

VEOLIA

2017

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Resilient Cities

WHO IS VEOLIA ?

OUR VISION: « RESOURCING THE WORLD »



VEOLIA DESIGNS AND DEPLOYS CIRCULAR ECONOMY SOLUTIONS FOR **WATER**, **WASTE** AND **ENERGY** MANAGEMENT TO IMPROVE EFFICIENCY FOR CITIES, INDUSTRY AND CITIZENS.

€24
billion revenue

163 K
employees
on 5 continents

6 M
tons equiv. CO₂
avoided emissions
and

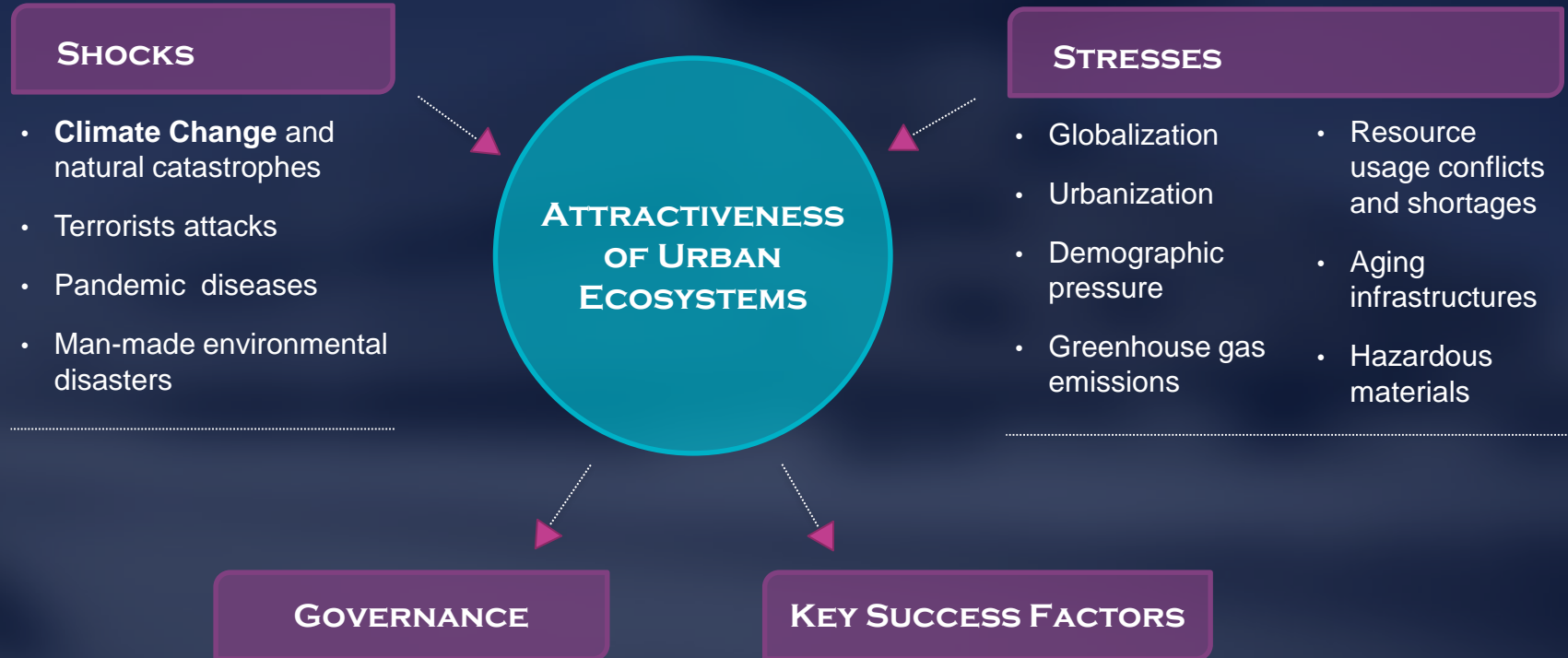
16 M
tons equiv. CO₂ of
reduced emissions

39 M
MWh of renewable or
alternative energy consumed

34%
of the company's total
consumption

WHAT IS RESILIENCE ?

RESILIENCE: Strategic approach to strengthen the socioeconomic attractiveness of the urban ecosystem, guaranteeing its sustainable growth.



OUR PLEDGE TO THE 100 RESILIENT CITIES INITIATIVE

Created to help cities become more resilient to the social, economic and physical challenges that are a growing part of the 21st century.

A \$100 million effort
launched by the
Rockefeller Foundation
on its Centennial in 2013.



100RC is a non-profit
entity, managed by
**Rockefeller
Philanthropy Advisors**
(RPA).

