

This presentation premiered at WaterSmart Innovations

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Which Technologies Are Likely to Have Greatest Impact on Future Residential Water Demands?

**Bill Gauley, P.Eng.
Veritec Consulting Inc. (a Miya Group Company)
Mississauga, Ontario, Canada**

**Tel. (905) 696-9391, x 102
bill@veritec.ca**



1st - Conservation vs. Efficiency

- This presentation about efficiency – not conservation.
- Conservation:
 - take fewer showers,
 - don't flush toilet when it's yellow,
 - Don't water lawns/gardens even if needed, etc.
- Conservation = some level of sacrifice
 - e.g., smelly people, smelly washrooms, brown lawns

Efficiency = Work smarter, not harder

- Volume of water on earth remains constant
- So, can't actually conserve water globally
- But we can use water more efficiently and effectively
- Efficiency =
 - do more work with same effort or resources, or
 - do same work with less effort or resources (less waste)

Do you need to remind me to breath?

- Many published water-efficiency lists contain items so obvious that they are silly, e.g.,
 - fix leaks,
 - turn off faucet when not using water, etc.
- These are Duh! measures
- Do we really need to tell someone planning to cross the desert to fix the hole in his canteen or to avoid pouring his water on the ground?

Not all technologies are created equal

- Some measures save more water than others,
- Some are easier to implement,
- And some are less expensive to implement.
- The most impactful measures
 - reduce significant volumes of water,
 - are relatively easy to implement, and
 - are not unduly expensive.
- **Should first target the “low hanging fruit”.**

Always a little surprised when...

- A water efficiency coordinator tells me about their new and exciting program to collect the moisture expelled by cows as they exhale when they don't even have a toilet replacement program.
- Hardly “low hanging fruit”.



Energy vs. Water

- Every day someone develops a new energy-using product (TV, fridge, microwave, xbox, iPad) –
- The same cannot be said about water-using products – especially in the residential sector.
- Consider that about 95% of residential water demand is related to:
 - Toilet flushing, clothes washing, showering/bathing, cleaning/washing, cooking, drinking, and irrigation
- **This is essentially the same list you would have found 100 years ago.**

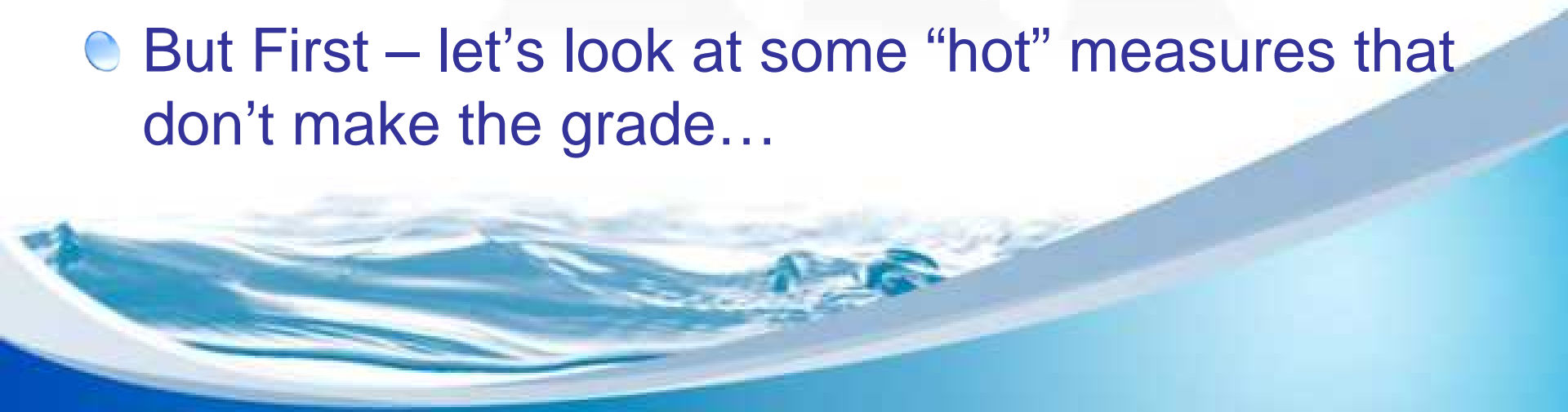
Three Basic Water Efficiency Options

- **Reduce**: use less water to do same task while maintaining performance (HET, H-A washer), or
- **Re-use**: use water more than once (gray water), or
- **Eliminate**: don't use water at all (air-cooled) or use non-potable source (rain water)
- Others are **Water Conservation** options:
 - Take fewer showers, flush toilet less often, don't irrigate lawn when needed, etc.
 - Require some level of sacrifice



