

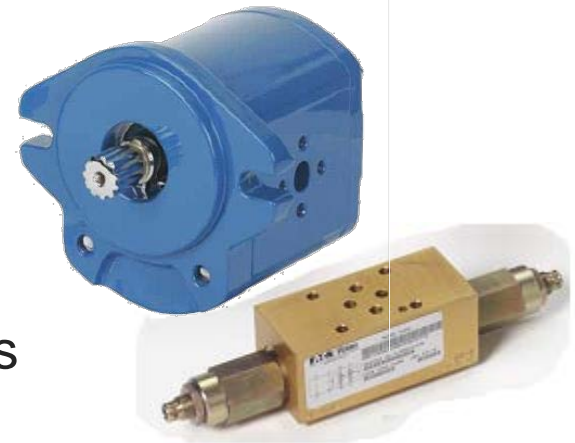
2012 Energy Efficient Hydraulics and Pneumatics Conference

Energy Saving Technologies for the Mobile Equipment Industry

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Changing Value Landscape

- Previously
 - Emphasis on Installed Costs
 - Simple, Fixed Displacements
 - Conventional Manifold Designs
 - Technology Solutions
 - Hard to Justify for Operating Cost Savings...



Changing Value Landscape

- Today:
 - Installed Costs Still Important
 - Focus Now on Total System Cost
 - If Improvements Can Be Delivered...
 - Justification for Adding Technology
 - Power on Demand Systems
 - Electro Hydraulic Solutions
 - Integrated System Designs ...



How to Gain Improvements?

- Complete System Review
 - Look at All Existing Sub-Systems
 - Individual Areas Consuming Power
 - Look For Overall System Needs
 - Alternate Ways to Achieve Mission
- Sources Of Power Loss:
 - Parasitic Losses
 - Efficiencies
 - Standby Losses
- So Let's Look at a Few...

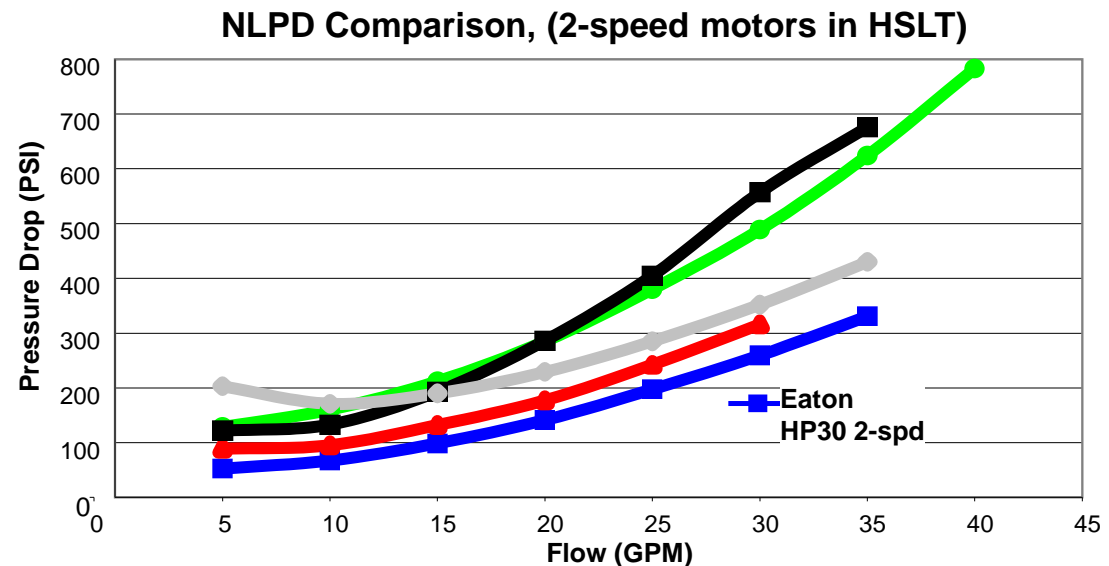
General: Pressure Drops

- Pressure Drops Can Occur in 2 Areas
 - Fluid Conduits (Hose, Fittings, Tubing, ...)
 - Hydraulic Components (Valves, Pumps, Motors, ...)
- Product Selection Critical
 - Products Designed For Different Criteria
 - Higher Starting Torques
 - Lower Pulsations
 - Quiet Operation
 - Etc.
 - Example: No Load Pressure Drop in Hydraulic Motor...



