



GoM Update, Global Issues & Water Technology Program

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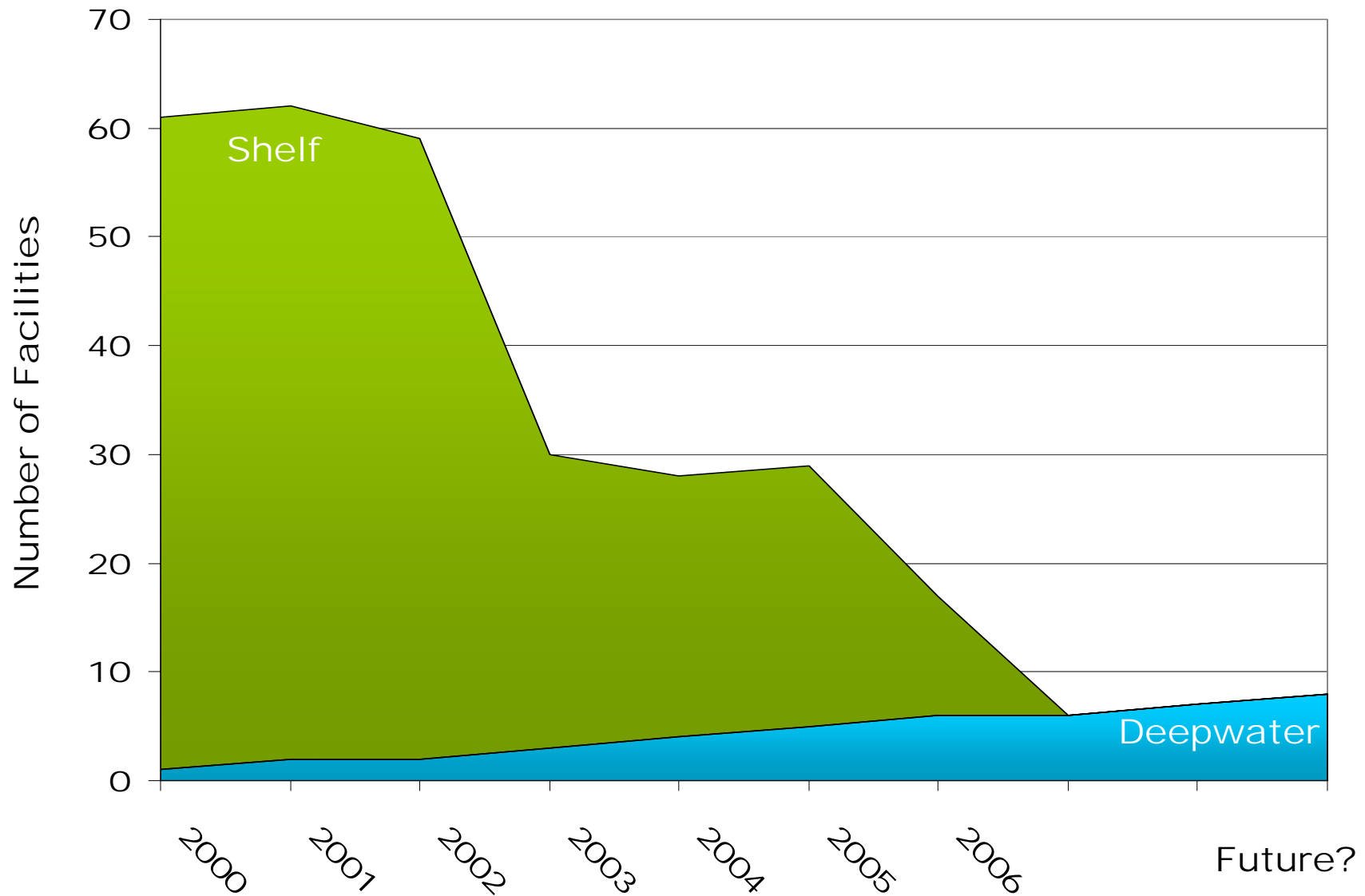
Produced Water Society
Jan. 17, 2007