100RC PROVIDES MEMBER CITIES 4 TYPES OF SUPPORT TO ADDRESS THESE PROBLEMS:

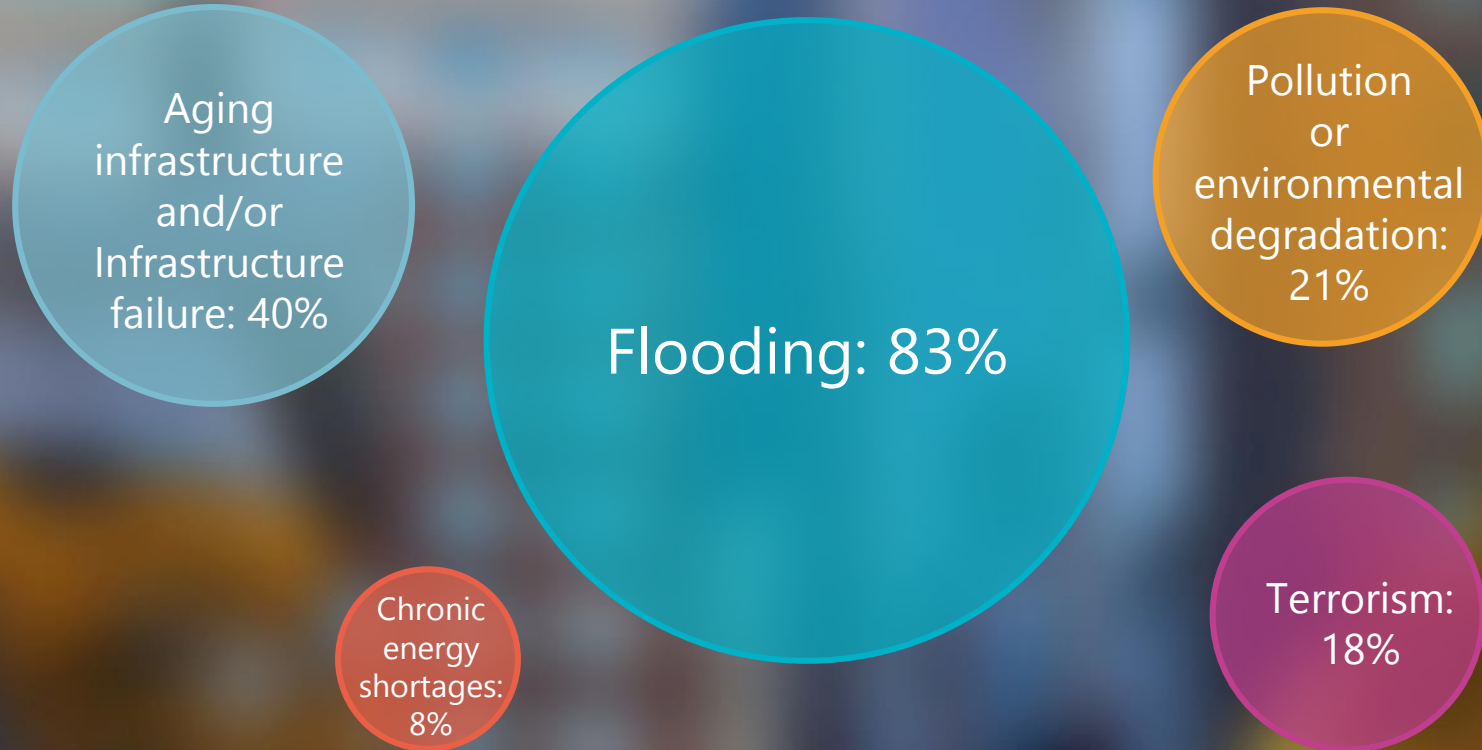
Funding to hire
a Chief Resilience Officer
(CRO)

Support to Develop
a City Resilience
Strategy

Membership
in the 100RC peer
Network of cities

A Platform of Services
to support strategy
implementation

CHALLENGES FACED BY CITIES WITHIN 100 RC



VEOLIA'S VALUE PROPOSITIONS: COVERS ALL ASPECTS OF RESILIENCE



VEOLIA'S VALUE PROPOSITIONS

- Robust infrastructure
- Resource conservation
- Flood management
- Critical energy supply
- Heat wave mitigation
- Critical event management

VEOLIA & SWISS RE IN NEW ORLEANS



Partnership to build resilience

SWISS RE AT A GLANCE

Swiss Re's VISION:
"WE MAKE THE WORLD MORE RESILIENT."