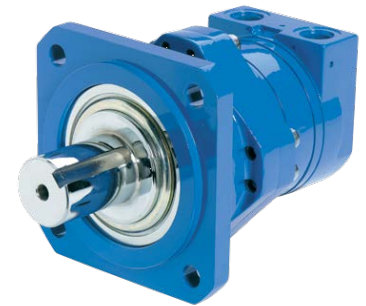
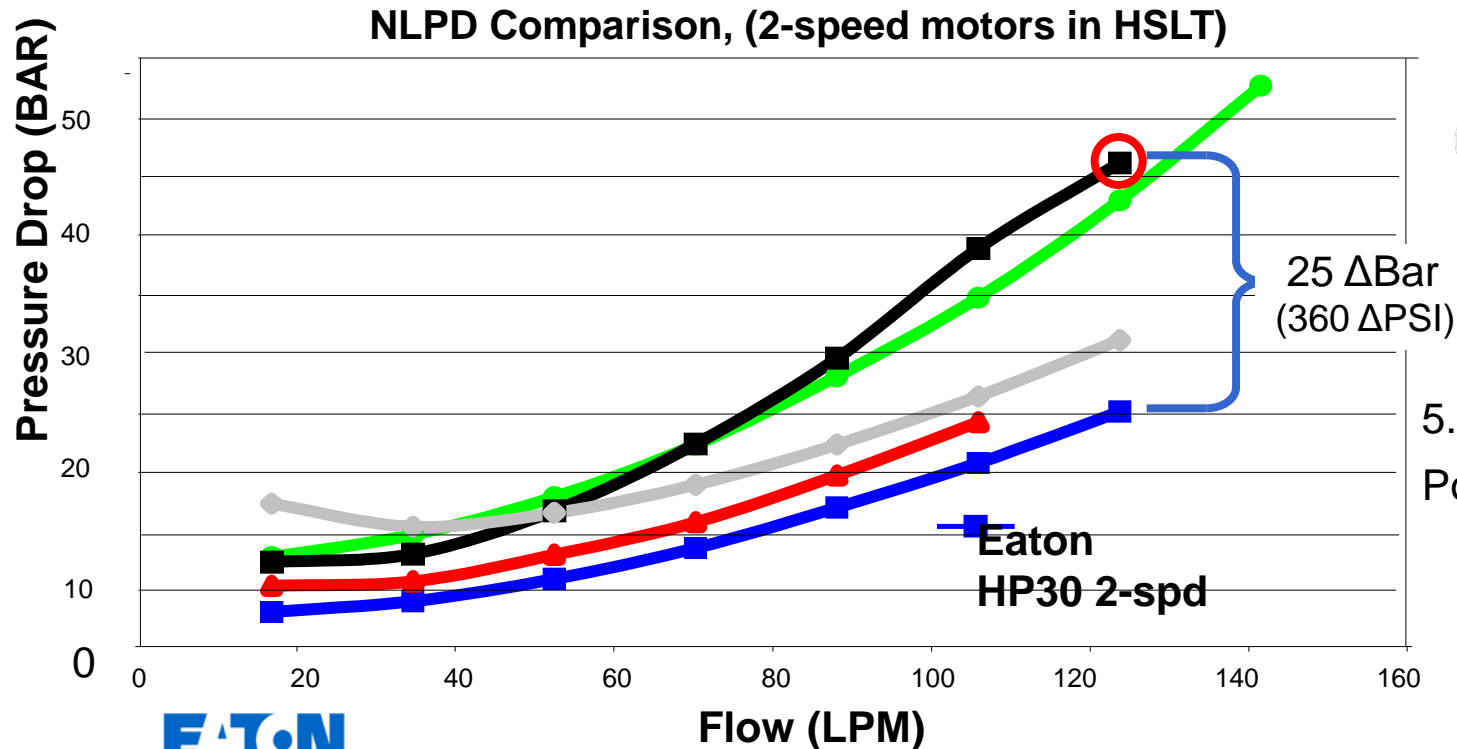
Example: Proper Product Selection

