TODAY: 90% of America’s energy comes from non-renewable energy sources
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2050
Efficient
Connected
Distributed
TODAY:

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TODAY:
90%
of America’s energy comes from non-renewable energy sources
TODAY:
90% 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

2005  2010  2015
Efficiency

Weight
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.

Currently, 94% of transportation is oil-fueled, cars alone account for half of all U.S. consumption.

Innovation Hub: 2016
Create a centralized, collaborative framework for industry transformation.

Parts Campaign: 2018
Adoption of a carbon fiber composite part on a mainstream production vehicle.

Our Goal:
To transform the current metals-based paradigm in the automotive industry into one based on ultralight CF composite-intensive vehicles.
Tripled-Efficiency Trucks and Planes
“We must leave oil before it leaves us.”

Fatih Birol
Chief Economist
International Energy Agency 2008
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

- EIA Baseline
- With Efficiency Only
- Transform with Efficiency + Electric Autos

Historic vs. Projected
3-4x Energy Productivity in Buildings, 2x in Industry

Same or better services
Integrative Design in Retrofitting the Empire State Building
ESB Approach

- Windows: $4M
- Radiative Barrier: $2.7M
- DDC Controls: $5.6M
- VAV AHUs: $2.4M
- Lighting & Plugs: $8.7M
- Avoided Chiller Plant Retrofit: Minus $17.4

Annual Savings: $4.4M
World Electricity Use
Motors 60%

60%
Saving Electricity

motors, pumps, and pipes
Less Capital Investment

smaller equipment
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

- Total US Soft Costs: $3.34
- PII: $0.24
- Installation Labor: $0.59
- Customer Acquisition: $0.69
- Gross Margin/Residual: $1.82

81% lower
10-20% Downtime

5-15% Downtime
Choreographing Variable Renewable Generation

Texas summer week, 2050

- Original load
- Load after efficiency
- Wind (30GW)
- Solar (25GW)
- Geothermal
- Biomass/biogas
- HVAC ice/EV storage
- Storage recovery
- Demand response
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

- Oil
- Coal
- Nuclear
- Renewables
- Natural Gas
- More-Productive Driving
- Efficiency Savings
- EIA's Projected Savings

Quadrillion BTU/y

USEIA forecast
Extrapolated
$5T +158\% \quad \text{in savings} \quad \text{bigger economy} \quad 0 \quad \text{oil, coal, nuclear}
Solutions to:

- Climate Change
- Nuclear Proliferation
- Energy Insecurity
- Energy Poverty