ARMONK, NEW YORK



Financial strength is currently rated:
Standard & Poor's:
AA-/stable; Moody's: Aa3/stable;
A.M. Best: A+/stable

Swiss Re is a leading
and highly diversified
global re/insurance
company



SIÈGE, ZURICH

152 years of experience
in providing wholesale
re/insurance and risk
management solutions

They deliver both traditional
and innovative offerings
in Property & Casualty and
Life & Health that meet our
clients' needs



THE "GHERKIN" LONDON

A pioneer in insurance-based
capital market solutions, they
combine financial strength and
unparalleled expertise for the
benefit of our clients

VEOLIA SWISS RE COMMON OFFER OVERVIEW

A city prepared to withstand and bounce back

1 Understand
your
vulnerabilities

2 Plan
your
response

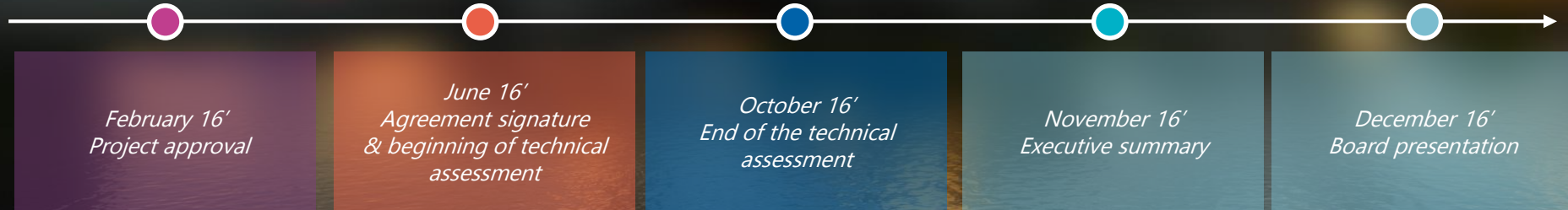
3 Implement
mitigation
measures

4 Transfer
Your
risk

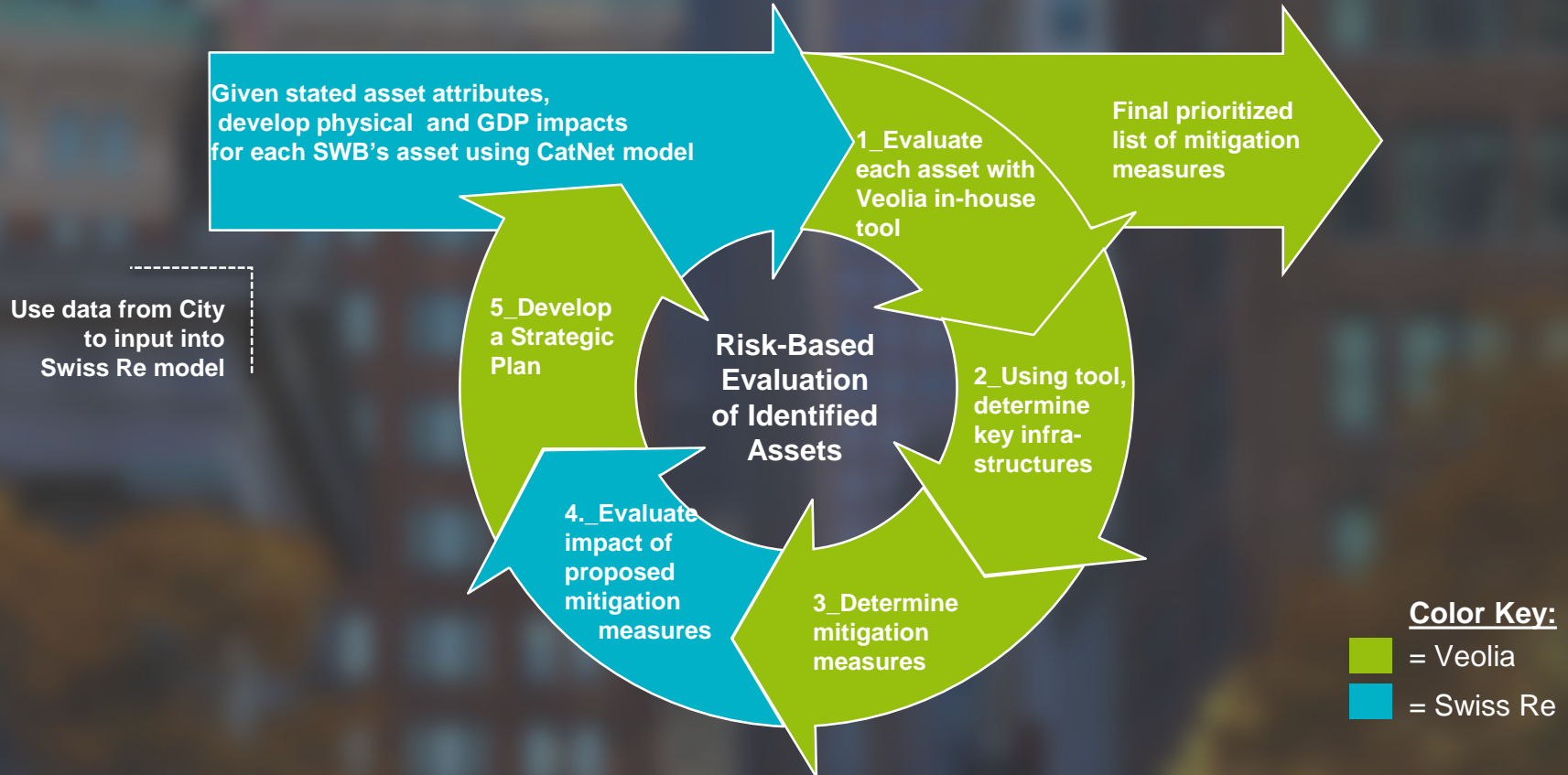
**Monitor progress and performance
and drive continuous improvement of systems and services**