Gulf of Mexico - Present Production Portfolio

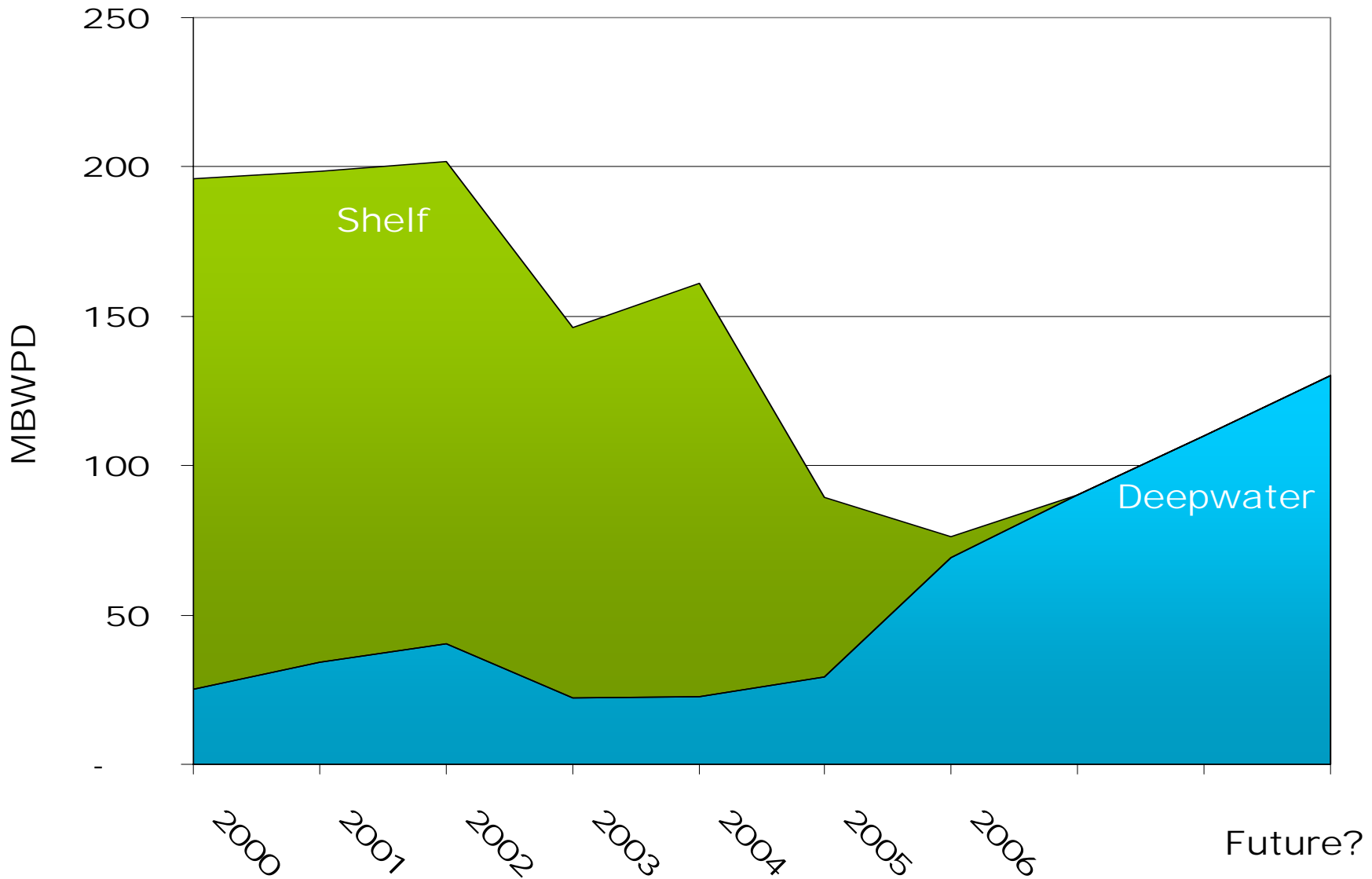


- 6 producing facilities in the GoM – all “deepwater”
- 2 new “deepwater” floating facilities to start production 2007-2008
- No shallow-water (Shelf) producing facilities in 2007
- Many recent and future “deepwater” projects are waterflood
- Plans for more seawater injection (waterflood)
- Plans for eventual produced water re-injection (PWRI)

