LIFELINES RESTORATION PERFORMANCE PROJECT

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Lifelines Restoration Performance Project

- How would we like lifelines to perform in an earthquake?
- How would lifelines perform if an earthquake happened today?
- What actions are needed to close the gap?

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Report Outline

- Introduction
- System wide Findings and Recommendations
- Sector Based Findings and Recommendations
- Updating the Project
- Appendices

For the first time, we have a common understanding of what restoration time across all lifeline systems in San Francisco.

- **Power and telecom** are fastest to recover because of flexible systems
- **Water, wastewater, roads, natural gas, port and airport** take longest to recovery because of complex reconstruction needs
- **Golden Gate and Bay Bridges** designed to nearly immediately open for emergency vehicles and potentially repair crews
- For **Kinder Morgan, Caltrans and BART**, worst case scenario is Hayward Fault

Expected Restoration Timelines and Restoration Goals

San Andreas Scenario

Sector	Organization	Emergency Response		Short-term Restoration		Long-term Recovery		
		0 hours	72 hours	2 weeks	2 months	6 months	1 year	3 years
Electric Power	PG&E							
	SFPUC							
Fuel	Kinder Morgan[1,2]							
Communications	AT&T Wireless							
	Comcast							
	Verizon Wireless							
	SF Dept of Technology							
Highways & Local Roads	Caltrans[2]							
	Golden Gate Bridge							
	Public Works							
Potable Water	SFPUC							
Transit	MUNI							
	BART[2]							
Natural Gas	PG&E							
Wastewater	SFPUC							
Solid Waste	Recology							
Port	Port of San Francisco							
Airport	SFO							
Firefighting Water (EFWS)[3]	SFPUC							

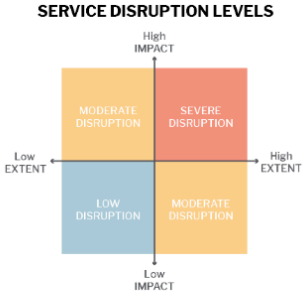
[1] Kinder Morgan has not provided expcted restoration performance. Kinder Morgan has many unknown and externalities that make estimating restoration of fuel delivery challenging.

[2] Wost case scenario is Hayward Fault

[3] Goal of EFWS is low disruption immediately after an earthquake. After post-earthquake fire fighting needs are met, SFPUC will focus efforts on restoring potable water first and then return to complete needed repairs to AWSS system.

The service disruption levels are defined as:

- Severe = disruptions with high spatial extent & high impact disruptions.
- Moderate = disruptions with low spatial extent & high impact, OR high spatial extent & low impact;
- Low = disruptions with low spatial extent and low impact;
- No disruption



Where,

- Extent = spatial reach of the disruption and proportion of people within the area that are affected.
- Impact = severity of consequences and the duration of the disruption. For example, complete loss of water supply is high impact (independent of how many people are affected), whereas a boil water advisory is low impact.

