

Ramboll environmental siting and permitting for data centers



Ramboll in brief

- Independent architecture, engineering, and consultancy company
- Creating sustainable solutions across energy, real estate, transport, water, waste, industry, finance, technology, healthcare and public sectors
- Founded 1945 in Denmark
- Owned by Rambøll Fonden – The Ramboll Foundation providing long term stability

35



Countries covered by global office network

>18,000



Experts

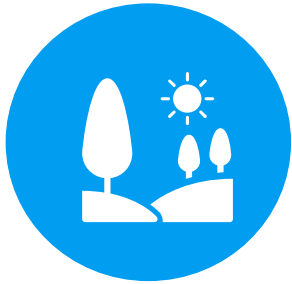
2.3 Bn



Global revenue, in 2024 across all markets

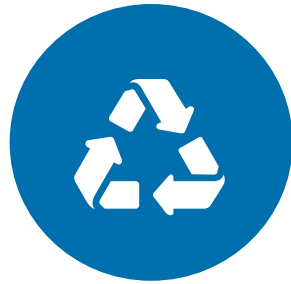


Consider the full data center lifecycle



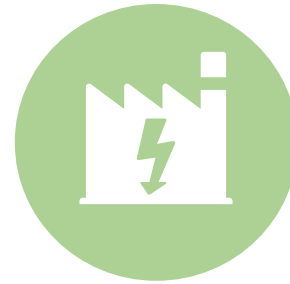
Site selection and development

- Due diligence
- Permitting
- Master Planning
- Infrastructure evaluation
- Community engagement and benefit planning



Sustainable planning and concept design

- Circularity
- Sustainable resources (i.e., water, energy)
- Scalability
- Carbon neutrality
- Science-based information sharing



Operations

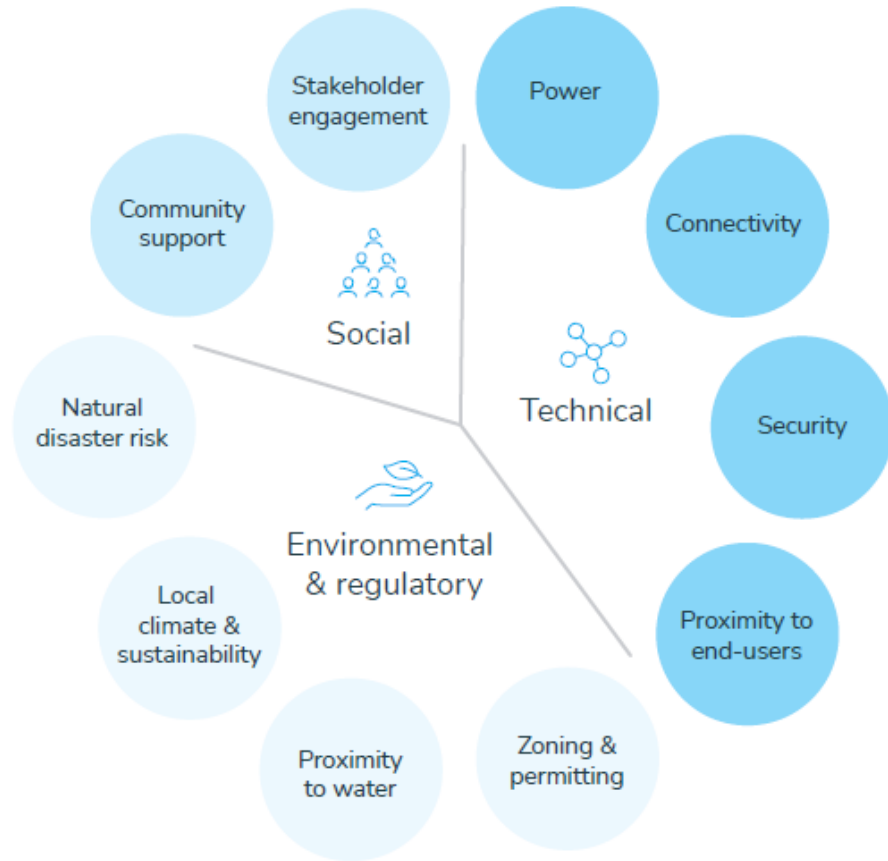
- Health & Safety
- EHS Management Systems
- Waste management
- Community benefits implementation
- Operational MOC



Decommissioning

- Property re-purposing
- Disposition of components
- Site restoration
- Community engagement

Site selection considerations



1. Technical considerations

- Securing reliable power
- Network connectivity and latency optimization
- Security measures – physical, network, and data security
- Proximity to end-users and industry ecosystems