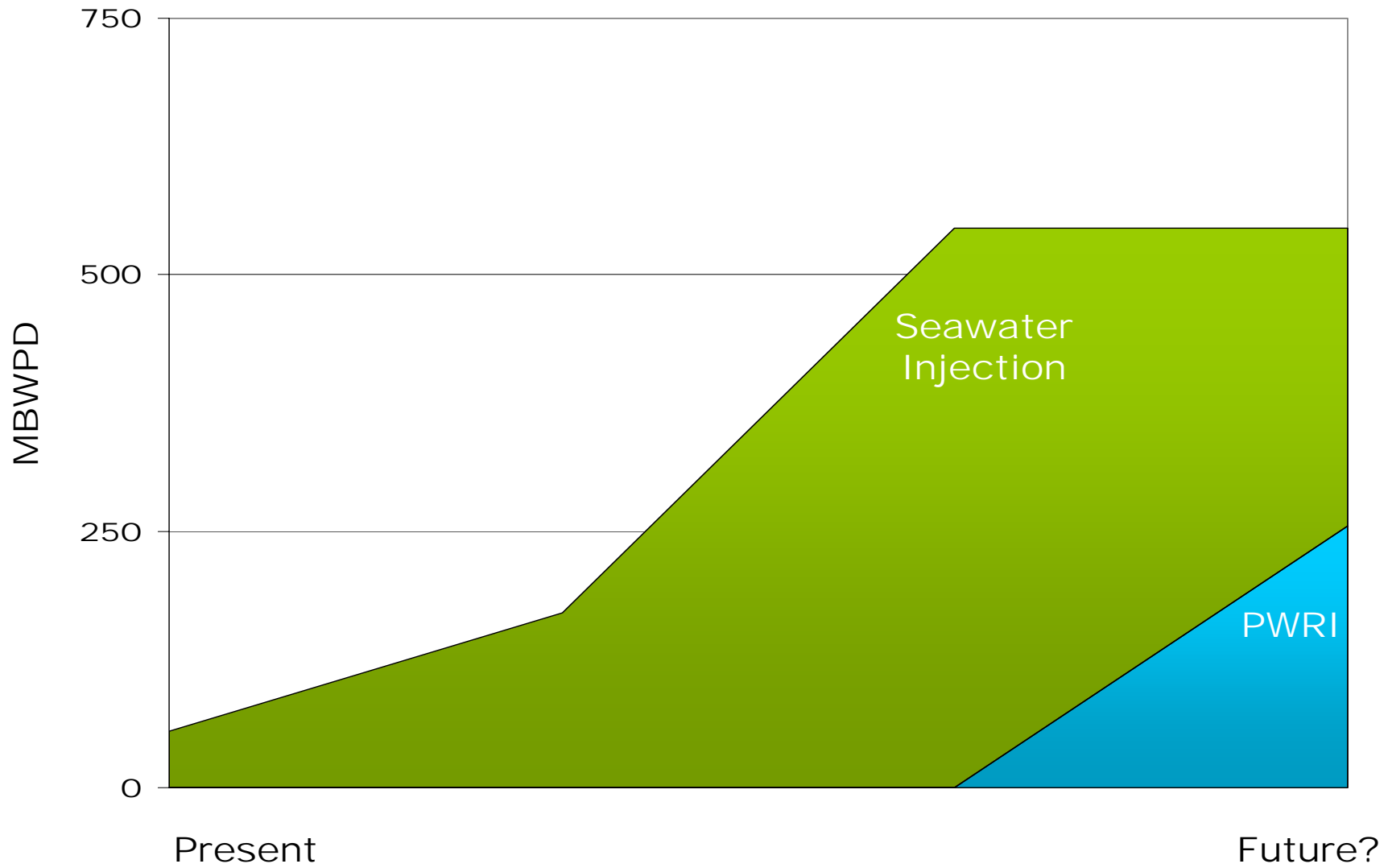
GoM Facilities Discharging Produced Water