- Product Selection Critical
 - No Load Pressure Drop in Hydraulic Motor
 - New Technologies Used in Component Designs
 - New Motor Designs Target Specific Goals
 - Starting Torque
 - Pulsations
 - No Load Pressure Drop
 - Etc...



No Load Pressure Drop

- Example Hydraulic Motors
 - No Load Pressure Drop = Parasitic Loss (Power Loss)
 - Worse at Cold Temperatures



5.5 kW (7.4 HP)
Power Loss Reduction

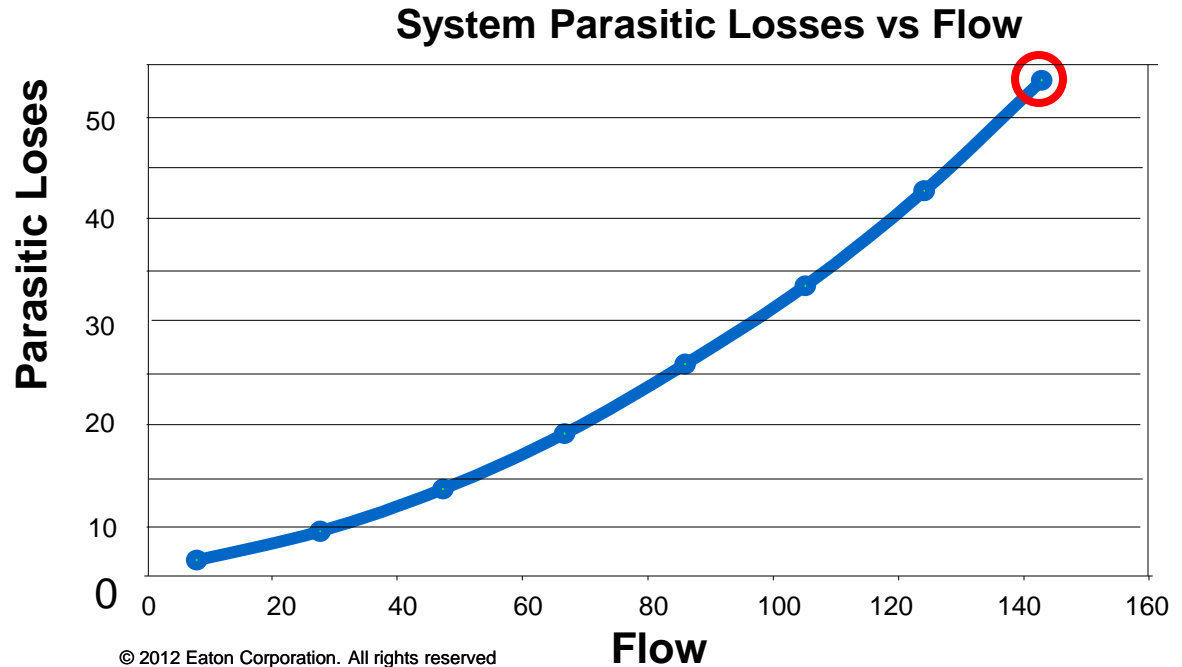
System Pressure Selection

- Systems Moving to Higher Pressures
 - 210 Bar → 280 Bar → 420 Bar
 - Why?: Power = Flow x Pressure
 - Parasitic Losses Increase as Flow²

