Dear Ron and also Crispin, Kevin, Iwan, and all,

Before I begin, let me say that - if you are the Ron Larson who as a  much younger man worked for SERI in Colorado  - then I our paths have crossed a couple of times back in the mid 1970's when I was helping to get NCAT up and running and for some reason caught a ride with you - probably in Denver. As I recall A K Reddy from the Bangalore Institute of S&T was a passenger and I clearly recall a very interesting discussion with him about whether the ethnicity and race of a scientist made any difference in India when it comes to discovering and delivering more AT solutions to the socio-economic problems of Indian villagers.  His answer was (in effect) the following: **as an essential next step in their own decolonialization, it was critically important for Indians scientists and AT-ers to visibly assume leadership roles - and to be seen to be actively taking responsibility for solving the technology problems of Indian villagers**.

I then remember AK Reddy saying something about: **you are welcome to play a helping role, but it is important for Indian scientists and technologists to 'liberate' themselves from old paradigms and take responsibility for helping Indian villagers arrive at the most appropriate solutions to the challenges they face**(or words to that effect).

Back on those days of the mid 1970's Black (and Small) were seen as being so Beautiful that middle class, patriarchal Mid-American 'whiteboys' - especially privileged well educated young white men - were under attack from all sides.  We were disqualified from holding leadership positions in the struggle to create a new America by African Americans, Hispanics, women of any ethnicity and class background, indigenous Americans, representatives of historically disadvantaged Euro-Americans (poor whites), and generic Third Worlders. White male professionals had somehow become the enemy.  It was our turn to ride in the back of the bus and let all the others fight about who was in the drivers seat and what direction to take to build a better, more inclusive future.

I put up a bit of a counter-argument by recalling something another Indian associate of the Gandhi Peace Foundation, the director of the Science for the Villages and also head of the Khadi Village Industries Museum - both in Wandha - had said to me when I asked him the same question.  He said: if humanity is a single organism, and that organism has an infection in one finger what happens?  I answered by remembering that white blood cells (an unfortunate reference to color!) congregate in the infected body part to isolate and fight the invading bacteria. That was his answer. Reflecting with the wisdom of 40 years of hindsight on my big development disasters and much smaller development successes, I now realize that I probably misunderstood Devendra Kumar when he used his infection of the body metaphor to explain the universalization of responsibility to help Indian villagers and the developing world learn how to appropriately apply science and technology to solve the challenge of producing and supplying affordable and environment friendly energy to power the development of the millions of impoverished villages everywhere.

I now realize that the**'first responders'** to any development crisis need to be those actors and agencies closest to the epi-center of the crisis who are culturally and linguistically competent to engage with those villagers or townspeople.  The role of the first responders is to ensure that the indigenous values and ethno-sciences (of stoves, fuels, cooking) are well enough understood by outside scientists, funding agents, and policy makers to:

1. create the platforms and bridges necessary for 'western-style' scientists and technologists to constructively engage with villagers and townspeople,
2. **accurately translate between** the cultural patterns and perceptions of indigenous actors to generate the framework of meaning, operator know-how and multiple role player interactions – on one end of the bridge - **and** the abstract models and variables used by scientists and engineers  on the other end  that are needed by them to create least cost/maximum benefit stove technology solutions,
3. facilitate feedback from villagers and townspeople that accurately captures and communicates outward to stove designers, funding agents and policy makers their preferred technology choices as indicated by in situ focus groups, demonstrations and market testing, and
4. ensuring that **scientists, technologists, funding agents, governmental policy makers, NGO helpers**, etc. actually listen to, correctly read, and then to act in concert to embody the preferences of rural and urban customers in prototype stoves which combine enough value added improvements to be  perceived as such good value propositions that stove users want to buy them because of the value they  add value to their lives.

In summary, the role of the first responder is to mediate between science and culture. Technology is a product of that mediates these two realms of knowing and doing when it is ‘appropriate’. Both science and culture are needed for progress to take place. Appropriate technology is the product of the successful marriage and/or cohabitation between these two strange bedfellows. The challenge to innovate more perfect stove technologies has everything to do with directing Kevin's village idiot to draw his circles around a series of different technologically improved stoves, or their component attributes, so that the stove scientists know what kinds of stoves to design.

I have found it useful to refer to culturally, economically, and environmentally appropriate stove prototypes as improved stove design **'prescriptions'**or **'agendas for stove innovation'**. Each of these improved stove prescriptions or targets represents a composite bulls-eye that directs the stove scientist's attention to cost and desired performances.  The cost is measured by how much the user group spends on average in money, labour or other resources to purchase and operate the stove for cooking and other functions.  A culturally relevant baseline assessment of stove performances also documents the habits (skills) and knowledge of fuels and stove operation that enable the stove using household to get the functional performance they need from their traditional stove. Lastly, the baseline assessment identifies the needs and interests that are fulfilled over the short, medium and long term by the stove technology and measures the strength of these socio-economic and cultural indicators of these needs and interests within the larger socio-economic system.  The resulting baseline assessment of the cost and performance indicators of traditional stoves is done on stoves in Battambang (Cambodia), or Yogyakarta Priovince in Indonesia or anywhere else in the world where people burn biomass (increasingly in Greece to keep from freezing on cold nights).