NOLA INITIAL PROJECT STRUCTURE

- > Analysis of risks and impacts
- > Portfolio of assets covered
- > Swiss Re's advanced simulation model
- > Veolia's detailed field investigation asset per asset
- > Conclusions discussed with SWB's management

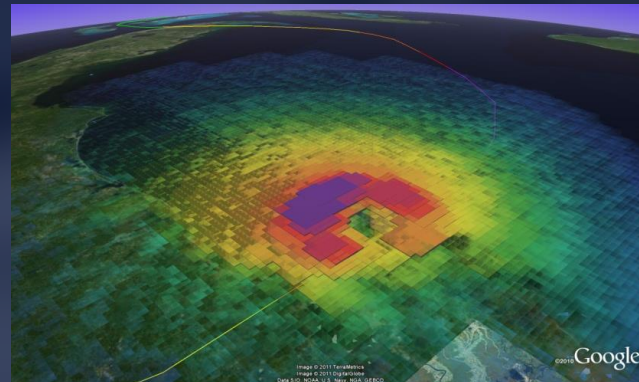
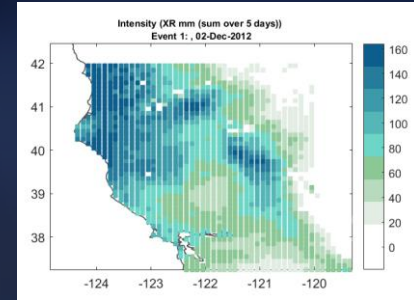
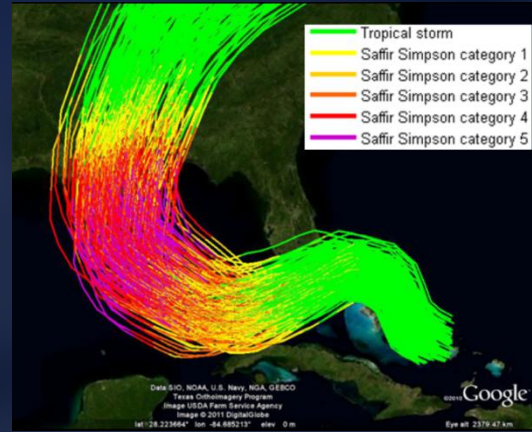


NOLA PROJECT – GENERAL STUDY APPROACH

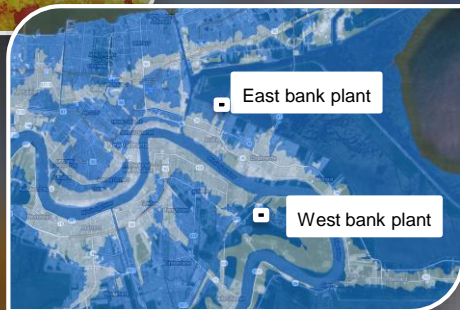
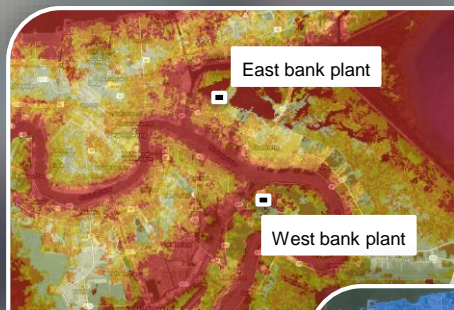