GoM Produced Water Rates



GoM Future Water Injection Rates



Summary – GoM Update



- Need to efficiently and effectively troubleshoot and optimize existing systems
- Need to increase capacity of existing systems, with minimal increase in weight and footprint, and minimal disruption to production
- Need to reliably inject much more seawater and produced water over the next few years

Global Issues - Present



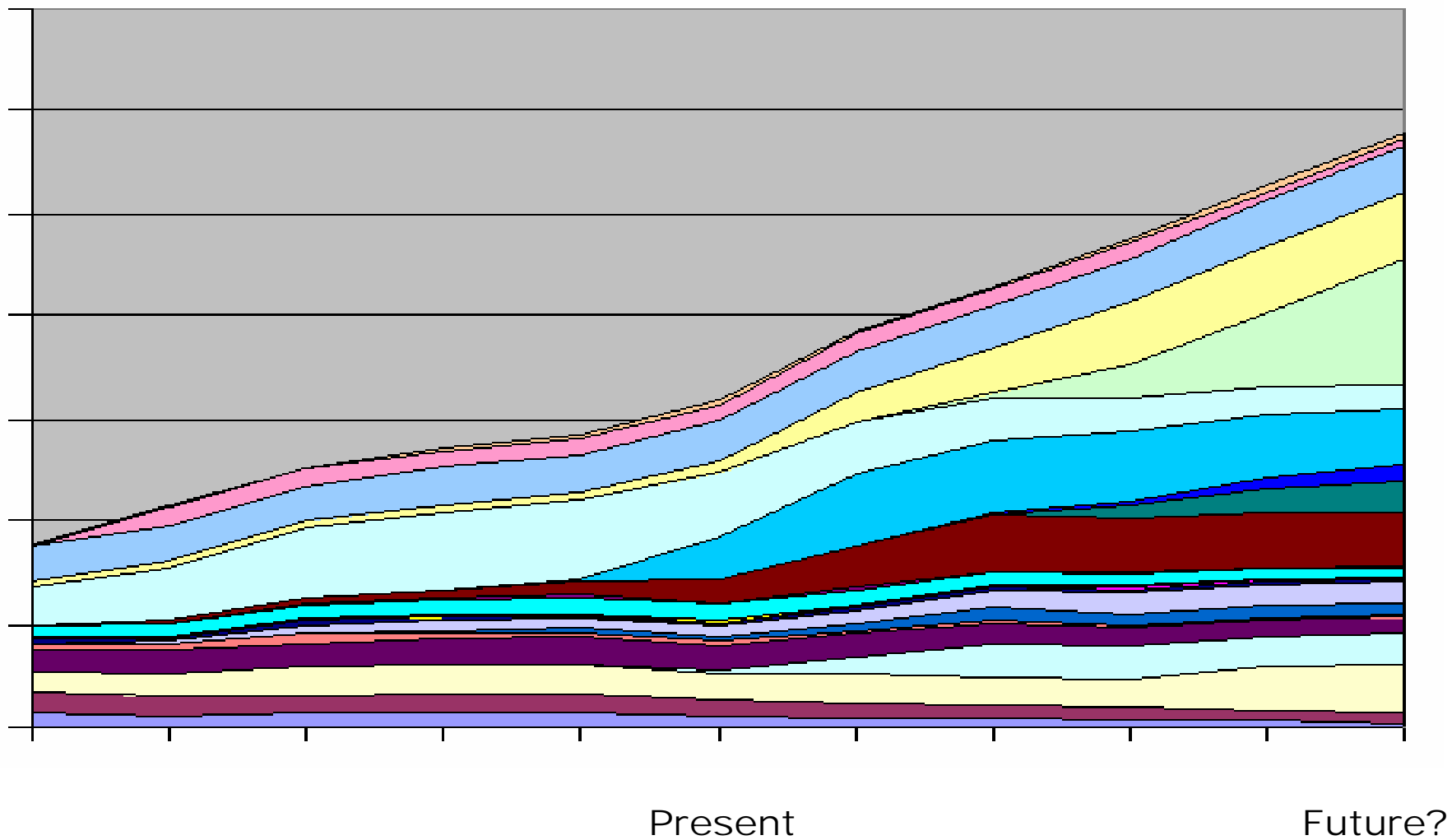
- Resolving of produced water sheens – refer to workshop on Friday
- Managing increasing volumes of produced water, due to:
 - Maturing fields
 - Confidence in water production forecasts (how much and when)
 - Facilities not achieving designed (rated) treatment performance
 - Tie-backs to host facilities
- Designing and implementing water handling expansion projects
- Understanding and resolving the effects of hydrate inhibitors and other production chemicals on primary and produced water treatment processes
- Designing systems to accommodate uncertainty and operational changes over facility life
- Designing PWRI well completions for unconsolidated sands (solids issue)
- Designing and Operating highly reliability PWRI systems (redundancy issue)