For Same Power:
145 LPM x 140 Bar
-Or-
72 LPM x 280 Bar

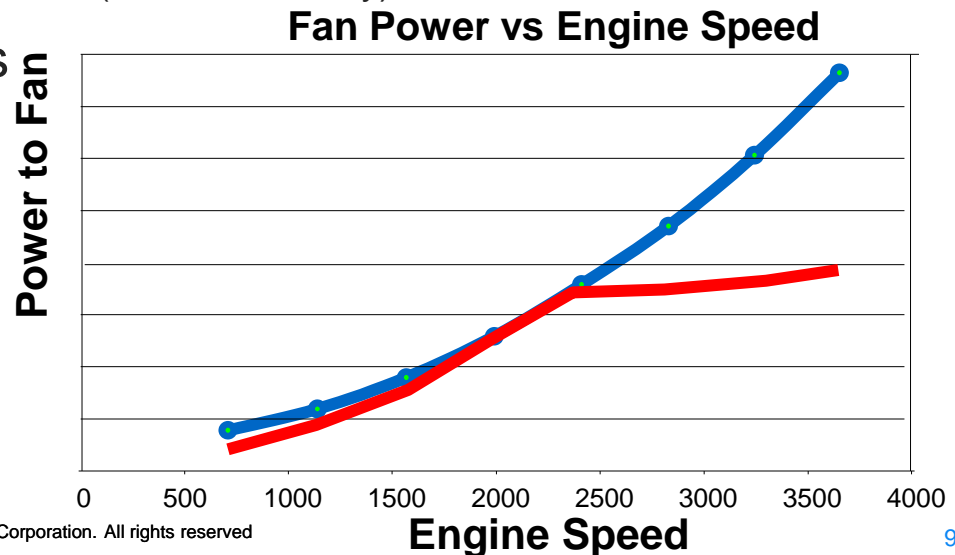
Results...

Savings of 10 kW (14 HP)
at 72 vs 145 LPM



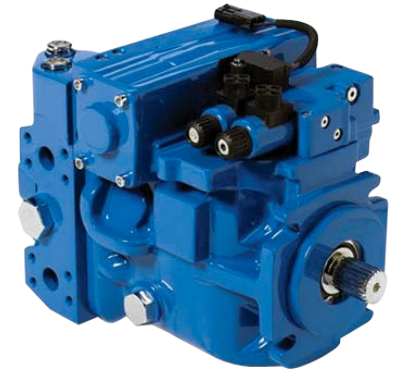
Fan Drives

- Traditional Mechanical Drive Systems
 - Sized For Cooling At Idle
 - Excess Power At High Speeds (Lost Power)
(Power to Fan \rightarrow RPM³)
- Hydraulic Fan Drive Advantages
 - Easier To Mount Fan In Best Real Estate
 - Tighter Mounting To Shrouds (Better Efficiency)
 - Significant Power Savings At High Speeds...

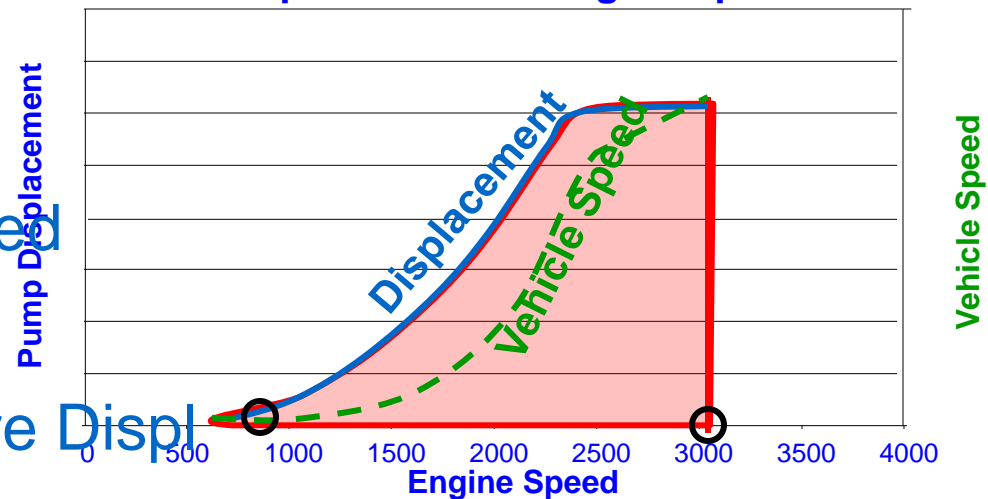


Propel Solutions: Hydrostatics

- “Automotive Drive”
 - Simplified Operator Control
 - Electronic Versions – More Capabilities
 - Match Engine Power Curves
 - Consistent Performance Hot/Cold



Displacement vs Engine Speed



Same Speed Achieved
But...