Process for risk modeling, system vulnerability assessment, and ROI analysis

- Swiss Re uses HURDAT Best Track data set from National Hurricane Center in Miami (includes all tropical cyclones in Atlantic Basin between 1891 and 2008)
- 1,117 historical tropical cyclones form the basis for the stochastic track set generation.
- Each historical track perturbed 199 times via direct random walk process
- 200 tracks result in a track set containing 223,400 tropical cyclones
- Holland model, coupled with a roughness layer, produces a wind field for each track
- SLOSH model, coupled to a 30 meter x 30 meter digital elevation model, calculates storm surge for each track, using atmospheric pressure, forward speed, size, angle of landfall, and track data.



SWB'S EXISTING AND FUTURE RISK EXPOSURE



SWB PROPERTY DAMAGE:

- Current annual Expected Loss for SWB assets: \$10.5 million
- 100 year loss: \$360 million (or 22 months of operating revenue)
- 500 year loss: \$1 billion (or 5 years of operating revenue)

SWB REVENUE IMPACT:

- From Katrina, indexed daily revenue loss equals \$380,000 per day

SWB Future Climate Exposure:

- With increased frequency and 2.5' of sea-level rise, the SWB losses increase by 90% to \$18.5 million per year.
- The 100 year loss increases to \$790 million.
- The 500 year loss increases to \$1.4 billion

Broader New Orleans Impacts:

- Looks at all insured residential, commercial and auto assets
- The 100 year loss is \$17.4 billion.
- The 500 year loss is nearly \$50 billion
- \$25.3 million per day in GDP lost from Katrina

Orleans Parish lost \$0.61 of tax revenue for every \$100 of hurricane damage from Katrina

MAIN VULNERABILITIES IDENTIFIED

**Power supply
reliability**

**Infrastructure
hardening
investments**

**Operational and
workforce
excellence**

Merci de votre attention !

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Resourcing the world



RECOMMENDATIONS IDENTIFIED IN THE PHASE 1 REPORT

Critical points

Power supply reliability

Infrastructure hardening investments

Operational and workforce excellence

Solutions

- Domestic utility
- High-voltage feeders & sub-station

- Must have investments
- Good to have investments
- Quick wins

- "Hypervision" and system automation
- Advanced asset management
- Workforce strategy