2. Environmental and regulatory considerations

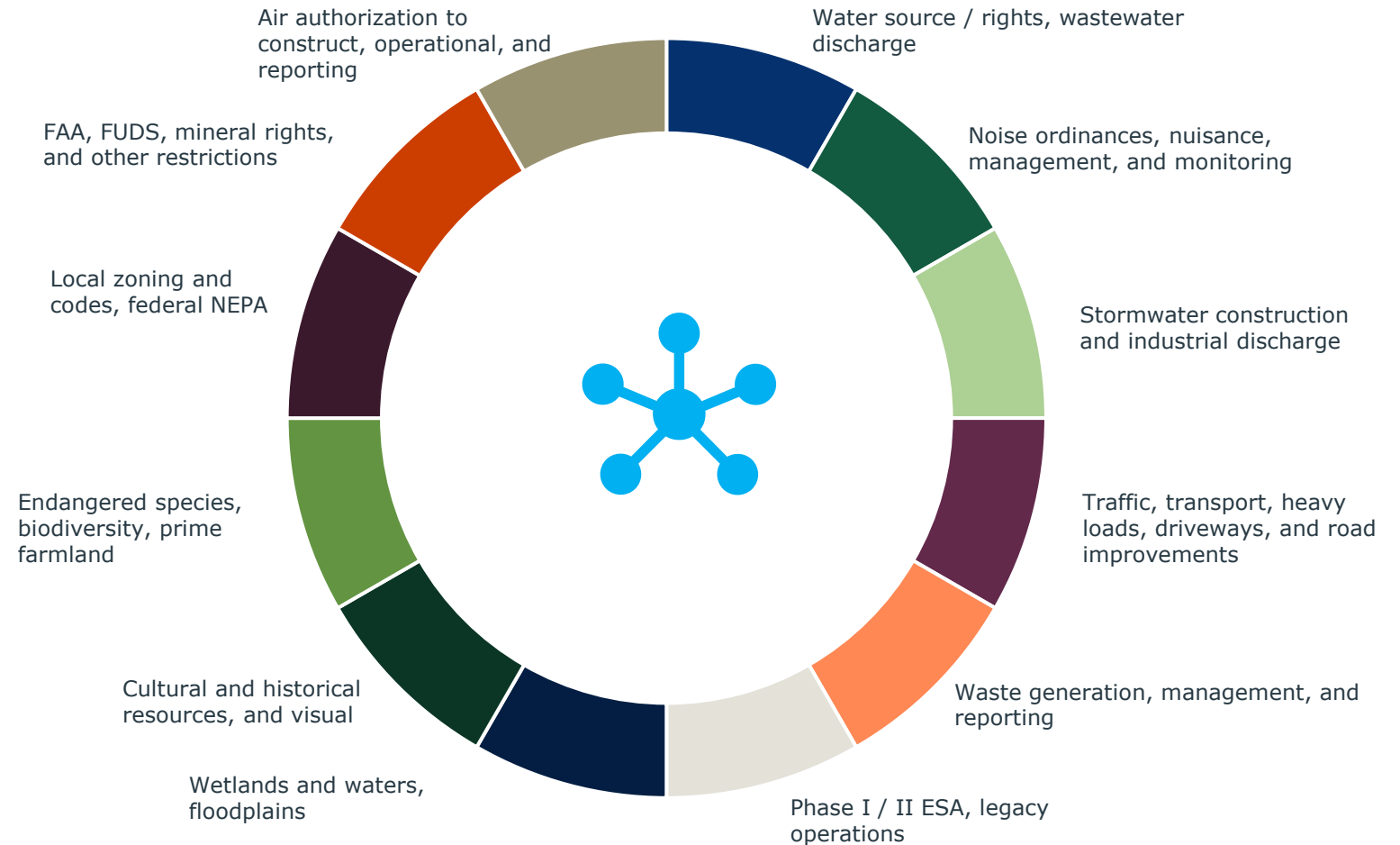
- Zoning and permitting
- Proximity to coolant infrastructure and water
- Local climate and sustainability
- Natural disaster risk

3. Social considerations

- Community support
- Stakeholder engagement

Environmental permitting

- Can be complex, plan ahead
- Decisions for one can ripple to others, environmental-development-engineering
- Remember the public has an opportunity to raise concerns, be proactive and develop materials that can take the technical and break it down
- Local and state regulators may have limited resources, consider appropriate support and allow sufficient time in the schedule
- If you need emissions credits, wetland mitigation banks, etc., identify this early and start the process



Managing water across a data center project life cycle

Strategic & risk planning

- Water sustainability goals
- Water supply risk assessments
- Scarcity & flood response plans
- Source water protection plans
- New region regulatory reviews
- Water recycling and reuse
- Biodiversity
- Watershed replenishment

Site selection & permitting

- Site technical due diligence
- Water infrastructure resilience
- Sustainable water withdrawal
- Wastewater discharge
- Reclaimed water use
- Stormwater & flood modelling
- Climate planning & resilience
- Conceptual master planning

