



New Ways of Investing in Our Grid

*How Modular, Quickly Re-Deployable Power Flow Control
Will Change How We Invest in Transmission
Given the Uncertainty in our World*

April 2017

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Navigating a Challenging Storm

1 Rapidly changing generation



2 Unpredictable future load



3 Challenge building new lines and stranded asset risk



4 Global, energy-driven economy



Short Term Need Windows

1

With so much volatility in transmission, most projects show limited need for new lines and upgrades within 10 years of the project completion. And 10 year models are growing increasingly inaccurate.

More Emergency Transmission Needs

2

The volatility in transmission markets is causing plants to close unexpectedly and leaving transmission operators with very few alternatives to some transmission challenges.

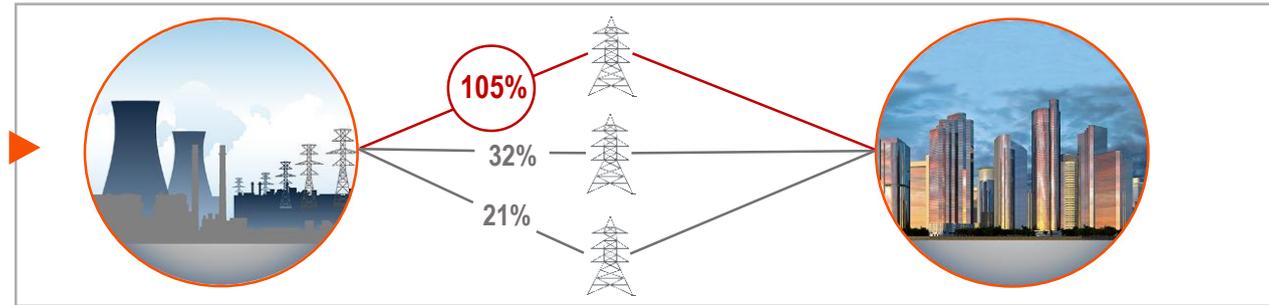
More Bubble Projects

3

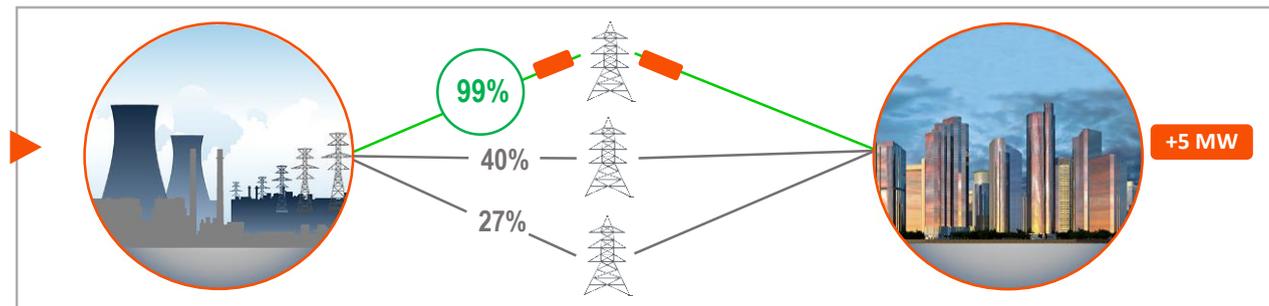
The penetration of distributed generation and energy efficiency on the system makes it difficult to validate long term needs for load growth based projects.

The Smart Wires Advantage

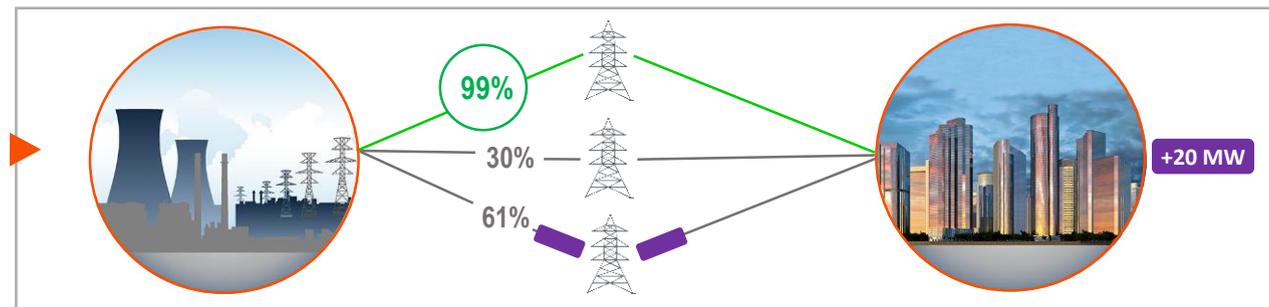
Before Smart Wires
Simplified planning scenario predicts future overload



