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Working together for clean air

Woodstove Retrofit Open Challenge

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Puget Sound Clean Air Agency

Woodstove Design Workshop, Brookhaven National Lab

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Why retrofits?

- Tacoma $PM_{2.5}$ Nonattainment area Emissions Inventory is ~ 75% woodsmoke (w.s.)
- > 50% (of w.s.) is uncertified stoves, ~ 20,000 devices
- $$ is big driver: many people don't want to switch fuel, few can afford new device
- replacement is ~ $4k (w options & installation)
- we can offer only $1500 incentive, or full (capped) cost for income qualified, but funds are limited
- ~ $80-100M to replace all
- enforcement is expensive and doesn't bring lasting emission reduction

Tacoma NAA Emissions Inventory
RWC as largest PM2.5 source

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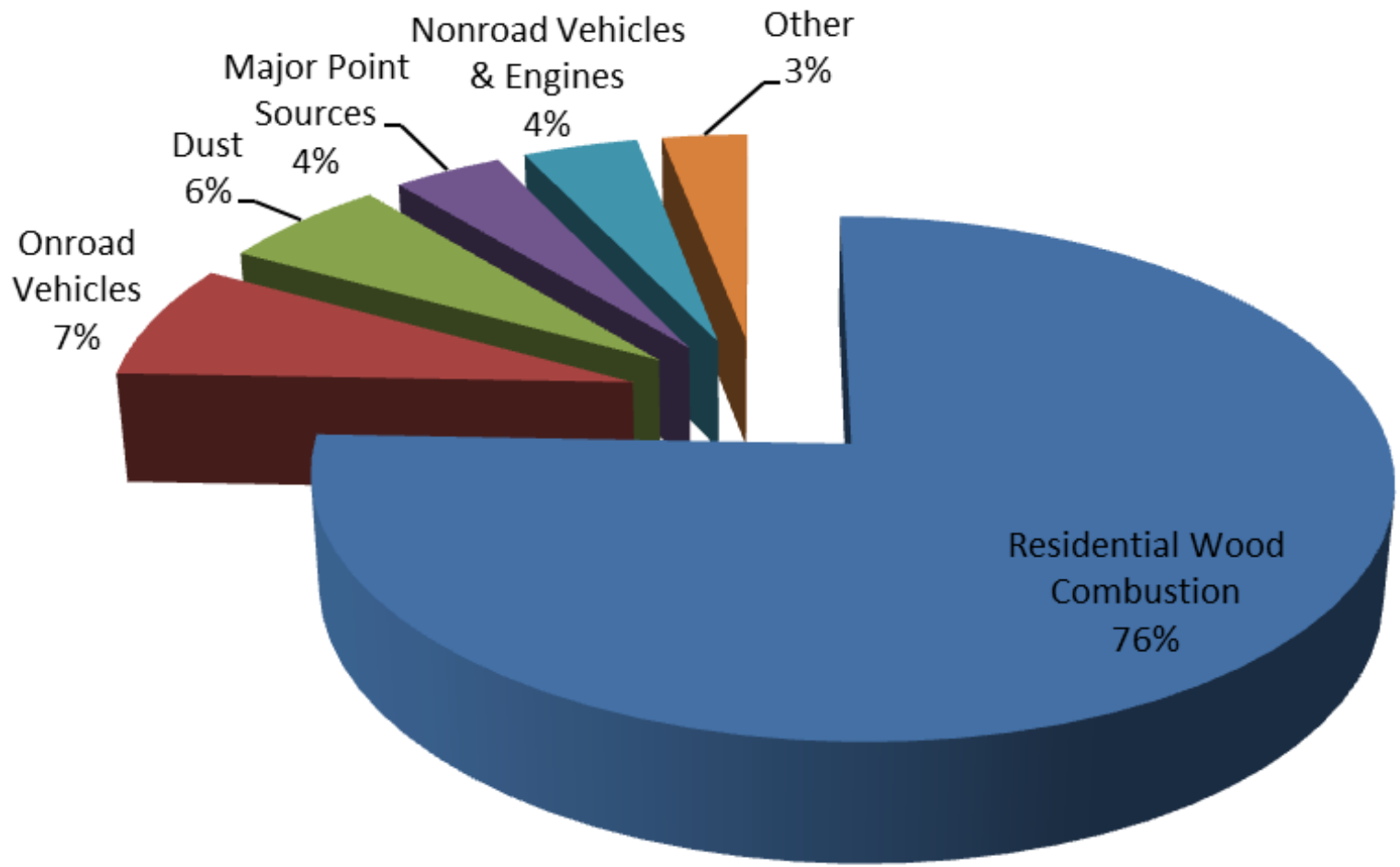

Why a challenge, what is it?