Design & construction

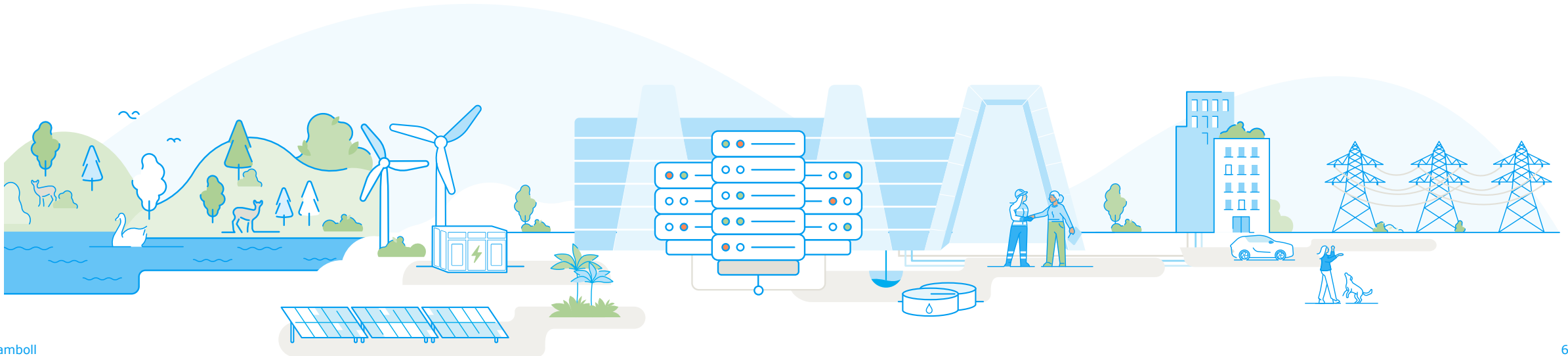
- Cooling water technologies
- Water treatment process selection
- Preliminary engineering studies
- Detailed design
- Hydraulic modeling
- Operability reviews
- Procurement support

Construction & Commissioning

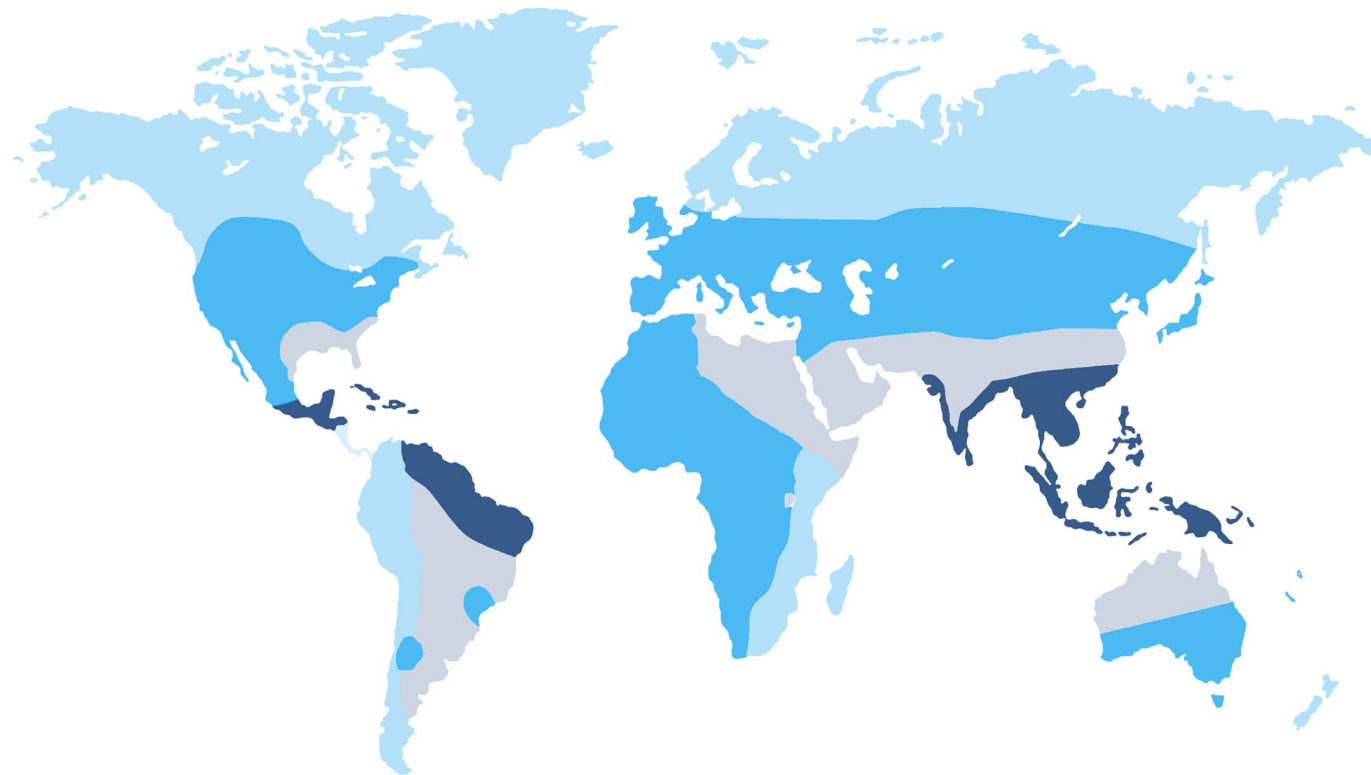
- Construction inspection
- Treatment skid fabrication
- Equipment commissioning
- Process startup
- Operating procedures
- Maintenance plans
- Training