With Less RPM, More Displ

Propel / Circuit Solutions

- “Anti-Stall”
 - Prevents Demands Beyond Power Available
 - Improved Fuel Efficiency
 - Better Productivity
 - Reduces Wear/Tear on Starters
 - Electronic Versions
 - Optimize for All Throttle Settings
- More Custom Controls Possible from Vendors...



Work Circuits

- Historic Method: Fixed Displacement
 - Puts Out Full Flow All The Time
 - Bleed Off What Is Needed
 - Common Across Many Areas
 - Steering, Work Circuits, Transmission Lube, ...
 - Power Loss Can Be Significant
 - Especially At Low Flow/High Pressure



Example: If Need is 8 LPM @ 200 Bar...

... but system puts out 80 LPM

... 24 kW (32 HP) Loss

Work Circuits: Power on Demand

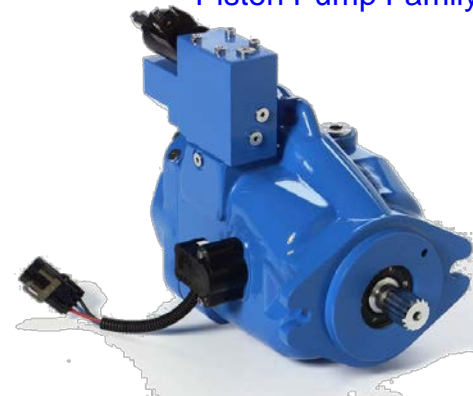
- Better System: Variable Displacement
 - Varies Flow Based on Demand
 - Maintains Pressure in Circuit
- Best System
 - Intelligent Pump and Valve Work Together
 - EH System Provides Only Flow Required
 - Smart Valve Directs Flow Where Needed