With Smart Wires Guardian
Power is pushed to alternate lines with spare capacity, resolving overload



With Smart Wires Router
Power is pulled onto lines with spare capacity, resolving overload



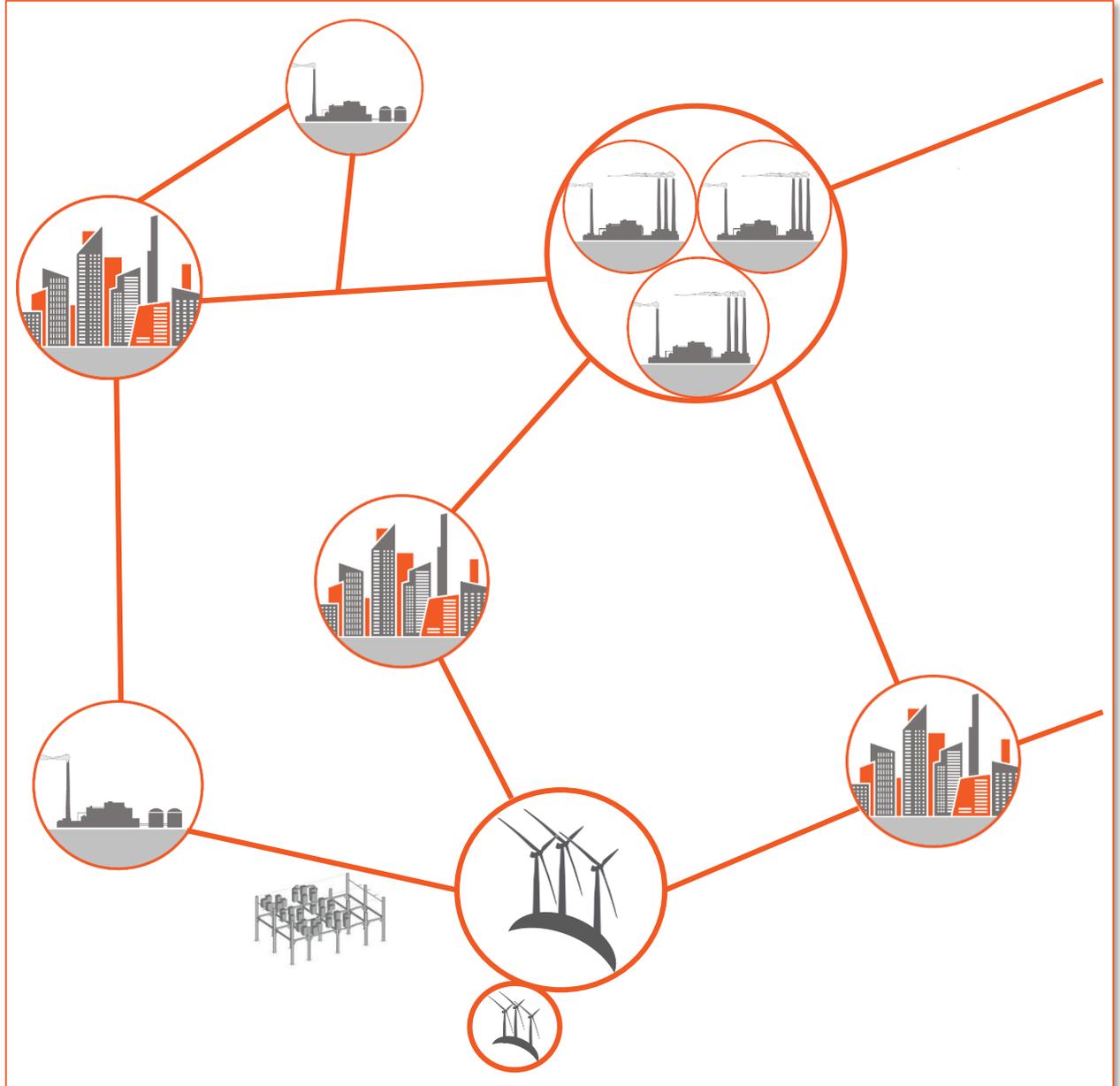
Vision of a Dynamic Grid

A Dynamic Grid for an Uncertain Future

1. Quickly Deployable
2. Optionality
3. Redeployable
4. Short Need Windows