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- like the Decathlon…
- aka crowdsourcing, contest-driven innovation, advertised to a broad audience, compete for a prize
- idea is to draw on all similar knowledge, including from previously disparate sources
- e.g. Exxon had problem with vacuuming spilled oil that was cold because the oil congealed and wouldn't pump
- A chemical engineer who had once poured concrete recalled that vibration was used to help it flow and proposed to use similar approach.
- proposal was success and helped Exxon clean up spill much more rapidly

InnoCentive leading host/ facilitator of open challenges

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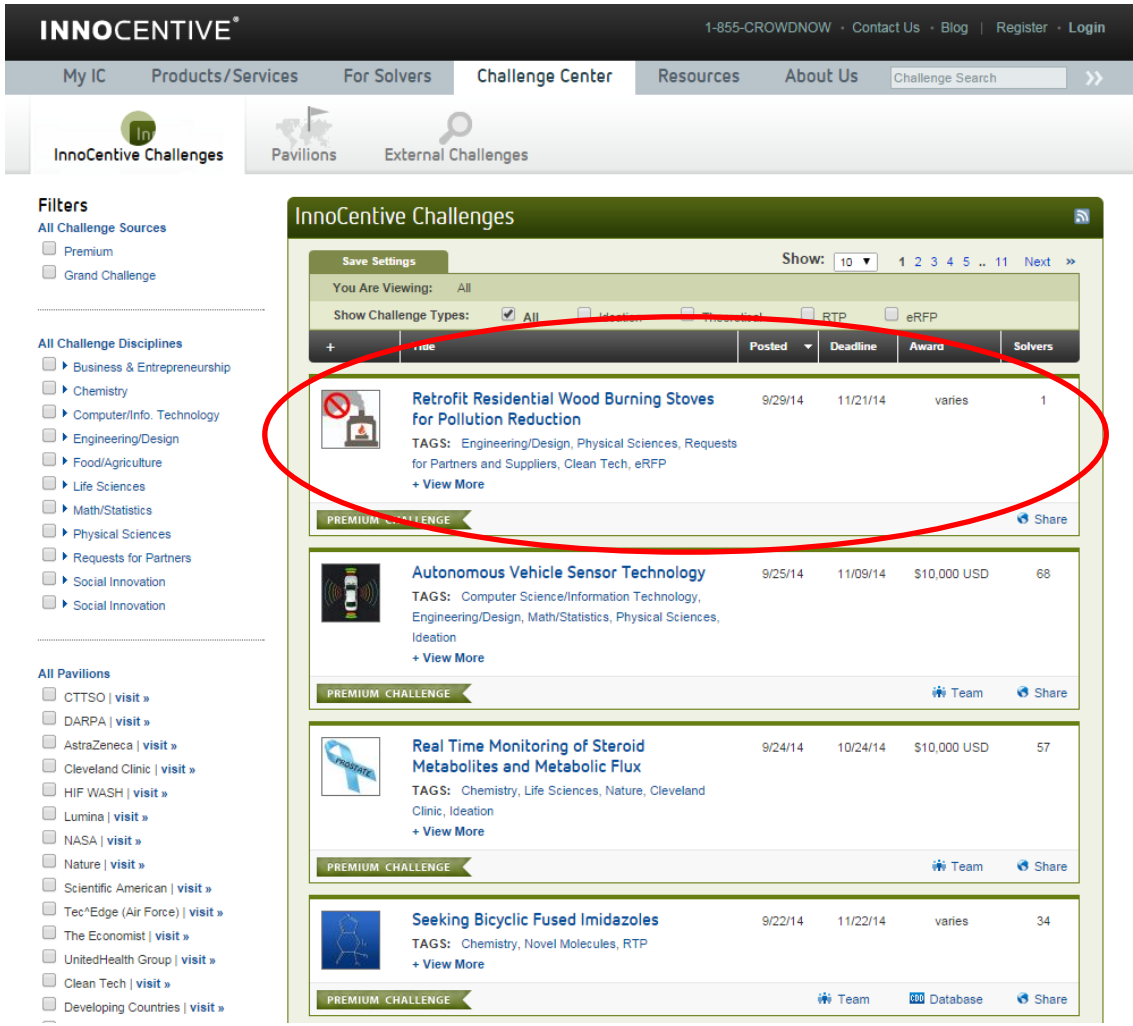
- 250,000 + registered solvers in 200+ countries
- more than 1200 challenges and 900 prizes
- awarded $7M
- online info and submissions