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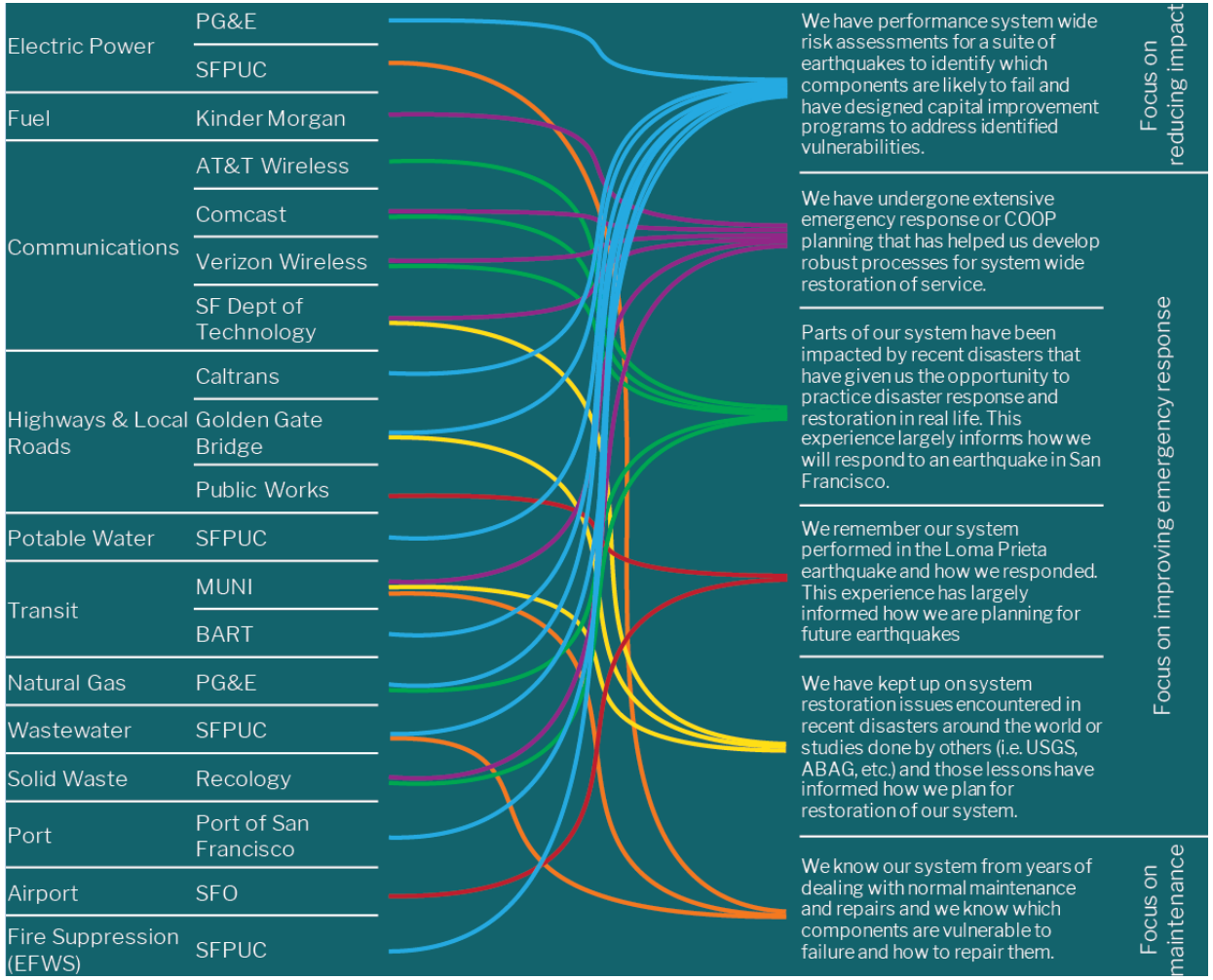
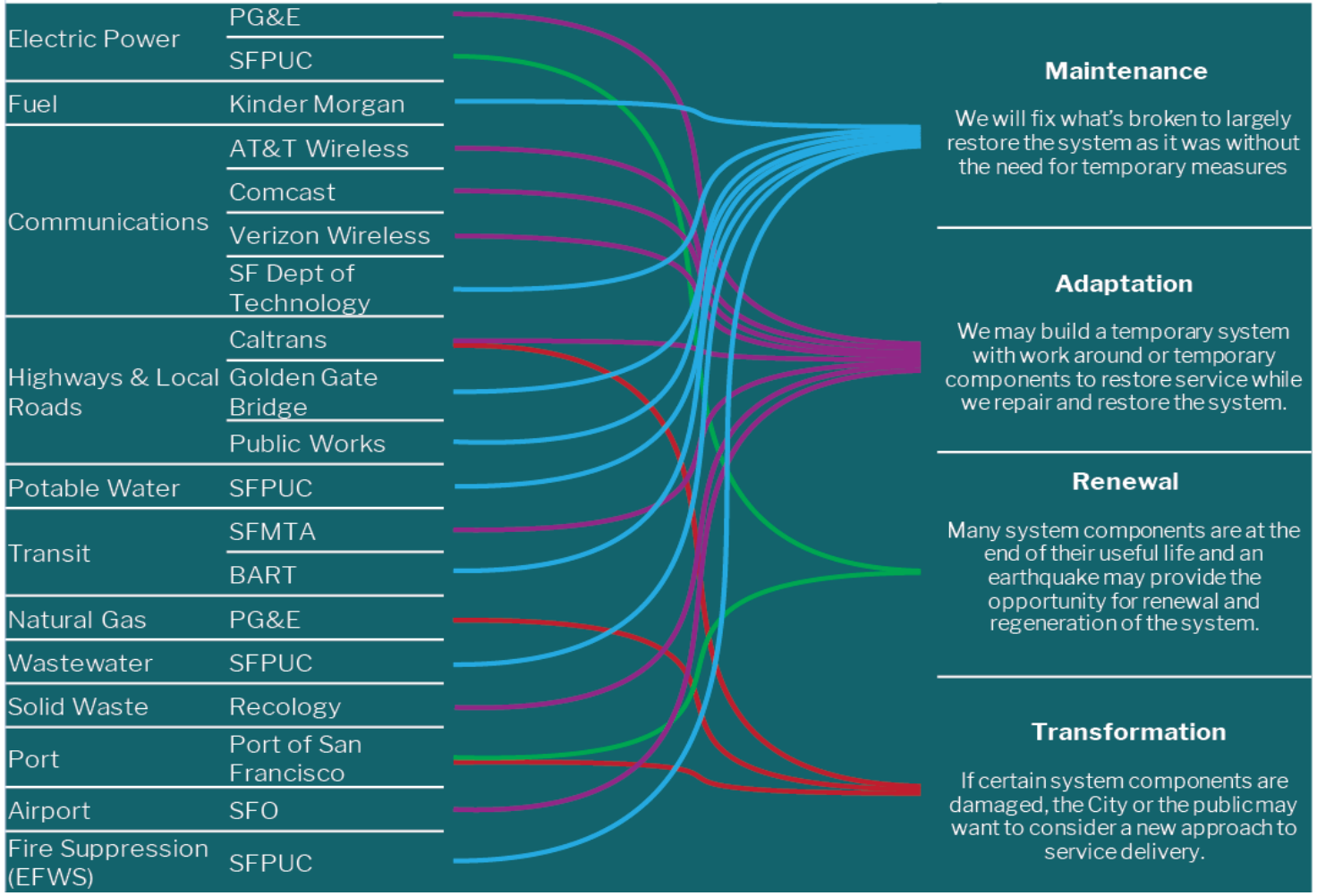
Decades of investment in infrastructure improvements will improve post-earthquake restoration performance