No Slight of Hand

- This presentation does not consider “Duh!” measures.
- We want to look at real products or devices that are practical and proven – either currently or in the very near future - and that would be readily acceptable to the typical man or woman.
- We want REAL products that save REAL water.
- But First – let’s look at some “hot” measures that don’t make the grade...



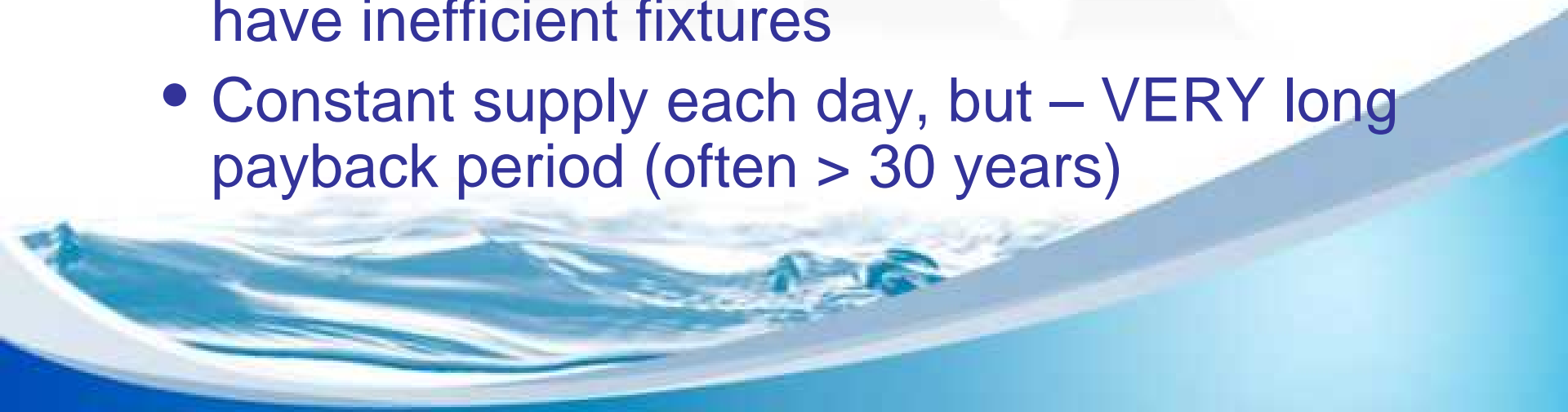
Missed the Cut -

● Rain Barrels

- Don't hold enough water
- Full after rainfall (when water is not needed)
- Empty after few dry days (no good empty)
- Not suitable for lawn watering (flower pots?)

● Grey Water Reuse for Single-Family Homes

- More grey water produced and used if you have inefficient fixtures
- Constant supply each day, but – VERY long payback period (often > 30 years)



Missed the Cut (con't)