The Retrofit Challenge

- National Estuary Program (NEP) grant to fund search for retrofits to reduce PAHs (and fine PM)
- A Technical Advisory Committee reviews, comments, rates, and make final recommendations on winners
- Will fund testing for up to three finalists
- Are significant challenges in maintaining motivation and protecting intellectual property
- Want to find, test, and highlight devices that perform well, but don't want to enable anti-competitive speculation

The Technical Challenge of our Challenge

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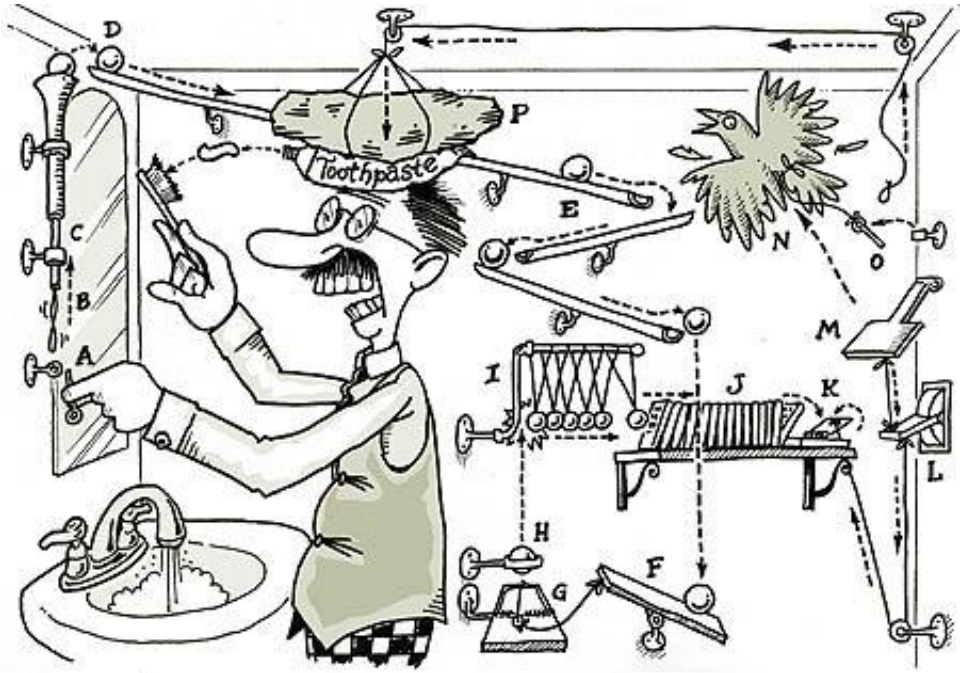
- Our current understanding of retrofit devices is that they have one or more of the following limitations (but we'd love to be proven wrong!) :

  - too expensive and complicated
  - require significant care and maintenance



  - have significant technical limitations that render them ineffective, unreliable, or hazardous.