- **Completed programs:**
  - Caltrans retrofits of elevated freeways and bridges crossing the Bay
  - BART Earthquake Safety Program
  - SFPUC Water System Improvement Program
  - Golden Gate Bridge retrofit
  - PG&E power and natural gas system upgrades
- **Programs underway:**
  - SFPUC Sewer System Improvement Program
  - SFPUC Auxiliary Water Supply System
  - SF Port Seawall Resilience Program

Approaches on pre-event planning for restoration



The type and extent of restoration each system may require varies significantly across systems.



Lifeline systems depend on other systems to operate

A. Lifeline Sectors

B. Lifelines given in A are dependent on these lifelines

Sector	Electric Power	Natural Gas	Water	Wastewater	Communic-ations	Highways and Local Roads	Fuel	Transit	Solid Waste	Airport	Port	Firefighting Water (EFWS)
Electric Power												
Natural Gas												
Water												
Wastewater												
Communications												
Highways and Local Roads												
Fuel												
Transit												
Solid Waste												
Airport												
Port												
Firefighting Water (EFWS)												

None	No reliance on sector
Low	Minimal reliance on sector
Moderate	Large reliance on sector with significant backup available, or moderate reliance on sector with no back up available
Significant	Large reliance on sector with limited backup available

Reading the matrix across each row shows which sectors a particular sector relies on. For example, electric power has a significant reliance on natural gas, but a low reliance on the Port.

Reading the matrix down each column shows which sectors rely on the designated sector. For example, all systems, except for EFWS have a significant dependence on electric power.

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Key Interdependencies

- Maintenance and repair workers needed for response and restoration in every sector increasingly live outside of San Francisco.
- Many lifeline operators will need to bring additional crews, materials and equipment from outside the region to support system restoration.
- Loss of power will significantly impact every single lifeline system, as well as all buildings.
- Reducing reliance on petroleum fuel will improve restoration of all systems.

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Additional Recommendations to Speed Restoration

- Adopt official restoration performance goals to help the public have a clear understanding of what to expect from the system in an earthquake and help agencies track progress towards improved restoration performance.
- Organizations that have not yet done so should undertake a systematic risk-based approach to evaluate system performance and needed improvements.

Thanks!

Any questions?

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