Global Issues - Future

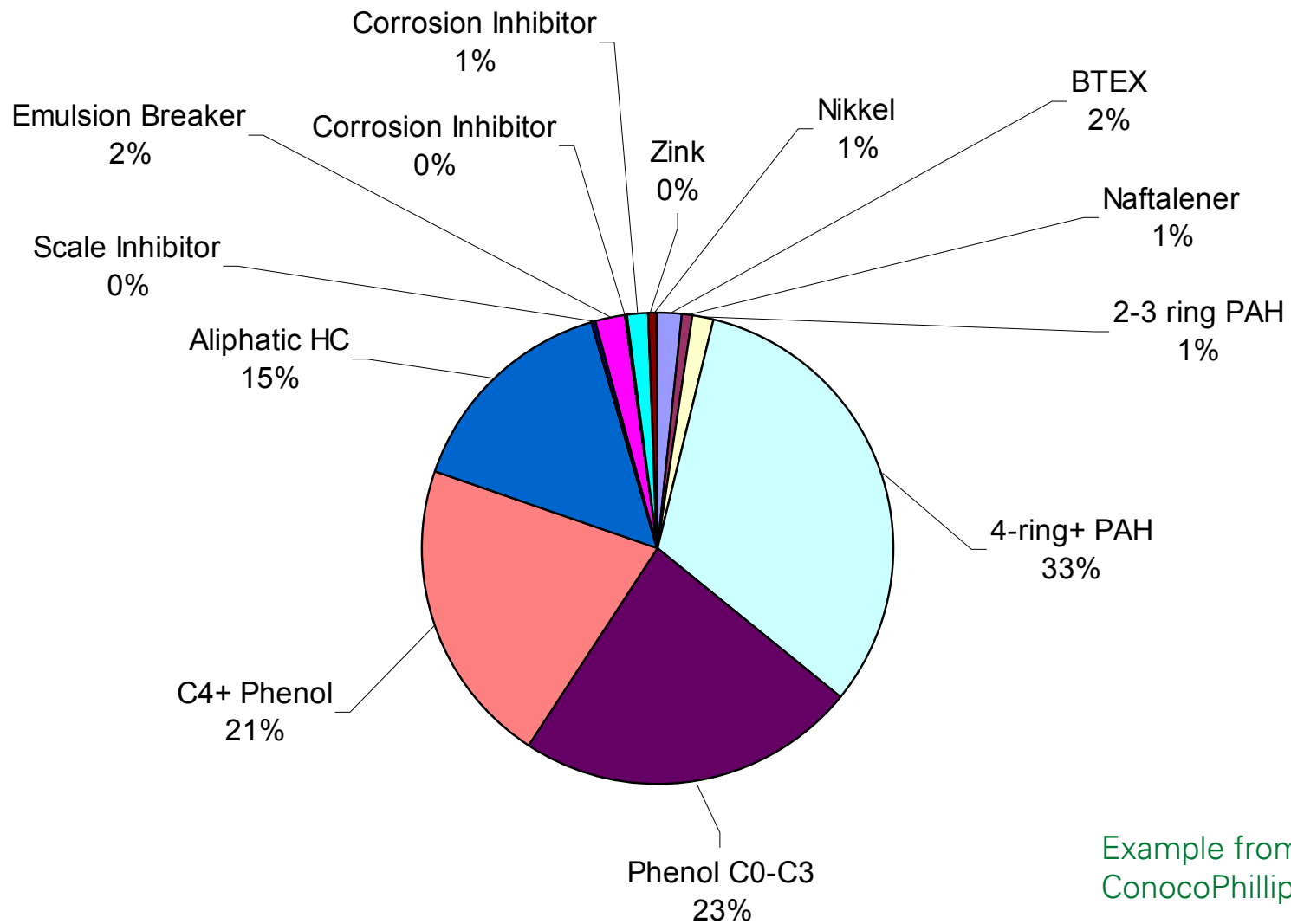


- More new oil developments supported by waterflood – increasing volumes of water
- Standardization – Modular Design – Engineering Technical Practices
- Produced Water Beneficial Re-Use – remote and arid regions
- Reduction of environmental impact of discharges attributed to soluble and trace pollutants
- Subsea processing, reinjection and/or discharge
- Increasingly stringent and uncertain future regulatory discharge limitations

Future Waterflood Supported Development



Example of constituent contribution to Environmental Impact Factor (EIF)