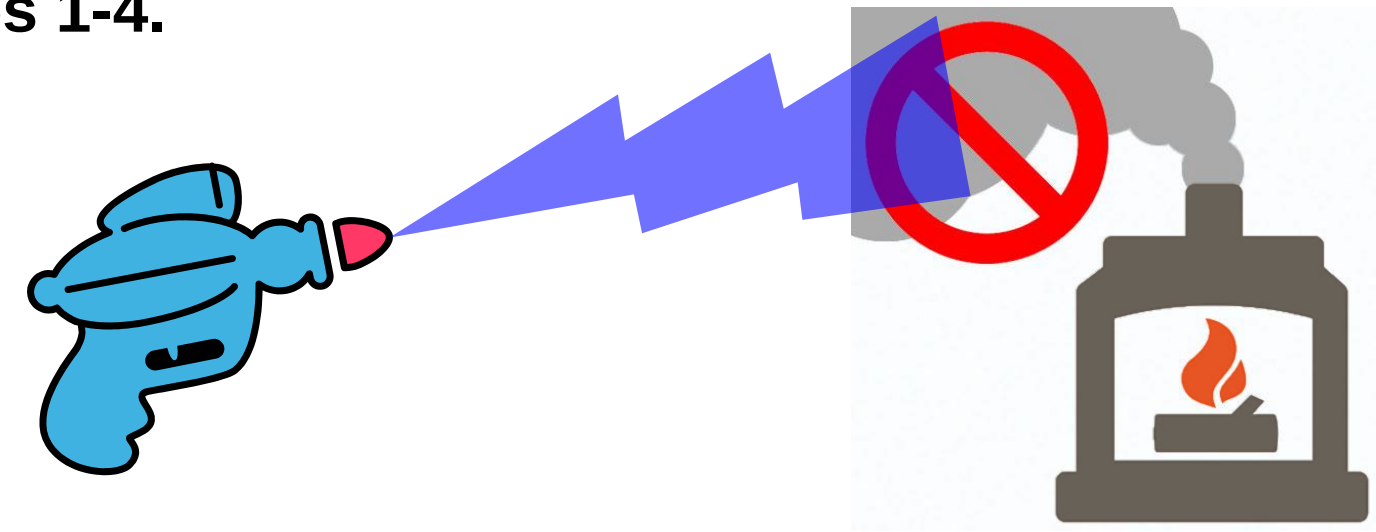
General approaches and our current understanding of the limitations… we hope we are wrong!

Disclaimer: None of this is directed at any device or approach here, this is just our general observation:

1. **Mechanical filtration: low filtration performance, not robust to exhaust gas temperatures, water, rapid/high particulate loading, may restrict exhaust flow**
2. **Catalyst in the burn chamber: insufficient pollution reductions, not robust to rapid/high loading, may restrict exhaust flow**
3. **Electrostatic precipitators: too expensive, not proven to be durable, insufficient pollution reduction, requires ongoing maintenance**
4. **Reburning outside the primary chamber: requires heat/energy input, may restrict exhaust flow**

… and the solution will be….

- ?… we've heard many promising approaches and prototypes…
- We are willing to consider any existing approach (1-4 above) that has robustly overcome all of the limitations.
- We are also open to novel methods that do not fit into categories 1-4.



Intellectual Property discussion

- Our highest priority is to help protect innovators, inventers, and entrepreneurs
- We worked with local IP attorney to develop concept and terms
- Submissions must agree to conditional nonexclusive royalty-free license to the public, in the event of lack of commercialization within 4-years
- But, developer/inventor retains IP ownership

Testing

- **After close of challenge, up to three best devices may be selected for testing**
- **will be tested under varying conditions with 3 devices**
- **use High/Low burn rate and wood moisture combinations**

ID of			Stove		
Parameter Pair	Burn Rate	Wood Moisture	1	2	3
A	HIGH	lower	Y	-	Y
B	LOW	higher	Y	Y	Y
C	HIGH	higher	-	Y	Y
D	LOW	lower	Y	Y	-

Challenge is OPEN!

- Sept 29 – Nov 21
- submission requires detailed description of method and device, and test data
- Evaluated on
  - efficacy
  - safety
  - cost

Discussion and feedback:

- What challenges or opportunities do you see might occur for
  - retrofits as a general approach?
  - testing of retrofits?
  - spurring commercial interest?
  - spurring regulatory revisions?

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- **For more information go to:**
- https://www.innocentive.com/ar/challenge/9933616

  or

- http://bit.ly/1oqGKFO

Or contact me

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