Operational support

- Water withdrawal reporting
- Surface water intake management
- Discharge permit compliance
- Water best management practices
- Stormwater control & compliance
- Efficient water use
- Cooling tower operations



Cooling method depends upon climate and operator preference



■ Mechanical cooling ■ High-efficiency mechanical cooling ■ Adiabatic cooling ■ Free air cooling

Source: [Modern Datacenter Cooling Infographic Update 3.24.23](#)

Colocation data centers prefer chilled water (Mechanical) systems

- Benefits:
 - Allow internal filtered air to recirculate and transfer heat to the exterior using water as middle medium
 - Allow for lower temps in the data halls with better humidity control
- Drawbacks:
 - Requires more power to operate mechanical cooling
 - Use more water when coupled with water-cooled chillers

Hyperscale data centers will often use evaporative (Adiabatic) cooling systems

- Benefits:
 - Use far less energy
 - Use far less water than water-cooled chillers with cooling towers
- Drawbacks:
 - Wide fluctuations in temperature and humidity control

Air Permitting and Compliance Considerations

Strategic & Risk Planning

- Siting studies, including evaluation of green field, brownfield and existing facility expansion or repowering options
- Identification of federal , state and local permits, approvals and obligations for construction & operation
- Cost estimates for permits and plans development
- Permitting schedules for critical path approvals
- Attainment status and background air quality
- Suitability of meteorological data
- Agency and community stakeholder landscape
- Evaluation of potential emissions vs. major source thresholds
- Specification and review of emissions data sets for equipment
- Operational flexibility options including operating hours, fuel usage, M&T hours
- Preliminary AQ impact modeling analysis
- Stack height sensitivity studies
- Multi-source modeling inventory concerns
- Control technology requirements including BACT & LAER
- Air permitting strategy development / pre-application meeting

Construction Permit

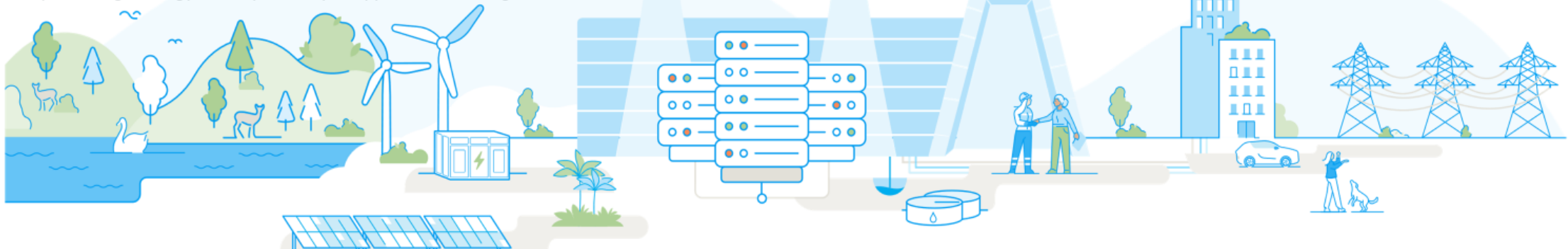
- Finalize emissions calculations
- Finalize preliminary modeling and modeling protocol
- Pre-application meeting with agency
- Air permit application and forms
- Agency review and draft permit
- Address intervenor and E-NGO comments
- Public hearing support
- Technical support during legal challenges to permit or permit appeals and/or stays
- Review of final permit

Operating Permit

- Initial Title V application
- Title V renewal application
- Equipment commissioning support
- Process startup notifications
- AQ Training support
- O&M plans

Compliance Support

- Construction notifications
- Start of operation notifications
- NSPS / NESHAP Notifications
- Semi-annual compliance reports
- Annual compliance certifications
- Review of compliance test protocols
- Review of test reports
- Assistance with test result reporting
- On-call support



Bright
ideas.
Sustainable
change.

RAMBOLL