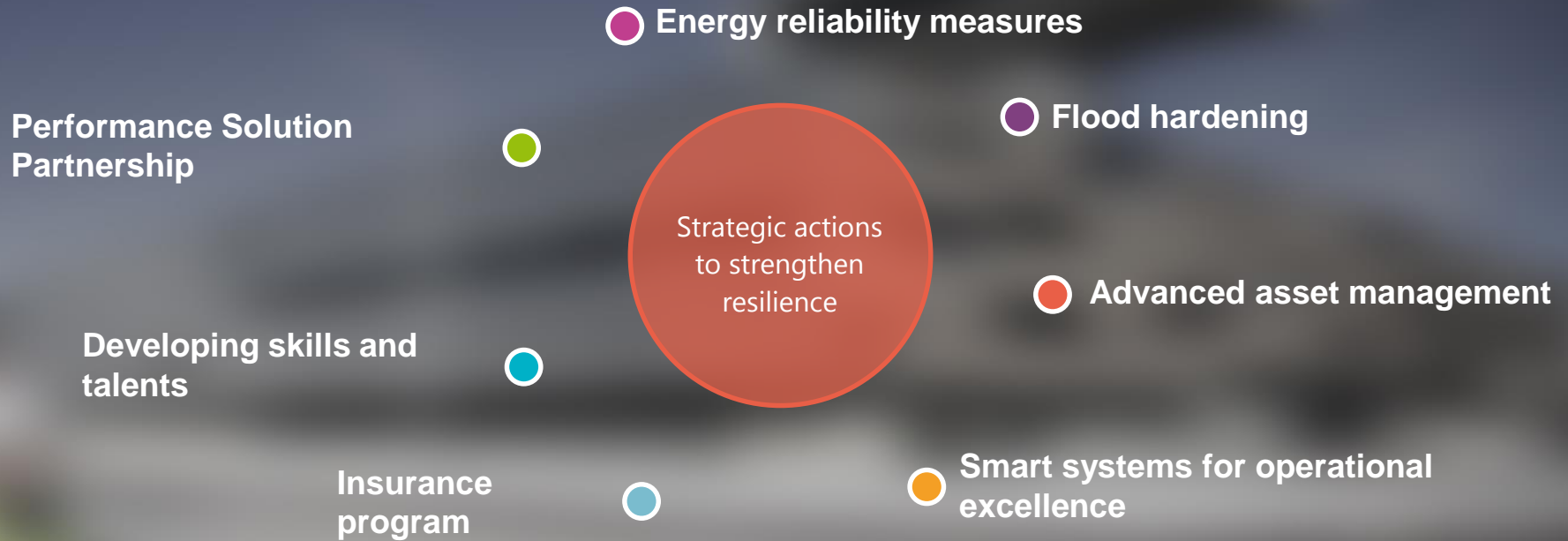
Next steps' topics

- Legal precedent
- Support for implementation

- Masterplanning / update of investment plan

- Co-optimization approach and case examples
- Veolia digital platform and case examples

A MULTIFACETED PROVEN ACTIONS PROGRAM



NOLA PROJECT – KEY FIGURES

200 ASSETS
\$1.7BN

>150,000

hurricane events modeled in the
Atlantic Ocean & Gulf of Mexico

More than
30 PEOPLE
involved

4 MONTHS
& STEPS

NEW ORLEANS, A HIGHLY PROTECTED CITY



- Over USD 14 Billion has been spent to enhance and expand the levees around New Orleans since Hurricane Katrina.
- Repair contracts at 23 stations and the Carrollton Frequency Changer Building
- Storm proofing construction (Pump stations, East Bank Waste Water Treatment Plant...)



Flood protections in place today are saving Orleans Parish USD 650-750 million of property damage per year from storm surge on an annualized basis

OPERATIONAL EXCELLENCE/ ASSET MANAGEMENT - A DEDICATED TOOL

Track and monitor actions and progress within the Resilience tool developed by Veolia for SWB

UNIT RESILIENCE ASSESSMENT

Emergency response
Loss management
Assistance
Critical parts management
Critical staff
BPC

ASSET RESILIENCE ASSESSMENT

Redundancy/capacity
Supply chain
Skills
Access
Procedure
Flood protection
Hazmat/fire protection

THREAT ANALYSIS

3

4 topics:

Safety
Environment
Operational
Direct

And recovery time

2 kinds of assessment:

- With current level of protection
- With improvements

VEOLIA CASE STUDIES



**Resilience expertise and
references**

BOSTON CASE STUDY: DISTRICT ENERGY NETWORK – MATEP



Context

Veolia Energy co-owns, operates and maintains the Medical Area Total Energy Plant in the Longwood Area of Boston, MA. This network produces and distributes electricity, steam, hot water, and chilled water to six hospitals that are affiliated with Harvard Medical School: the Brigham & Women's Hospital; the Children's Hospital; the Dana Farber Cancer Institute; Merck; the Harvard Medical School; and the Joslin Diabetes Center.

CUSTOMER CHALLENGES

- The hospital facilities collectively have more than 12 million square feet of space in 45 buildings, 2,000 beds, 85,000 inpatients and 50,000 outpatients each year
- Mandates to participate in energy reduction initiatives and utilize “green” sources of technology

SOLUTION

- 970,000 lbs. per hour of steam/hot water capacity
- 42,000 tons of chilled water capacity
- 1.3 miles of steam/hot water distribution pipe systems
- 0.8 miles of chilled water distribution pipe systems
- 83.4 MW of electric generating capacity, of which 47.0 MW represents combined heat and power (CHP) technology
- Operating and maintaining a plant of this nature requires specialized expertise in cogeneration and district energy, along with the reliability to provide for the critical requirements of the six hospitals 24 hours-a-day/7-days-a-week/365-days-a-year (24/7/365).

RESULTS

- Operate and maintain the energy infrastructure under a long-term contract with performance guarantees
- Fuel hedging strategies are developed in cooperation with MATEP's customers to meet their budgetary goals
- Financial and environmental value has been created during the first year of operation in the form of several hundred thousand dollars in local utility rebates to the customers and the plant, and two new clinical buildings receiving LEED certification due to their use of cogeneration.

BOSTON CASE STUDY: DISTRICT ENERGY NETWORK – CENTRAL BUSINESS DISTRICT



Context

Veolia Energy owns, operates and maintains the district energy network in the central business district of Boston, MA. This network produces and distributes steam, hot water, and chilled water to approximately 240 customers, including university facilities, hospitals, hotels, and office towers.