● Composting Toilets

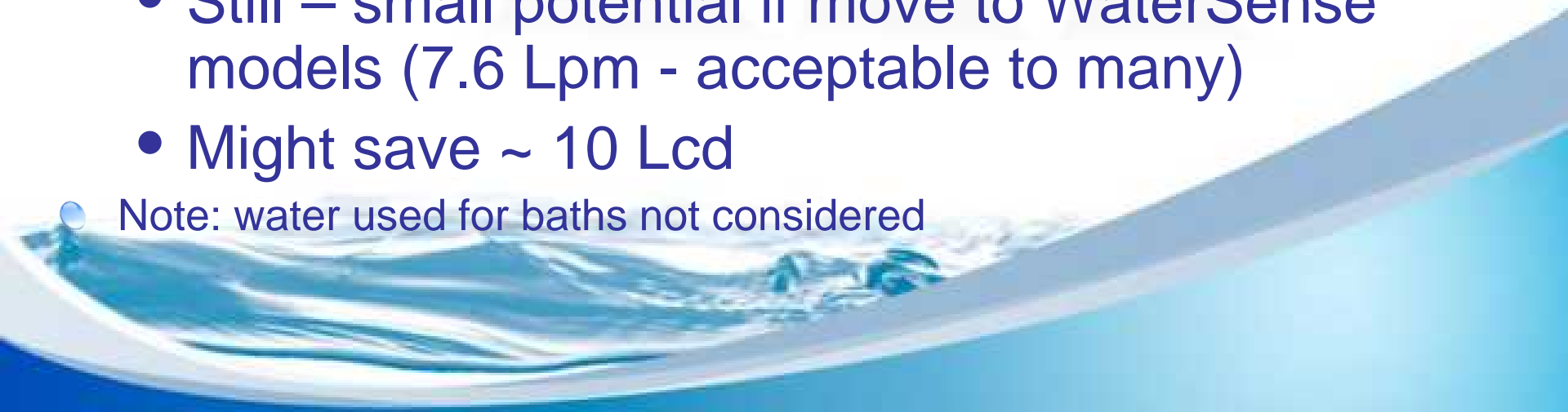
- Can eliminate water for toilet flushing, but -
- Not widely accepted (at least currently)
- Not cost-effective (save ~ \$15/toilet/yr based on 2 toilets/home), ~ 50-100 yr payback
- Plus - sometimes energy cost to run fans

● Incinerating Toilets

- See above
- Plus – even more energy costs

Missed the Cut (con't)

- Showers (some potential)
 - Practical lower limit to flow rate before unacceptable (rate varies between persons)
 - If flow rate too low = not acceptable
 - If not acceptable = replaced by homeowner, or shower duration just gets longer
 - Most showerheads already efficient (~ 9.5 Lpm)
 - Still – small potential if move to WaterSense models (7.6 Lpm - acceptable to many)
 - Might save ~ 10 Lcd
- Note: water used for baths not considered



Missed the Cut (con't)

● Dishwashers

- Very little water used by automatic dishwashers
- So, very little opportunity for significant savings

● Drinking (don't mean beer)

- It is what it is – no savings opportunity

● General cleaning and washing

- Not much savings potential with indoor washing
- Not much savings potential with outdoor washing unless you use uncontrolled hose (a duh! measure)