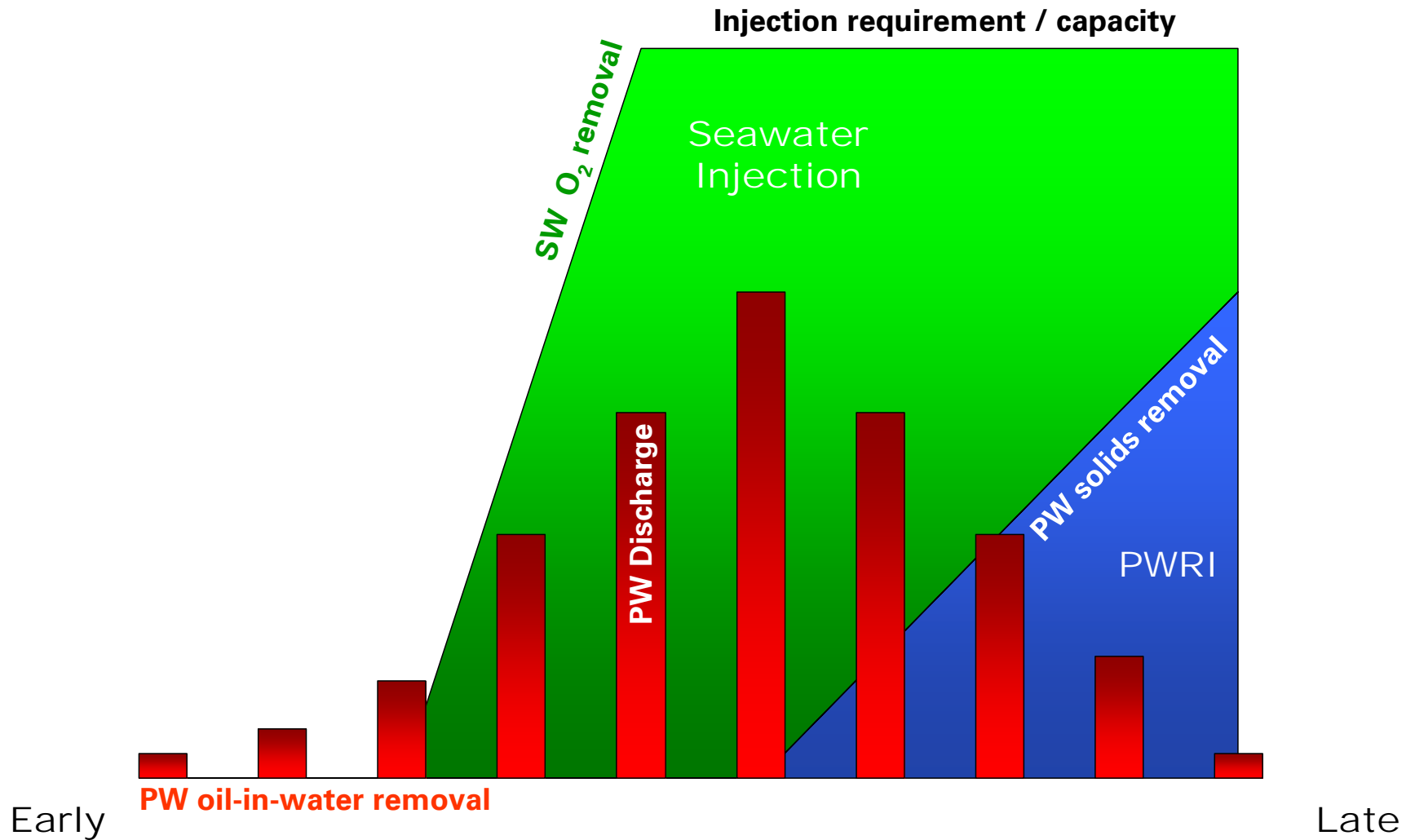
Example from ConocoPhillips

Water Technology Program



- Water Technology Needs
- Technology Development: R&D Projects and Field Trials
- Industry Collaboration: JIP's, JV, PERF, GPRI, API, OGP, ITF, Produced Water Club, Oil-in-Water Monitoring Club, etc.
- Networks, Technical Training & Knowledge Management

Water Technology Throughout Facility Life



Water Technology Needs



- Water treatment equipment performance and reliability
 - Troubleshooting and Optimizing existing treatment systems
 - De-bottlenecking existing treatment systems (increasing volumes)
 - Impact of chemicals, sand, scale, asphaltenes and naphthanates
- Development of injection water specifications for solids concentration, particle size distribution, and oil-in-water concentration
- Scale & corrosion management of commingled PW & Seawater (to enable more wide-spread PWRI)
- Produced water treatment to reduce soluble and trace pollutants

Technology Development – Short Term



Recently completed, underway or planned:

- Field trial and comparison of absorption media (multiple media suppliers)
- Field trial of continuous monitoring with Jorin's ViPA video-Imaging Particle Analyzer
- Field trial of EVTN's Voraxial Separators
- Field trial of Epcon's Compact Flotation Unit (CFU)
- Field trial of Opus' Mare's Tail long fiber pre-coalescer
- Field trial of TORRCanada's TORR compact resin filter cartridge based coalescer
- Development of cross-flow ceramic membrane technology for produced water
- Development of ozone oxidation technology for produced water

Technology Development – Long Term



Under consideration:

- Field trial of Produced water treatment technologies for beneficial re-use
- Field trial of ProSep CTour mixing and extraction with a heavier solvent
- Field trial of Akzo Nobel Macro-Porous Polymer Extraction (MPPE) to reduce soluble pollutants
- Development of methodology and interface for troubleshooting and optimizing produced water treatment processes using video-imaging particle analyzers

Summary – Water Technology



- Industry Collaboration: JIP's, JV, PERF, GPRI, API, OGP, ITF, Produced Water Club, Oil-in-Water Monitoring Club, etc.
 - Many producers have common water treatment and monitoring technology needs
 - Some producers have similar ongoing programs for water technology development
 - Producers benefit by collaborating to develop and field trial new water technologies via JIP's, industry forums, etc.
- Technology application and success depends on people - Process Designers & Operators
 - Networks (internal & external)
 - Technical Training
 - Knowledge Management - Organizational Memory