Energy Use of Pumps

According to studies by the US Department of Energy:

- Nearly 25% of electricity demand comes from industrial motor systems
- Over 50% of pump life cycle costs result from energy and maintenance expense
- Energy savings of 20% or more are possible with systems optimization

www.pumpsmatter.org
Place to start thinking about the subject:

- Wells clog and corrode:
- Clogging reduces capacity to transmit water
- Corrosion can mean waste downhole
Clogs mean excessive drawdown: this causes excess power costs, etc.

System Optimization = reduce actual drawdown
Performance history:

Well 1 specific capacity history

- **Original SC @ 1100 gpm**
- **Begin well cleaning period SC @ 400-800 gpm**
- **Attempt big fix**

Specific capacity = Flow rate/unit drawdown

Graph showing the performance history of Well 1 with specific capacity measures over years.
Well efficiency and total system optimization

- Big drops in specific capacity (SC in previous chart) = drop in well efficiency (Ew – theoretical: observed pumping drawdown)
- Drop in SC and Ew = higher system head = pump works harder
- More kWh per unit water pumped = degraded wire: water ratio
Visual reinforcement:
- Seeing is believing
- Before and after
Pump cannot pump water well
Corrosion pump damage

Pump delivers 700 gpm, 200 gpm reaches the surface
Many well owners’ take on potential well problems...
Well Rehabilitation: Correcting deterioration

- Well cleaning
- Repair or replacement of worn, corroded components:
- The right equipment and methods
- Evaluation: Before and after procedure
Well cleaning: large-scale bottle washing

Chemical, application of force, and maybe heat
Methods of well rehab

- Numerous
- Many new since 1990
- Much improvement in chemistry and force application
- Update your specs
- Learn the new ways
Materials

- Smooth and best-suited to be corrosion-resistant
- Choose based on life-cycle cost basis
- Don’t be afraid of newer options
- Test!
Pre-cleaning well testing

- Document pre-cleaning condition
- Calculate well and aquifer loss
- Compare pumping head to pump curve
Post-cleaning testing

- Repeat tests at same flow rates and same methods
- Calculate same values
- Document changes afterwards
Now what do we do?

• After rehabilitation – do not stop and put the file away!

• If you don’t have one, start an asset management plan that includes the wells

• Make material and system choices to slow decay and decline

• Make it practical, effective, and updatable

• Make it institutional: Not “Martha’s Pet Project”
Asset management is (one definition):

a planning process to reduce cost, and increase efficiency and reliability while achieving service performance and business goals
Finding places that fit the regulatory requirements …

Then: endless horizon

Now: struggling to find acreage
Run to failure (neglect):

“go and sin no more…”

If your system has a history of ‘run to failure’ - Repent! Start a life of maintenance.

Jesus (2nd from L) with woman caught in the act of adultery and her self-righteous accusers (quote aimed at all present...) story from Bible
Key to A.M./ maintenance: Institutional memory from data

- Diagnostic information from tests tells you how the well is performing
- Water quality testing (physical, chemical, microbial) detects deteriorating effects
- Have data records? Plot trends
- Long data history? Better trends
- Know what was done in the past to inform the present and future.
The Need for Records and Databases

1. Wellfield actions happen at long intervals
2. No one lasts forever – help the next person
3. Spot trends and plan for actions before the crisis happens
4. Help your advisors help you
Comparison well charts

T-M well 6 step testing 2003

Before 2003

After 2003

Original test 1983

6/6/03 post-cleaning  ->  pre-cleaning  ->  Apr 1983 original
Trend Analysis: gal per kWh

$80 per MG @ $0.09 per kWh

$241 per MG @ $0.09 per kWh

Chart anything this way, including microbial and WQ.

700 gal/kwh
Then, use the information!

• You do not have to guess and work in the dark
• Knowing your costs, hydrologic factors such as specific capacity, water quality, power usage
• Keeping good records to do this
• Know your benefits as well as costs
Domestic wells: The final frontier:

Lots of them:

Largely neglected
Questions?

I’ve got some time...

Now published! CRC Press

SUSTAINABLE WELLS
Maintenance, Problem Prevention, and Rehabilitation

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Science and Planning for Earth’s Most Critical Resource
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