Amec Foster Wheeler is a partner of 100 Resilient Cities (100RC) – pioneered by the Rockefeller Foundation to give urban centers across the world access to groundbreaking tools allowing them to better plan for potentially destructive weather events.

In collaboration with 100RC, Amec Foster Wheeler will harness meteorological data to provide 100RC member cities with highly detailed forecasts on extreme weather patterns and the impacts they will have on localized infrastructure. The forecasting technology will empower cities to prepare comprehensive plans in advance of oncoming tropical storms, blizzards, and other dangerous natural events. With this data, cities will be able to accurately discern which roads will be most impacted in the event of a massive snowstorm or which bridges require additional reinforcement to survive a powerful hurricane. Amec Foster Wheeler is providing 100RC cities – and cities outside the network – with other important resilience services which include:

- Critical asset data management to help cities identify, prioritize, and track key critical city assets that are most vulnerable to shocks and stresses
- Green Infrastructure planning and emergency management response
- Water scarcity and security
- Tactical action plans for resilience implementation and grant applications allowing cities to bridge from planning to action and obtain funding for specific resilience projects

As part of the agreement, Amec Foster Wheeler is joining 100RC’s network of Platform Partners – a group of specialized organizations from the public, private, and non-profit sectors that provide critical tools and services for cities to make 100RC member cities better at adapting to the shocks and stresses of our world and transforming them into opportunities for growth.
Climate change is a unique cross-cutting issue. It challenges governments, private sector, and society in multiple ways. Physical changes to the natural environment, emerging greenhouse gas and energy efficiency legislation, and new share- and stakeholder interests, as well as ever rising energy prices force us all to identify unique ways to cope with these challenges.

Sustainability and resiliency planning and implementation are required in today’s climate change impacted world to reduce costs, drive efficiency, and manage risks. Amec Foster Wheeler leverages both mitigation and adaptation strategies to meet client needs and implement integrated engineering solutions. As interlinked services, sustainability drives efficiency and costs related to waste, water and energy, and allows organizations to reduce their carbon footprint. Resiliency addresses the expected climate change and extreme weather events that may impact operations and areas, and provides engineering and planning solutions to address those identified risks.

Amec Foster Wheeler has the expertise to develop and implement adaptation plans to upgrade infrastructure and operations to withstand future climate change related scenarios – along with meeting sustainability goals. We provide the services needed to drive sustainability, determine climate change impacts, and adapt infrastructure, operations, and activities to address those impacts, and reduce risks with engineering and proactive planning solutions.

Adaptation planning
Mid- and long-term consequences of climate change are especially relevant to governments and industries whose infrastructure has a long life expectancy. But

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more frequent weather extremes can adversely affect most sectors in the short term. Amec Foster Wheeler employs internationally recognized meteorologists, hydrologists, oceanographers, geologists, biologists, and civil engineers who combine their scientific expertise in working with our clients to ‘weatherproof’ their infrastructure and supply chains.

Amec Foster Wheeler’s Approach

Amec Foster Wheeler is a worldwide provider of sustainability and resiliency services, supporting public infrastructure and transportation, industrial and commercial, oil and gas, mining, and other clients. Our sustainability and infrastructure engineering teams understand the challenges of a worldwide economy, the sources of risk, and their impacts to your operations.

Amec Foster Wheeler develops integrated plans that can assist in identifying and tracking areas of sustainability and resiliency to improve and protect your operations and business performance. Our services include addressing climate change events such as damage from heat, sea level rise, storm surges, extreme weather or the reduced availability of water.

The assessment of climate change and its impacts is however still subject to uncertainties and information gaps. There is a need to appreciate the level of uncertainty and how it affects decision making. We believe that our flexibility and broad skill base are essential to addressing the technical complexities and uncertainties involved in this subject, and our expertise in stakeholder engagement can ensure the effective and essential communication of risk and choices to decision makers and individuals affected by climate change.

The Amec Foster Wheeler approach is to assemble specific project teams comprised of in-house specialists from a range of sectors and from its academic and research partners to help clients understand the potential impacts and opportunities afforded by climate change. We can therefore provide a comprehensive matrix of support to address the range of projects, strategies, policies, and plans that could be affected by climate change. Our key strengths are in developing strategies and technical advice for long-term planning and cost minimization.
Sustainable development is the most challenging issue for our generation. Amec Foster Wheeler is committed to being part of the global solution in what we do and how we do it.”

- Frances Fay  
Head of Sustainability, Amec Foster Wheeler

Amec Foster Wheeler’s experience in climate change impacts includes regional scoping studies and infrastructure specific vulnerability assessments examining the impacts of climate change in key sectors. Our approach to assessment of impacts includes the application of the global climate scenarios, the use of statistical downscaling to allow impacts to be assessed at a local level, the application of GIS and water resources planning and flood risk modelling techniques, and the application of costing methodologies to case studies in specific regions and sectors.