CUSTOMER CHALLENGES

- Ensure a continuous, reliable supply of energy in the form of steam, hot water and cold water to the buildings connected to the network
- Ensure a secure supply of energy and comfort to residents, customers and employees

SOLUTION

- 1.6 million lbs. per hour of steam/hot water capacity
- 2,750 tons of chilled water capacity
- 16.9 miles of steam/hot water distribution pipe
- 800 kW of electric generating capacity, of which 500 kW represents combined heat and power (CHP) technology

RESULTS

- Nearly 40% of the steam is produced at a large CHP plant in Cambridge (owned by GenOn), at which Veolia Energy owns two steam boilers

COPENHAGUEN CASE STUDY: FLOOD FORECASTING AND ALERT



Stakes:

Foresee rainy events and then implement a tailored monitoring of sewage networks and waste water treatment plants to limit the dischargement of pollutants.

Veolia Solution :

In Copenhagen, Veolia put forward a monitoring of meteorological radar data combined with a dynamic management of networks enabling to foresee and be more reactive in case of rainy events.

Customers benefits :

- Overflows related to rainy events were shrinked from 100 to 10 occurrences a year.
- More nature within the city as well as more leisure areas
- The port turned into a bathing area
- A higher environmental quality
- An improved safety for all
- Alerts and information in real-time



MILWAUKEE CASE STUDY: REDUCE POLLUTION AND MINIMISE ENVIRONMENTAL FOOTPRINT THROUGH GREEN INFRASTRUCTURES



Stakes :

The management of water as a valuable resource is one of the most critical challenges for the upcoming decades. Milwaukee was willing to innovate when it comes to infrastructure management to improve quality of service by ensuring a strict compliance with environmental regulations while seeking potential savings.



Veolia Solution :

Veolia offers a sustainable and environmental management of waste water of the city through green infrastructures, which help better absorb water, rather than burdening the combined sewer system.

Customers benefits

- Implement smart tools that enable to monitor urban green infrastructures in real-time (Environmental footprint analysis: Wiix and carbon statement)
- Dynamic management of rainy events (Sensors and telemetry are placed into the infrastructures)
- Data is then communicated to central servers that evaluate the performance of green infrastructures
- Technical innovations and production of fertilisers (bio-solids)
- Involvement of communities and local small businesses
- Patrimonial management

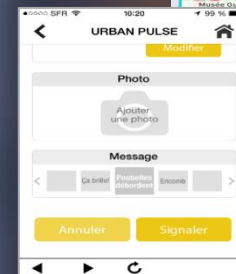
VEOLIA 'S SMART TRIO FOR CITIES: CONNECTING STAKEHOLDERS FOR CRISIS MANAGEMENT



REACTIVITY

One platform to manage critical events

Real time monitoring
Efficient and coordinated reaction



CITIZEN ALERT THROUGH MOBILE APP

Two way communication about events

Information to citizens on crisis
Feedback from citizens on local situation



CONTROL

A global view on critical events

Help with decision making
Information on citizen's perception on crisis management

FACING TERRORIST RISKS

WATER QUALITY TRACEABILITY AND SECURED EVENTS

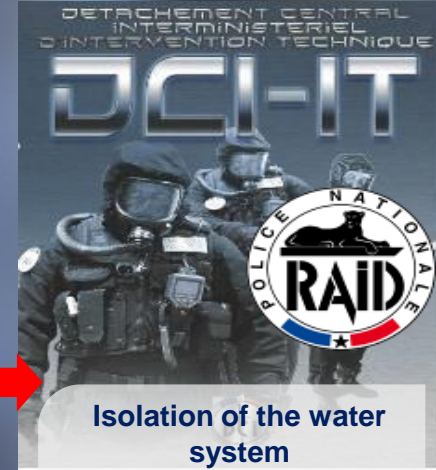
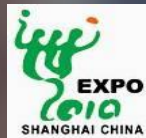
Continuous monitoring of the water quality through a secure web service



Monitoring PC transmitted to the remote RAID PC



Warning of abnormal and unexplained evolution in water quality



Isolation of the water system

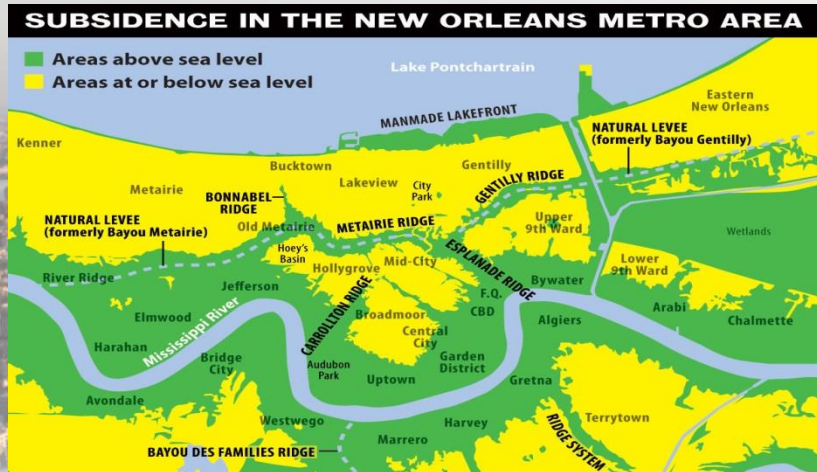
Intervention in the proceedings of RAID and DCI-IT