I agree with Kevin when he says stove designers and enthusiasts often get lost in the forest when they search for ever more scientifically perfect stoves - and loose sight of how to simply and concretely test these abstract stoves.  They are forgetting to pay attention to the obvious socio-economic baseline realities of particular groups of stove users. They have lost the trees in the forest which provide the socio-economic and stove technology matrix of choices within which people buy and use traditional stoves. In most of SEAsia and much of Africa  artisan fabricated traditional stoves retail from $1 to $3 per unit . These cheap industry standard stoves are typically short lived (6 months or less) and typically costly to operate. However, the stove users know how to manage them to get the performance they want from their stoves for cooking food, purifying water, grilling meat and fish, and other home industrial functions.

What I am discovering in Central Java is that there are probably opportunities for the development of several, perhaps as many as a dozen different types of biomass stoves that are specialized to meet the needs of:

            (1)                   street level food sellers,

            (2)                   big outdoor social functions,

            (3to 7)             a range of different home industries (more than 4 different products),

            (8 to 9)            specialty food preparation,

            (10)                 restaurants,

            (11)                 commercial caterers,

            (12)                 water purification and heating,

            (13)                 rice cooking,

            (14 to 15)       home cooking for small and large families,

            (16 to 20)       industrial applications of biomass energy to brick making, producer gas for internal combustion engines, drying operations, etc.

Some of these biomass stoves will be the same but many will be designed and optimized for particular purposes.

What I am trying to do is identify the different biomass stove user groups in Central Java and understand the culture that mediates the relationship between each group and their traditional (baseline) stove technologies as a prerequisite before presuming to introduce an improved stove that can meet the market test of head to head competition with traditional stoves.  Remember, in Indonesia most traditional stoves are made for less than $.50 (the one pot Keren clay stove) and retailed for $1.

Figuring out how to build an improved stove for - say - $1.50 to $2.50 that performs all of the tasks currently performed by the baseline stove as well as reducing emissions and fuel use while improving the efficiency of the operator+stove+fuel+pot system is a very serious ‘high noon’ mountain to climb.  Stove-slinging experts will have to be at the top of their game if they are going to hit enough bulls-eyes dawn by particular user groups to out perform traditional stoves on a level playing field.

How many quick-draw-McGraw's are out there in the 'bio-energy stove' network who are willing to test their marksmanship by shooting at the sometimes small and difficult to hit bulls eyes set by spectrum of different stove using groups and customers?  It's the community of culturally and socially differentiated stove users who will and must decide whether a stove designer and fabricator have in fact created a stove product that is superior to the traditional stove products that presently dominate the market. The new stove has to convincingly outperform the traditional stove on its home turf.  To achieve that market performance a brave new stove has to so convincingly outperform the old faithful traditional stove that conservative minded stove users willingly switch to the new stove product.

Lastly, who is the boss when it comes to choosing the appropriate bull eyes for improved stove programs?  We need to know up front whether the

* stove buyers and users,
* stove producers,
* stove seller,
* stove funding agents (the World Bank and USAID and the carbon financiers),
* stove scientists, and
* government officials who make modern energy policies

have equal say and authority over design, performance and cost of the improved stove while it is under development, or whether the commitment to democracy by the government and facilitating agencies is simply a charade  and in reality – as George  Orwell warned us in Animal Farm - some role players (remember Mr Pig?) are 'more equal than others' in the confusing world of Orwellian speak???

What I am proposing is that representatives of all these stakeholders or constituencies make time to sit down together at the big table at the very beginning of R&D process to innovate, optimize, transfer/train, produce, distribute, and institutionalize improved stoves in Indonesia and in other biomass using countries to openly negotiate about what kinds of stove(s) make the most sense for particular user groups, producers, vendors, and regions.  All these role players will be assisted to clarify and advocate for stove functions and performance attributes they want, feel strongly about, and are willing to buy, produce, invest in and/or support.  These stakeholders will have to reason together, struggle and eventually compromise until they arrive at enough common ground to agree on a **prescription for a specific improved stove design for a specific user group.**Such a prescription will have to answer the following questions:

1. what will a first generation improved stove will look like (aesthetic appeal),
2. what functions must it perform?,
3. how it will be fabricated and out of what materials?,
4. where will it be produced and by whom?,
5. What is a fair price for the improved stove?
6. How much are different user groups willing and able to pay for an improved stove?
7. how will it be distributed and sold and with what mark ups?,
8. how many jobs will the improved stove create or eliminate?,
9. how long will it last?,
10. how much will it cost at the production site, the wholesale and retail price?,
11. what combustion and system efficiency does it need to achieve?,
12. how much fuel savings in comparison with the traditional stove is wanted?,
13. how will stove standards be established and maintained?