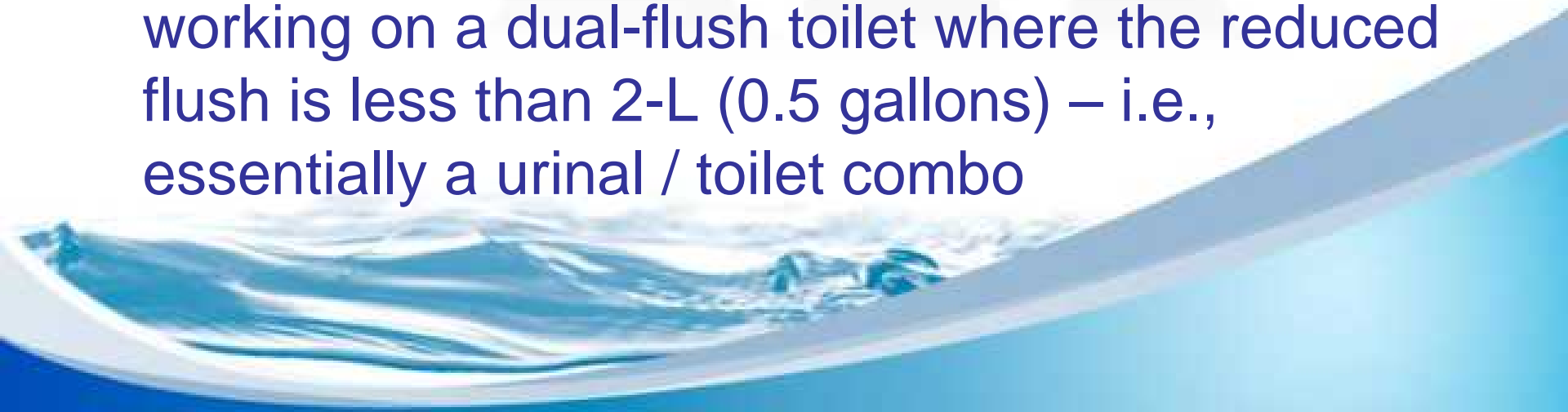
Sensor-Operated Faucets

- Not typically used in residential applications
- Wouldn't reduce faucet use in kitchen (fill jugs)
- Little water used by bathroom lavatory, so little opportunity for savings
- All independent studies (that I know of) show water demands are higher after manual faucets replaced by sensor-operated fixtures (though this might change in future).

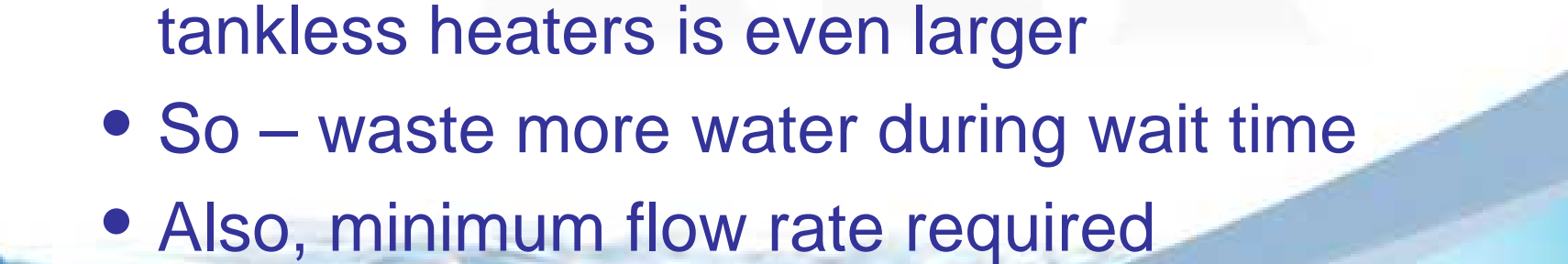


Waterless Urinals

- Not currently used in residential installations
- Potential savings with residential urinals, especially if used by both men and women
- Likely stay away from non-water urinals because of potential maintenance issues
- At least one toilet manufacturer is currently working on a dual-flush toilet where the reduced flush is less than 2-L (0.5 gallons) – i.e., essentially a urinal / toilet combo



Tankless Water Heaters

- Not “point of use” water heaters
 - Tankless or on-demand water heaters may save energy but they don’t save water
 - They don’t eliminate the ‘cold plug of water’ that causes wait time at the fixture
 - In fact, the ‘cold plug of water’ associated with tankless heaters is even larger
 - So – waste more water during wait time
 - Also, minimum flow rate required
- 