SEWERAGE AND WATER BOARD OF NEW ORLEANS AT A GLANCE

Governance

- The S&WB is responsible for protecting the City through a complex drainage system, as well as providing potable water and wastewater services.
- The S&WB has an **eleven member Board of Directors** consisting of the Mayor, two representatives of the Board of Liquidation, and eight citizen members (of which five represent each council district, one at-large representative, and two consumer advocates).



Drainage System

- **New Orleans is like a bowl**, levees that have been built to protect the City against Mississippi River and Lake Pontchartrain waters also retain all the rain water that falls within the City.
- Most **rainwater is pumped into Lake Pontchartrain** through 22 fully-manned drainage pump stations, 13 automated underpass pump stations, 90 miles of open canals and 90 miles of subsurface canals.
- The system's **pumping capacity is over 29 billion gallons per day**, more than the flow rate of the Ohio River, the nation's fifth largest river.

SEWERAGE AND WATER BOARD OF NEW ORLEANS AT A GLANCE

Wastewater System



- Two wastewater treatment plants, one on the East Bank and one in Algiers with a **combined treatment capacity of 132 mgd**, are **currently operated by Veolia**.
- The sewer network consists of **1,600 miles of lateral and trunk sewers**, ranging in size from 8" to 7' in diameter.
- Three pump stations (A and D on the East Bank and C on the West Bank) are **fully manned by S&WB staff**. In addition, there are numerous automated pump stations in the system all controlled by S&WB staff.

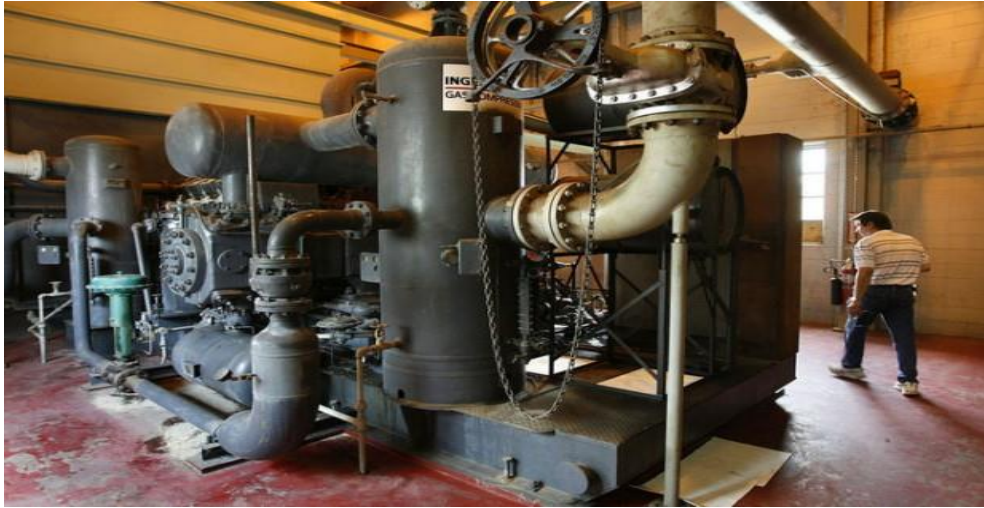
Water System

- **Average daily capacity for the Carrollton WTP is 135 mgd** for the east bank of Orleans Parish, serving ~300,000 people.
- **Average daily capacity for the Algiers WTP is 11 mgd** for the west bank of Orleans Parish, serving ~ 53,000 people.
- Potable water from both plants is pumped through more than **1,610 miles of mains** to more than 100,000 service connections.



SEWERAGE AND WATER BOARD OF NEW ORLEANS AT A GLANCE

Power System



Gas compressor powering the City's drainage pump station on South Claiborne Avenue.

- Power supply to the S&WB water distribution pumping system from Entergy is **prone to frequent failures** resulting in boil-water advisories due to loss of pressure.
- Built at the turn of the 20th century, **the S&WB power plant at Carrollton Water Treatment Plant generates electricity at 25 Hz** (which largely fell out of use before World War II) to power most of the S&WB storm water pumps as well as the water treatment plant.