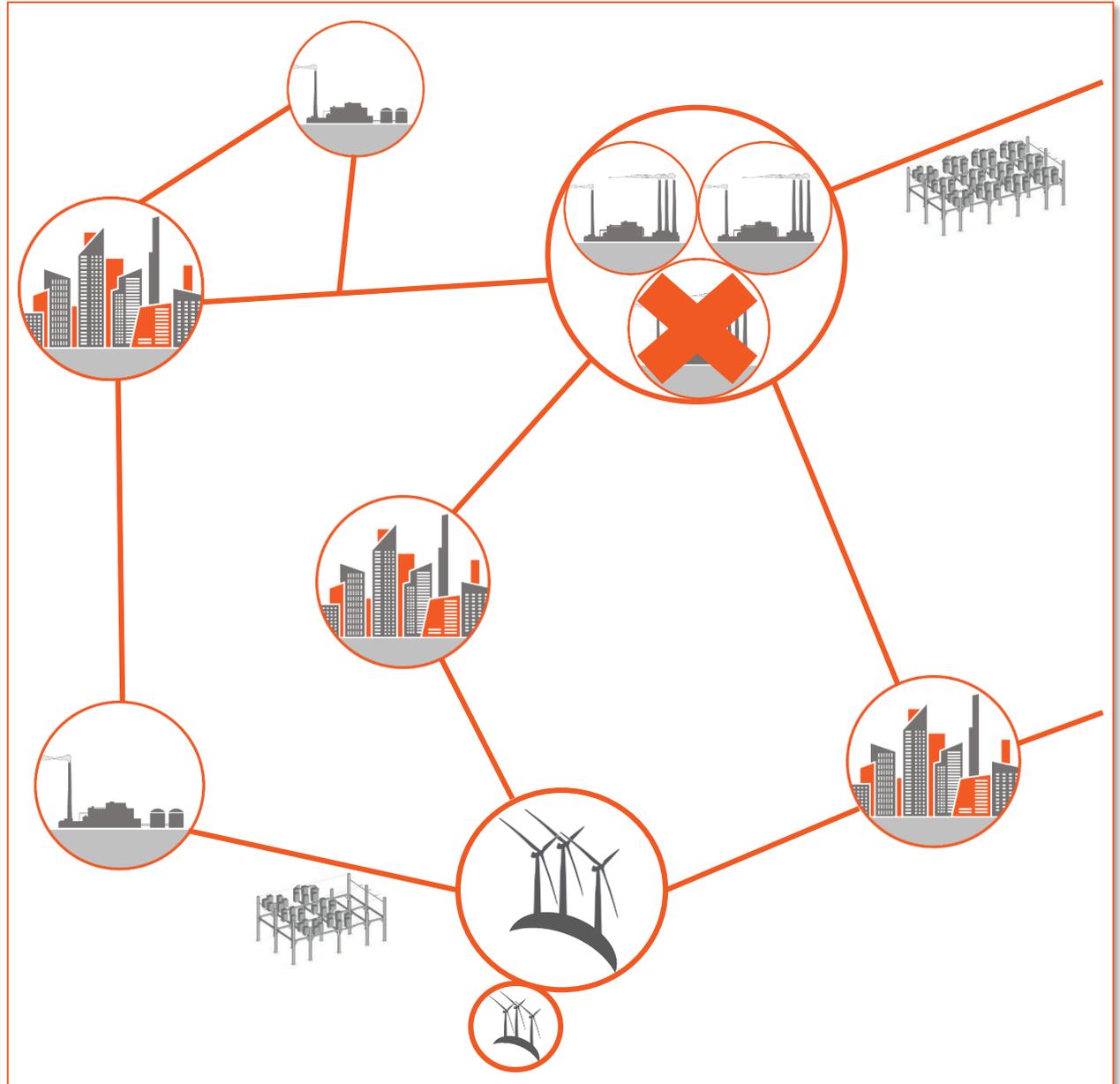
A Dynamic Grid for an Uncertain Future

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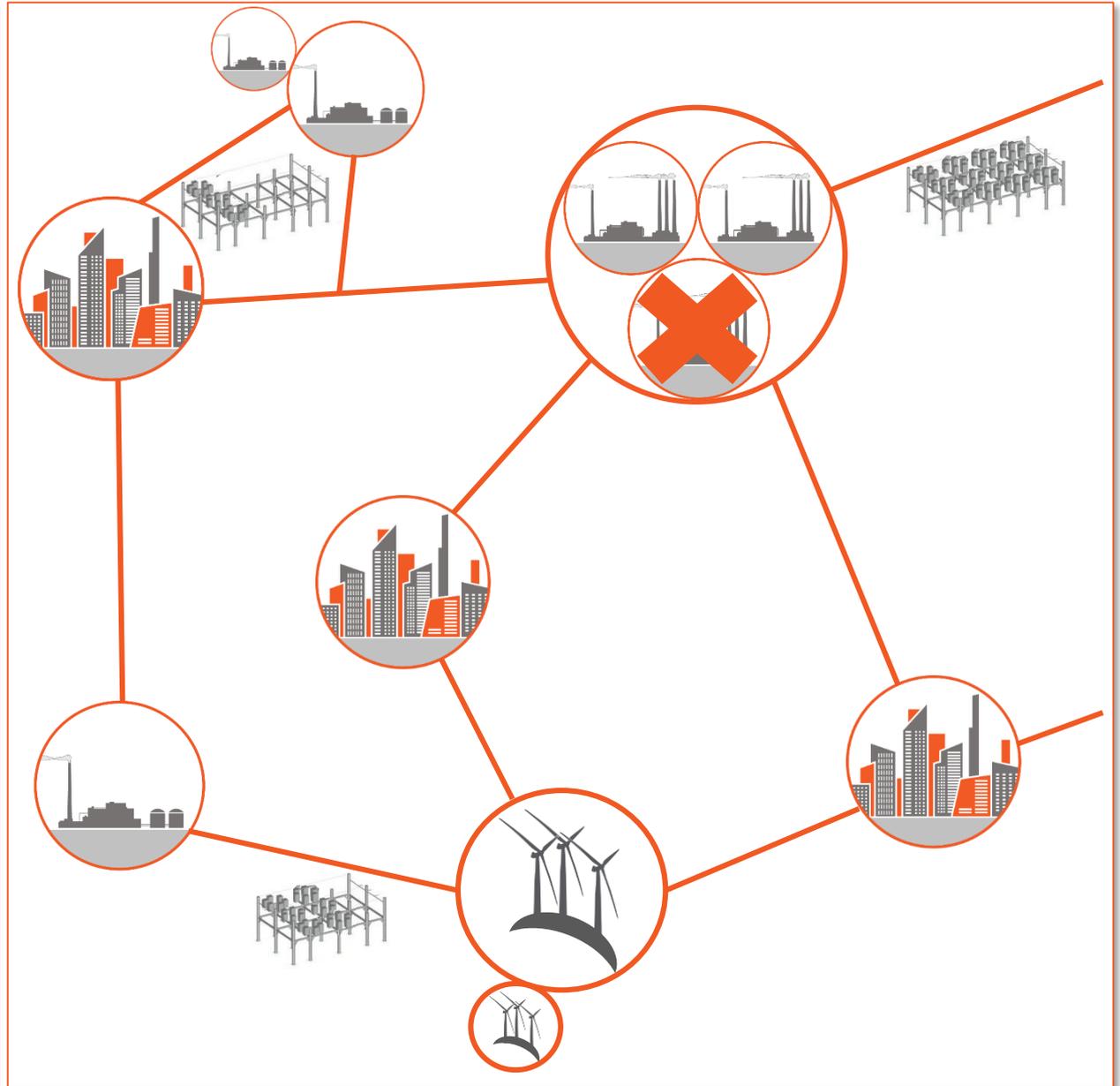
A Dynamic Grid for an Uncertain Future