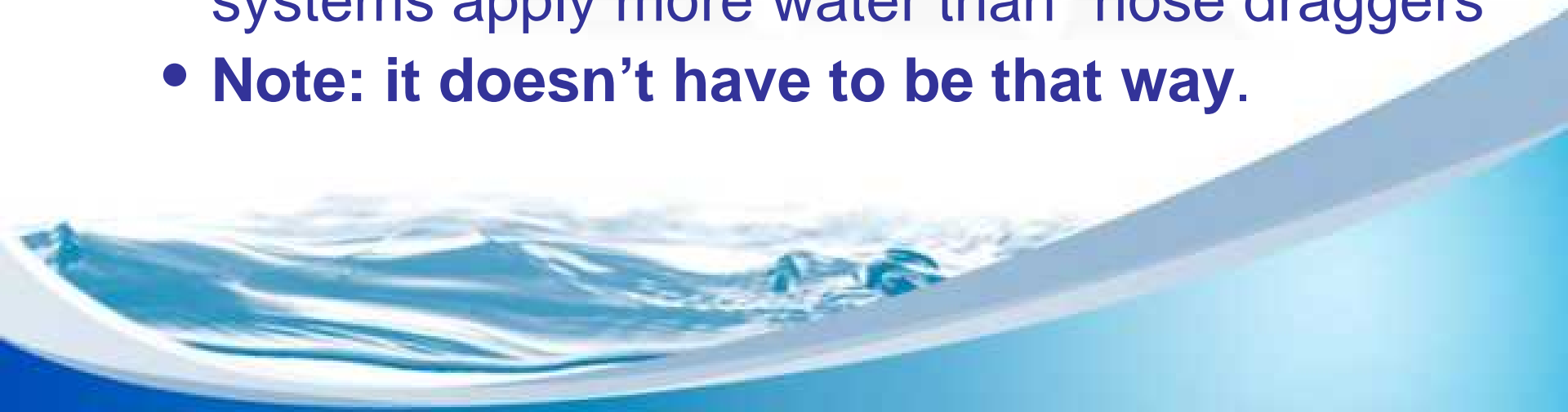
Water Softeners

- Put in the DUH! category if it doesn't regenerate only when needed.
- Almost all new systems regenerate based on through-put vs. the number of days of operation
- Fewer regeneration cycles not only saves cost of water and salt but also reduces the amount of salt discharged into wastewater collection system



What about irrigation?

- Odd / Even day watering restrictions
 - Generally not mandatory, generally no fines issued
 - Measure doesn't even work out mathematically! Why is odd/even so popular???
- Automatic Irrigation Systems
 - Almost all research shows that automatic systems apply more water than “hose draggers”
 - **Note: it doesn't have to be that way.**



Unlawning

- Huge potential but need to convince homeowners that there is no need to have a largely useless front lawn (or even such a big back lawn)
- Maybe in the future??



Rainwater Harvesting

- Huge potential in certain situations, but -
 - Need to be able to collect enough water to make the system worthwhile
 - May need to treat water (unless just used for irrigation)
 - Need to ensure that you are substituting potable water with rainwater
 - If water used indoors, may have to pay additional “sewage” charge
 - Like most water efficiency measures, works best in areas where water is scarce
 - Payback period can be 50 years (residential)

“High Hanging Fruit”

- None of the preceding measures are going to significantly reduce residential water demands
 - At least not under normal conditions
- So which measures might be considered to be “low hanging fruit”?
- There doesn't seem to be a lot left -

Toilets

- Research: need ~ 3-L (0.8-G) for drainline carry in SF homes
- We're almost there -
 - WaterSense toilets flush no more than 4.8-L (1.28-G) and there are some models that flush **3-L (0.8-G)**

| HET | ULFT | Water Saver |
|---------|---------|-------------|
| 9 Lcd | 15 Lcd | 51 Lcd |
| 2.4 gcd | 4.0 gcd | 13.5 gcd |

- **Absolutely no sacrifice with HETs, great performance!**
- Note: could use outhouses or incinerating or composting toilets but to be realistic, we are stuck with flushing toilets for a while to come.



Clothes washing

- Front-loading washers (available in Europe for years) save about 50% of water and energy used by top-loaders
 - Note: almost all energy savings from reduced drying times
- Most models have WF < **5** (i.e., gal/ft³ drum volume)
- Most use automatic water level settings
- Marketplace moving towards front-loaders (2/3 of washers sold by Sears and HD are front-loaders)
- Save about 20 Lcd (5.3 gcd) by switching to front-loader



Automatic Irrigation

- Hose draggers not an issue (on average)
- Peel Research - most savings from proper design and operation of system – “fine tuning system”
- Less savings from using “smart controller”, including rain shut-off
- For example:
 - Reduce from 3"/week to 1"/week via “tuning system”,
 - Further reduce from 1"/week to 5/8"/week via “smart controller”



On-Demand Hot Water Recirculation

- Almost no effort required from homeowner
- Homeowners WANT these systems – not because of water & energy savings (not too cost-effective) but because of the convenience of not waiting for hot water at shower.
- A win/win water efficiency measure
- Save 8 to 10 Lcd (2.4 gcd)