The effects of climate change can be substantial, and Amec Foster Wheeler can provide comprehensive services relating to environmental, social, and economic impacts that may occur. Examples include:

- **Water supply**: Changing rainfall patterns could affect availability of water resources
- **Insurance**: Insurance coverage and availability in subsidence and flood prone areas
- **Business**: Increased energy use in winter for heating and in summer for cooling
- **Transportation**: Increased flooding and potential risk of tarmac melting in summer
- **Flood defense**: More frequent flooding leading to disruption
- **Tourism**: Changes in domestic tourism and risks to coastal heritage sites
- **Health**: Fewer deaths related to cold spells but potential increase due to hot spells
- **Agriculture**: Changing agriculture, including impacts on crop production
- **Wildlife**: Changing biodiversity with threats and opportunities for species

Amec Foster Wheeler has developed a weather forecasting and met-ocean service line that mitigates financial and safety risk for clients whose businesses are sensitive to high impact weather events or severe ocean conditions. Forecasting and consulting services to industry and government clients are delivered on a 24/7 basis anywhere in the world. Key customers include various governments, oil and gas companies, energy companies, insurance providers, and water conservation authorities.

Our personnel, forecasting systems, weather instrumentation, and research and development have allowed us to achieve an industry leading level of accuracy. Examples of continuously improving and high end services include:

- Air quality forecasting and modeling
- Climate change studies
- Database management and web design and development
- Deep and shallow water coastal sea state modelling
- Energy demand forecasting
- Extended range forecasting
- Marine weather and sea-state forecasting
- Meteorological monitoring and data management, and sensor solutions
- Mobile and desktop weather applications and geospatial weather product delivery
- Road Weather Information Systems
- Sediment and dispersion modeling
- Severe weather forecasting (thunderstorms, hail, hurricanes, etc.)
- Soil temperature and moisture modeling for spring load restriction applications
- Storm surge and tsunami modeling
Municipal water system managers can use a combination of demand and supply forecasts to assist in decisions about when to impose demand management programs, when to acquire or release supplemental supplies, and when to invoke contingent agreements for water allocation. Energy system managers can use supply and demand forecasts to schedule generation and make energy purchasing decisions.

The current state of our knowledge of the linkages between climate and hydrology has made it possible to generate increasingly more useful and skilful forecasts. It is no longer necessary to puzzle over the significance of traditional ‘wetter than usual’ or ‘drier than usual’ forecasts.

**Key services**
- Statistical analysis
- Temporal and spatial downscaling
- Downscaling of Global Circulation Model (GCM) output
- Re-sampling techniques
- Climate state conditioning
- Monte Carlo techniques
- Climate variable forecasts
- System variable forecasts
- Distributed parameter hydrologic modeling
- Water allocation modelling

**Representative projects**

**Colorado River Water Availability**
For the Colorado Water Conservation Board, Amec Foster Wheeler is leading an evaluation of the impact of climate change on water availability. This work uses projections of future temperature and precipitation based on a variety of projections of future greenhouse gas emission scenarios and General Circulation Models (GCMs), uses the gridded hydrology model VIC (Variable Infiltration Capacity) to assess the impact of projected climate change and paleohydrology to incorporate information about the frequency of drought, and water rights, and employs existing operations models to develop probabilistic estimates of water availability. Amec Foster Wheeler’s strength lies in the blending of paleohydrology research carried out by NOAA, analysis of GCM scenarios, and hydrologic modeling to develop probabilistic estimates of water availability.

**The Potential Consequences of Climate Change for Boulder, Colorado’s Water Supplies**
Amec Foster Wheeler’s Boulder office was a principal investigator/author of a NOAA-funded study done in cooperation with Stratus Consulting and the City of Boulder. This study addressed the issue of climate change while incorporating tree ring-based paleohydrology (which provided a wider range of hydrologic variation than recorded flows) and Colorado’s water rights laws (which shows how changes in future supply will not be allocated uniformly) to produce what is probably the most comprehensive evaluation its kind. This study is a model of how the topic of climate change can be addressed by a medium sized city. The results of the Boulder Climate Change Study were incorporated into the City of Boulder’s Source Water Master Plan, which was adopted by the Boulder’s City Council. Amec Foster Wheeler was a principal author of the master plan.
Innovation in Resiliency Projects

World’s First Deepwater Wind Farm
Amec Foster Wheeler was awarded the contract to design and manage the delivery of the turbines for the Beatrice Wind Farm Demonstrator project, the world’s first deepwater wind farm, and a collaborative venture between industry, the education sector, and the UK Government.

The Beatrice Wind Farm demonstrator project was a central part of the DOWNVInd (Distant Offshore Wind Farms with No Visual Impact in Deepwater) renewable energy research and development program, which includes 18 different organizations from six European countries.

Amec Foster Wheeler combined the expertise of our offshore oil and gas engineers, project managers, and fabricators with our renewables business. We delivered an innovative project which will not only help reduce the energy consumption, but also extend the life of the offshore platform. Renewable energy is part of the UK Government’s longer term aim of reducing CO2 emissions.

