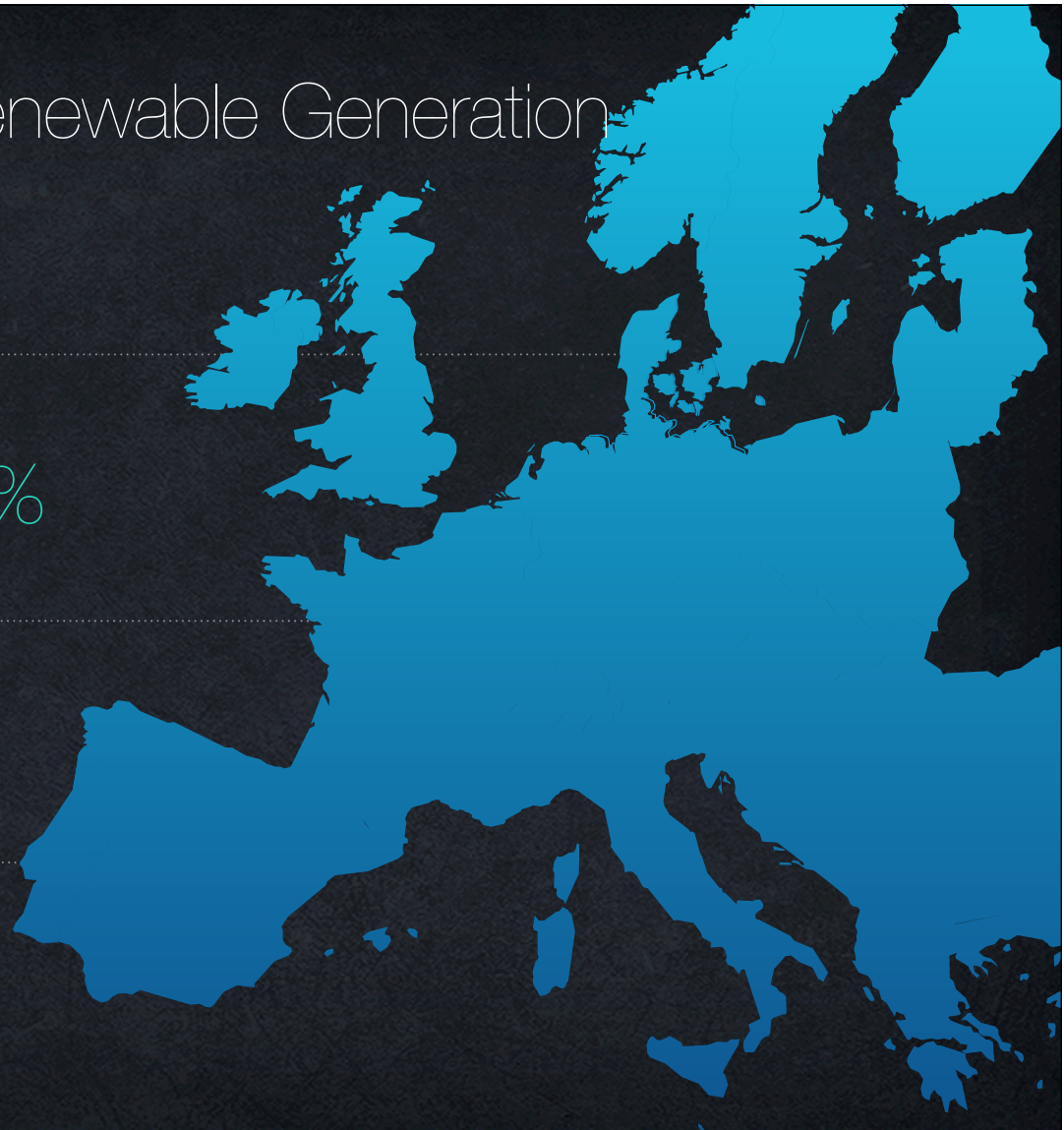
Denmark

43–52%

Four German States

45%

Portugal



RMI's Electricity Innovation Lab is focused on solving complex multistakeholder issues in the power sector



+



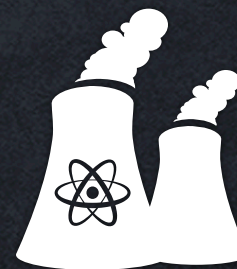
Design session with over two dozen innovators focused on creating a roadmap for the Fort ZED project