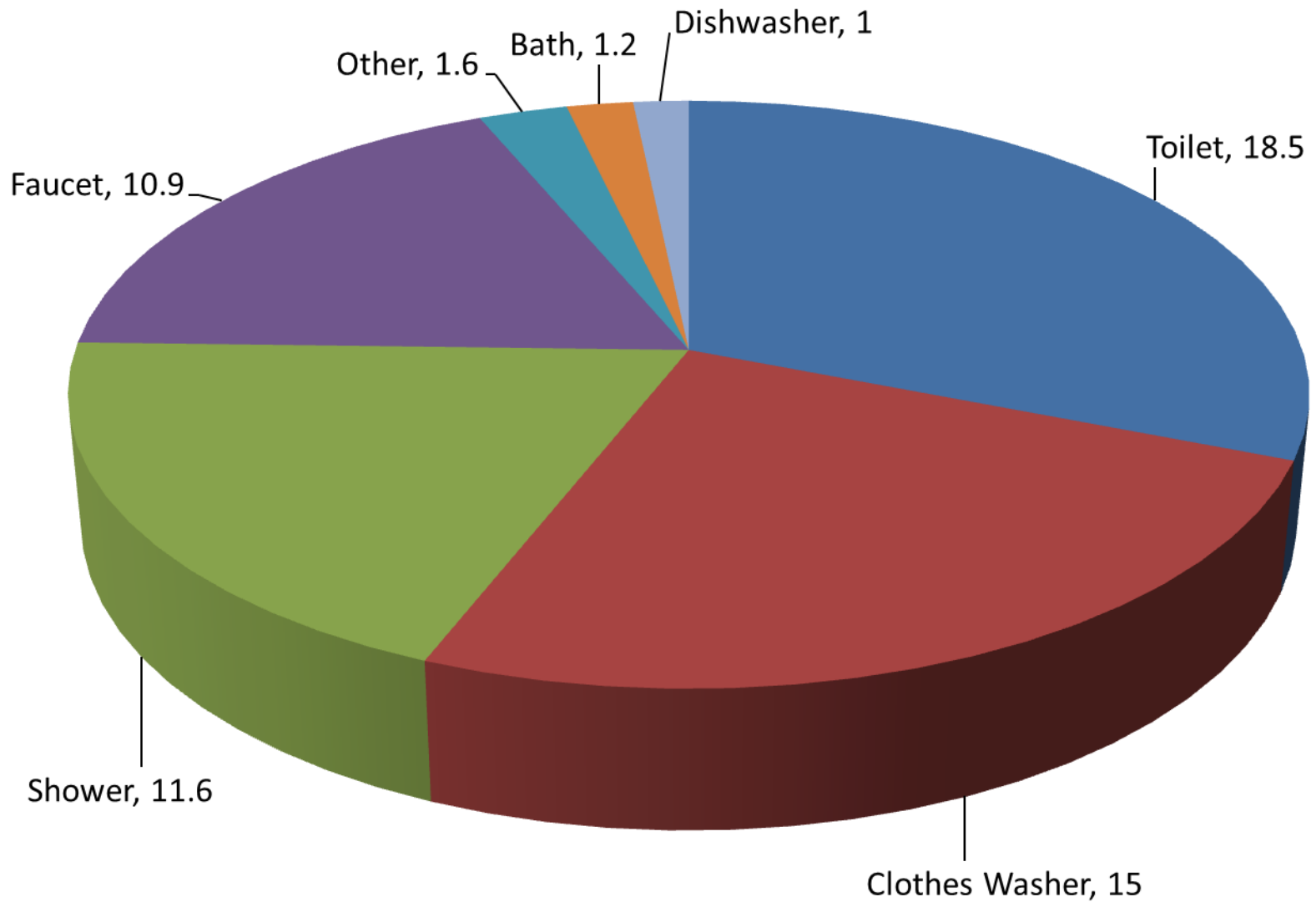


And the Winners are...