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A Dynamic Grid for an Uncertain Future

1. Quickly Deployable
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1 Build a Better Grid

Smart Wires, in conjunction with traditional investments, can provide **more transfer capability and more transmission flexibility for a given capital budget.**

2 Rapid Solution

Deployable in weeks, Smart Wires **can be deployed quickly for economic development (e.g., data centers)** or to solve other near term transmission challenges.

3 Better Integrate Renewables

DNV GL Study: Deploying Smart Wires **cut transmission investment costs** by \$1.8B (out of \$4B) and lowered consumer energy bills by more than \$850M per year

4 Capital Optimization

Smart Wires solutions **typically cost 20% of reconductoring** and have demonstrated **\$200M in savings** on a typical \$500M portfolio for one large West Coast utility.

Technology Overview

Guardian

- Increases reactance using local control or central dispatch
- PowerLine version has 4+ years of field operation



PowerLine Guardian (left) is deployed on conductors. Power Guardian (right) is deployed on structures



Router

- Modular SSSC, provides variable voltage to synthesize capacitive or inductive reactance
- First customer pilots in 2016



The Power Router for pilots (left) is deployed on existing structures and the first commercial Power Router (right) is deployed on structures



The Router leverages and innovates upon proven Guardian technology

1. Communications package
2. Transformer
3. Controller

Guardian technology

4. Physical package
5. System protection

6. **Electronic injection unit**

Additional Router innovation

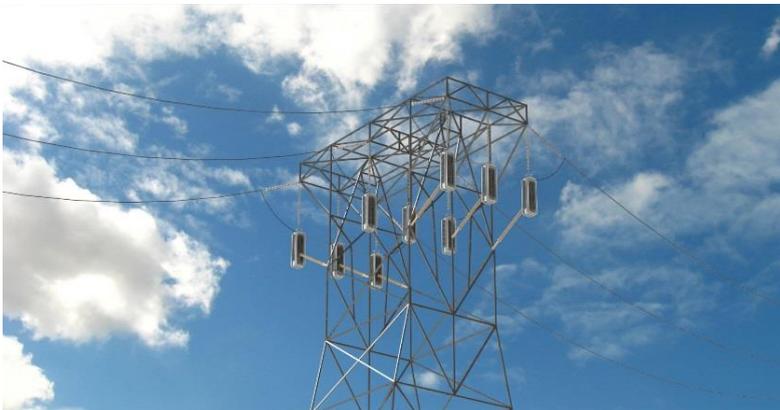
1 Standard PowerLine Guardian Deployment



2 Compact PowerLine Guardian Deployment



3 Install on Smart Tower



4 Deploy in a Smart Bank



Technology Incubated by Utilities for Utilities

Leadership



Gregg Rotenberg
Acting CEO and President
Former GM of Renewable Power Group at
Chevron Energy Solutions



Tom Voss
Smart Wires Executive Chairman
Former CEO, Ameren

Advisory Board



David Ratcliffe
Former Chairman &
CEO, Southern Co.



David Whiteley
Executive Director
Eastern Interconnection
Planning Collaborative



Elisabeth Brinton
Executive General Manager, New
Energy for AGL Energy Limited



Anjan Bose
Regents Professor, WSU
IEEE Fellow



Ian McLeod
Former CEO, Ergon Energy



Daniel Dobbeni
President, GO-15
Former President, ENTSO-E

Awards



2016 PLATTS
GLOBAL ENERGY
AWARDS FINALIST



Customers



Partners



Questions?

Todd Ryan, Ph.D.

Director of Regulatory Affairs

Todd.Ryan@smartwires.com

617.784.5342

Smart Wires, Inc.

201 Spear St, Suite 1350

San Francisco, CA 94105

smartwires.com