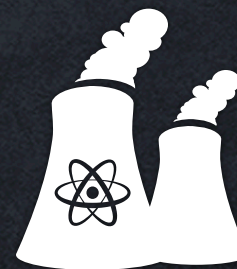


- Future vision
- Impact acceleration
- Tariff design
- Stakeholder management

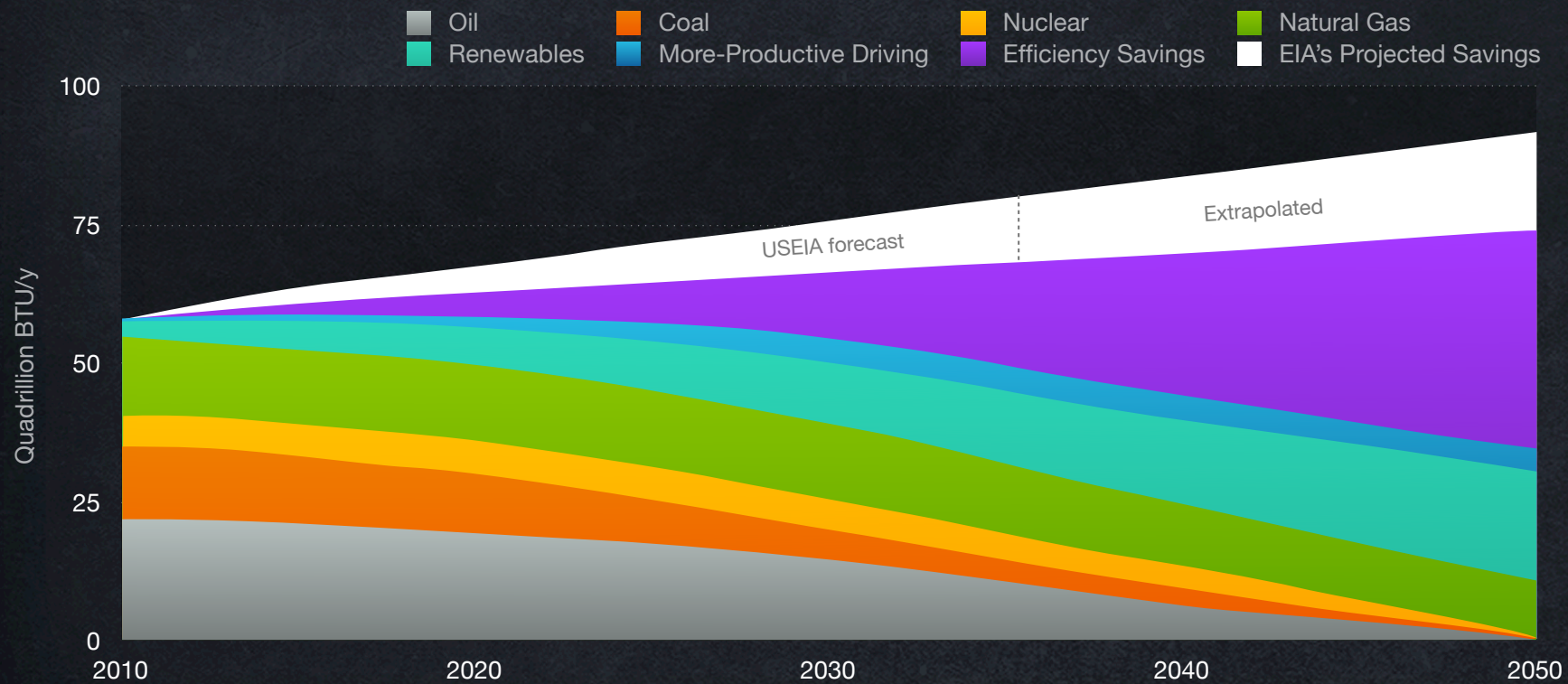
Costs







Reinventing Fire: U.S. Economy Free From Oil and Coal



\$5T

in savings

+158%

bigger economy

0

oil, coal, nuclear

Solutions to: Climate Change

Nuclear Proliferation

Energy Insecurity

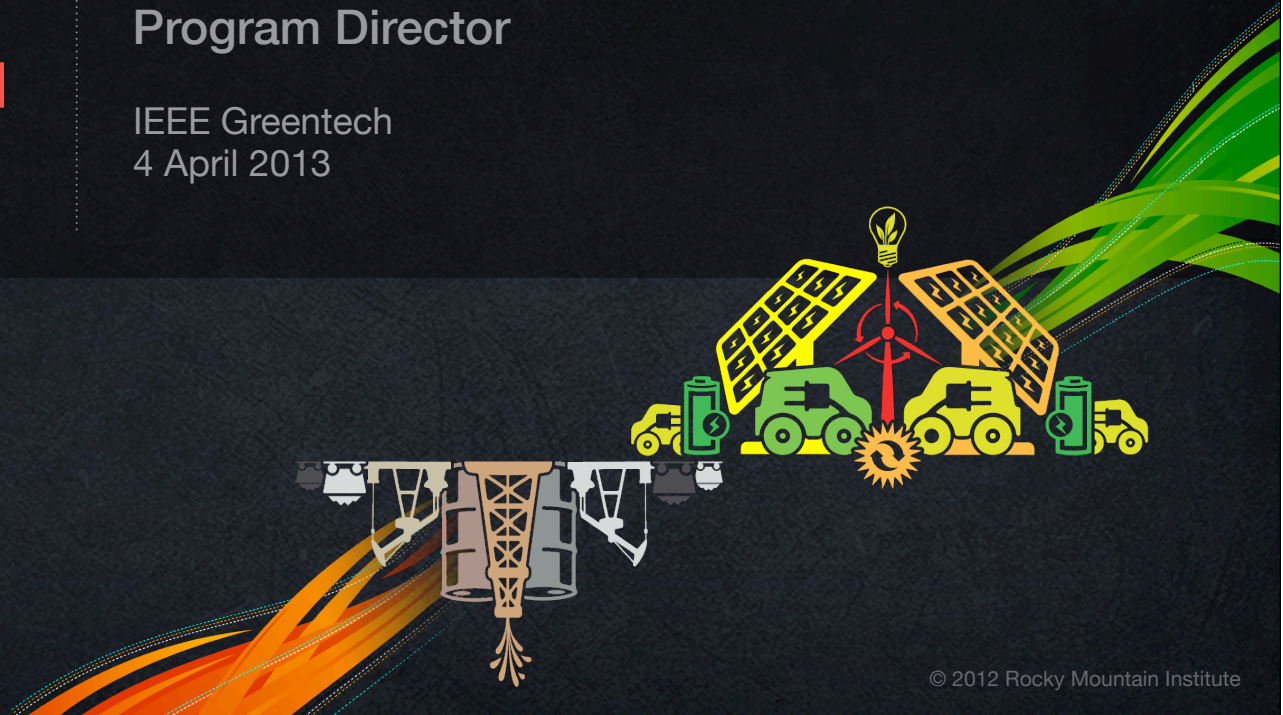
Energy Poverty

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