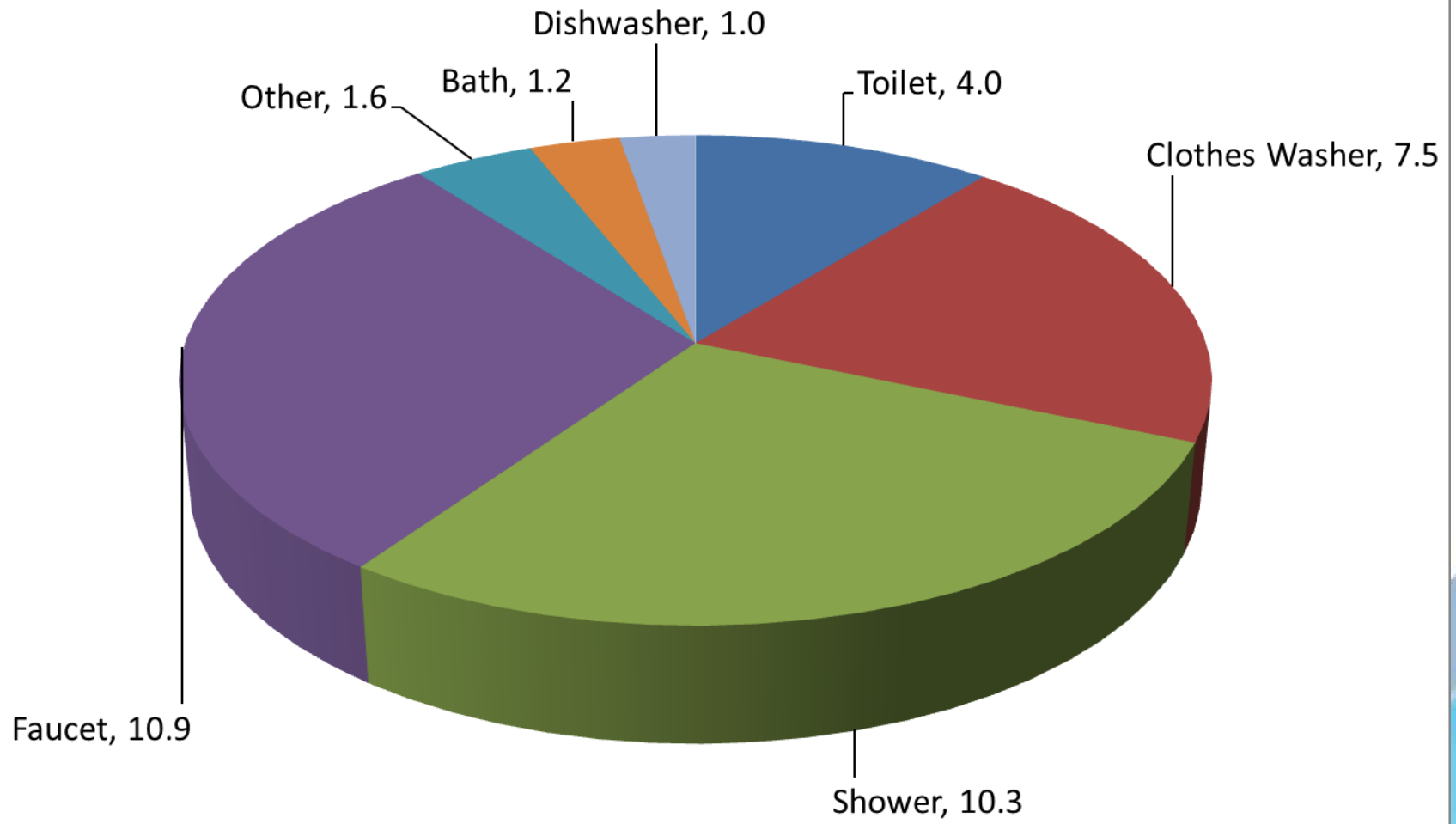
- Because these measures are proven to save water and are actually wanted by homeowners –
 - HETs (especially if $< 4.8\text{-L}$ or 1.28-G)
 - Front-load clothes washers with $\text{WF} < 5.0$
 - Hot water recirculation systems
 - Properly “tuned” irrigation systems
- These are your “low hanging fruit”