Great Lakes Project
Climate Change And Adaptation
The Coastal Zone Climate Change and Adaptation Project identified coastal features and processes on the Great Lakes, which are likely to be affected by climate change, and to determine sustainable management practices that will reduce the vulnerability of these features and processes. The primary project objective was to evaluate various climate change scenarios and create a matrix of potential impacts and adaptation options for the coastal zones of the Great Lakes.

Amec Foster Wheeler’s role in the project was to study 12 sites on the Great Lakes (including parks, marinas, wildlife and important bird areas, significant spawning and nursery areas for fisheries, and other areas of concern) and assess potential impacts and adaptation strategies.

Climate change adaptation measures
The Greater Moncton Area in Canada is a highly urbanized area situated on the Petitcodiac Estuary that discharges into the Bay of Fundy - home to the highest tides in the world. Amec Foster Wheeler provided the Greater Moncton Area with a flood risk assessment based on impacts of climate change, to identify vulnerable infrastructure and to recommend adaptation measures. The primary flooding risk for the project area results from extreme high water levels in the estuary, which is a combined result of six components, including:

- Tide
- Storm surge
- Freshwater flow
- Land subsidence
- Global sea level rise due to climate change
- A unique bathymetrical and hydrological environment

To determine the total flooding risk, Amec Foster Wheeler developed a unique methodology specific to the region which addressed how the parameters are affected by climate change, their dependence on each other, and the timing and coincidence of the underlying processes.

The project involved climatic projections for predetermined planning horizons; evaluation of total water levels consisting of the six components; and inundation mapping, assessment of infrastructure at risk and recommendations for adaptive measures, and recommendations on how climatic change adaptation can be incorporated into a regional governance structure.

U.S. Air National Guard - Air Emission Inventories
Amec Foster Wheeler is currently under contract with the Air National Guard to conduct complete air emission inventories at 25 Air National Guard installations across the country. The air emission inventories are both to satisfy the Department of Defense requirement that military installations maintain updated air emission inventories, and to confirm the current status of each facility with respect to air quality permitting requirements.

We are quantifying actual and potential emissions of criteria pollutants and hazardous air pollutants from stationary air emission sources at each installation. In addition, Amec Foster Wheeler is quantifying actual emissions of criteria pollutants from mobile air emission sources to provide background information in the event that the installation undertakes a project that requires a general conformity analysis under the Clean Air Act.
100 Resilient Cities

100RC Global CRO/Partner Summit – Mexico City

100 Resilient Cities (RC), hosted the second annual Chief Resilience Officer (CRO) and Platform Partner Summit in Mexico City, which brought together leading experts and CROs from six continents and more than 30 countries with a focus to improve CROs’ ability to lead resilience building efforts in their cities. More than 50 global partners representing leading firms across financial, built environment, social, environmental, and technology sectors attended the summit and collaborated with CROs to identify urban resilience solutions and collaborative solutions. Mr. Peter Hall, Amec Foster Wheeler’s 100 Resilient Cities Platform Partnership Director, attended the Summit.

Amec Foster Wheeler co-lead a workshop at the Mexico City Global summit on “maximizing resilience value through project design and implementation” along with the 100RC Program Director and the Global Infrastructure Basel (GIB) Foundation. This workshop focused on utilizing the City Resiliency Framework (CRF) and identifying ways that 100RC Partners can help cities maximize the resilience value of projects through design and implementation. As an output from the workshop, Mr. Hall is now working directly with 100RC to develop a city resilience code of conduct/standard practice for 100RC Platform Partners that will be a key element for the organization in becoming the global world standard for city resilience, along with maximizing collaboration across the partner network.

Amec Foster Wheeler met with several CROs at the Summit to identify opportunities for collaboration with other partners, such as Trimble, Impact Infrastructure, CityMart, RMS, HR&A and SwissRe. As an outgrowth of this meeting, we are now working with several 100RC cities to begin planning and implementing resilience projects associated with their strategic plans. Amec Foster Wheeler is now beginning to work with CROs in cities that include NYC, New Orleans, Vejle (Denmark), Bangkok, Christchurch, Rotterdam, and Norfolk. As part of this summit, Amec Foster Wheeler also participated in a session to explore ways to better align the Platform Catalog structure with 100RC/Platform objectives and better define city needs to drive markets and provide resilience solutions to meet those needs. We worked directly with CROs from Toyama, Japan; Rotterdam, Netherlands; and Pittsburgh to work through a resilience challenge issue for each city and identify urban resilience solutions.

As an outgrowth of our 100RC partnership, we have co-led with 100RC resiliency planning workshops for New York City Transit, the City of Boulder, and Navy Station Norfolk.

100 Resilient Cities – Pioneered by the Rockefeller Foundation, was created in part to help solve two key problems:

- Cities are complex ecosystems, resistant to change and made up of a myriad group of systems and actors
- Existing solutions aren’t scaling or are not being shared more broadly. In other words, cities constantly find themselves reinventing the wheel.