Eaton x20 Series
Piston Pump Family

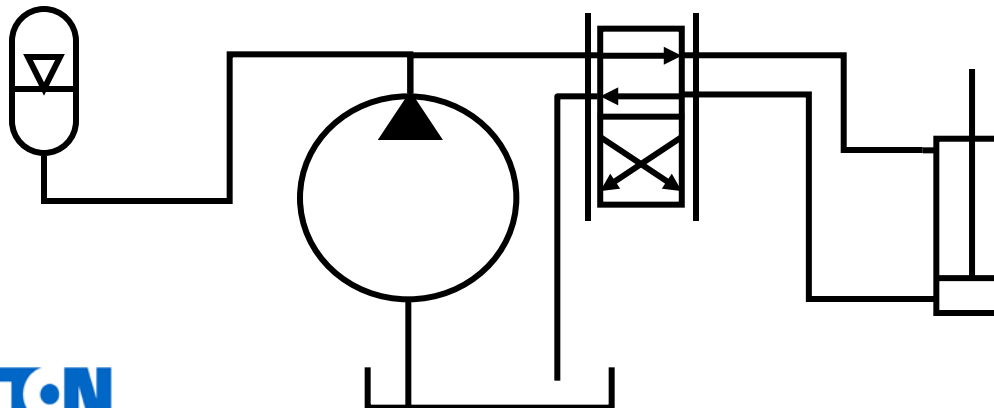


Eaton Ultronics
EH Valve



Load Leveling Systems

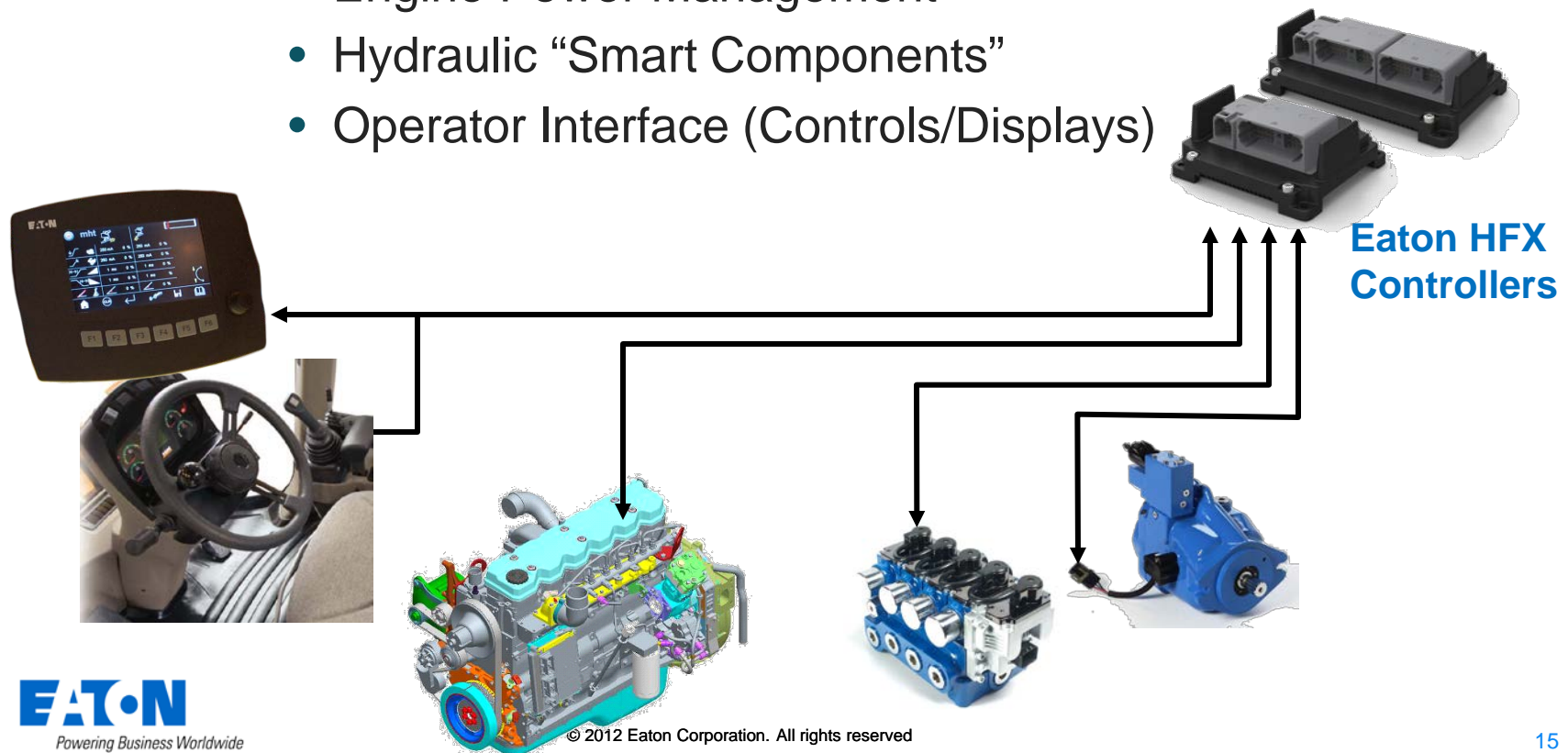
- Complex Systems Power Management
 - Opportunities for Specialized Circuits
 - Store Energy to Level Out Peak Demands
- Intelligent, Pressure Compensated Valve
 - Capability to Proportionally Divide/Share Flow
 - Operate from Pressure Rail/Accumulator
- Already Used in Industrial Applications



Eaton Ultronics
EH Valve

Adding Brains – Electro Hydraulics

- Critical Technology for Significant Savings
- Ties Intelligence To Key Areas
 - Engine Power Management
 - Hydraulic “Smart Components”
 - Operator Interface (Controls/Displays)





Powering Business Worldwide