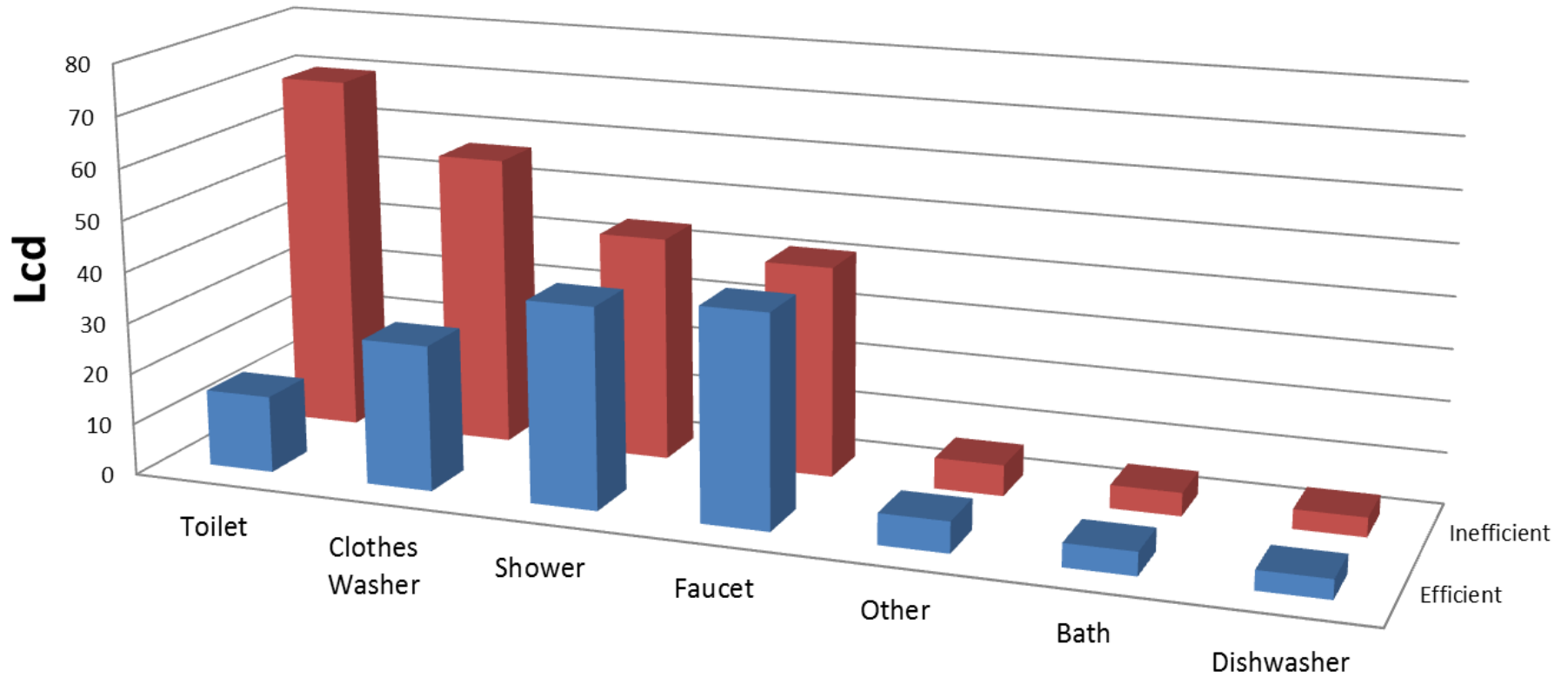
Inefficient Per Capita Water Demands = 60 gcd (226 Lcd)



Efficient Per Capita Water Demands = 37 gcd (138 Lcd)



How to go from 226 Lcd to 138 Lcd



| | Toilet | Clothes Washer | Shower | Faucet | Other | Bath | Dishwasher |
|-------------|--------|----------------|--------|--------|-------|------|------------|
| Efficient | 15 | 28 | 39 | 41 | 6 | 5 | 4 |
| Inefficient | 70 | 57 | 44 | 41 | 6 | 5 | 4 |



Thank you...

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