Once all the above stakeholders have bought into particular prescription for a first generation improved stove, it becomes possible to tell the stove scientist, thermodynamic engineer, materials engineer, business man, banker and government policy maker what the target is that they have all agreed to.  They become collectively responsible to each other for doing their level best to support and underwrite the development, testing, optimization and roll out of the first generation improved stove for a particular user group to which the stakeholders have  mutually agreed.

Ultimately we will probably have to work out the spiritual politics of the relationship between science and culture to get the 6 major stakeholders to come together and agree on a series of first generation improved stove.

If they cannot agree then I propose we resort to a **stove technology court** in which a panel of experts representing the interests of all these major stakeholders is formed and charged with assessing the improved stove prototypes by holding hearings from all role players who have something to say about what kind of biomass stoves and fuels will combine together to give the greatest benefit to the stove using and buying public, stove producers and stove sellers.  There are representatives of 6 different stakeholders sitting on the technology court.  It may be necessary to give the buyers/users and the producers and the vendors more than one vote when it comes time to decide between competing prototype stoves.

These stove technology judges may have to witness the ‘mother of all shoot outs’ at the OK Corral between the ardent (fanatical) proponents of the different competing stove technologies and camps.  But maybe not?:

* These stove technologies will have to give a guaranteed (unsubsidized) retail sales price over the next 12 months.
* The stoves will be operated by people from the target community who have been trained by the proponents of each type of stove technology.
* They will cook the same culturally valid meal and perform all the other functions which the user group expects its stoves to perform.
* After this ‘cooking shoot out’ the judges will review all the data on performance, including interviews with all the stove operators and follow up mixed focus groups composed of the operators of all the stoves.
* Finally there will need to be focus groups composed of onlookers from the target communities to get their votes and the reasons for favouring one stove more than other stoves.

 The panel of stove judges then retire, review all the evidence before them and decide which improved stove gets the highest score within the fit for purpose’ and appropriate assessment matrix. There is a reference to the idea of an environmental court – borrowed from idea of a science court that arrives at decisions about what is wort while to investigate - in a book written many years ago (1974) by Elting E Morrison, a historian of technology at MIT, **No-how to Nowhere: the development of American technology.**Morison was addressing the interface between S&T and culture where modern society is figuring out how to manage new technological powers, responsibilities and potentialities for disaster but there are as yet no agreed upon standards for managing these technologies or agreed upon principles to govern the distribution of responsibility for solving the environmental problems created the new technological powers.

My thought is that unless the stove community wises up it runs a serious of polarization, breakdown, and paralysis.  It could quickly degenerate into a repeat of the Climategate fiasco with scientists behaving badly and the looming threat of a destructive Hobbesian war of all against all while the glaciers melt away to nothing or advance into the next ice age, depending on your ideological and scientific predilection.  I think most participants on the bio-energy list will agree that as passionate as things sometimes get we do not want to descend into the non-science of 'stove-gate'.  We need to hold the center and make sure that stove science, testing, and the customers in need of low cost high performance biomass stoves get the benefit of the best stoves that our collective genius and ingenuity can create!

Morison recommended that we should radically decentralize the management of the application of western S&T to real world problems by creating a series of bio-regional environmental courts which would correspond to the major watersheds and river systems of each region, country and continent. These environmental courts would use the well established English common law tradition which gradually builds up precedents as judges and panels of wise, science literate men and women arrive at well thought out decisions about the best way to resolve particular conflicts between interested parties, long established standards and precedents when confronted by the opportunities and the potential threats posed by new science and forms of technology.  English common law encourages a bottom up process – in contrast to the Dutch-Roman law which is universal, therefore centralized, and tends to empower government officials and dis-empower citizens. .

Over time, if there are learned, independent minded, and public service oriented  men and women in charge of the **regionalized stove technology courts** in the extremely diverse regional and cultural environments of – for example - Indonesia, it is very likely over time that these regional technology courts or panels will  begin to accumulate evidence based knowledge about biomass energy systems and technologies through:

(i.)    testimony by interested stakeholders and invited experts

(ii.)   studies of socio-economic and environmental impacts of different stoves and biomass fuels,

(iii.)  examination of the the social and economic costs and benefits of alternative stoves-fuel combinations ,

(iv.)  the positives and negative consequences of different fuel supply chains, and

(v.)   the health and environmental problems caused by biomass burning under different household and urban settlement conditions.

The judges will apply use this evidence of cause and effect to decide on the balance of the evidence presented what they agree will be the most reasonable, fair, and majority serving way for the biomass stove industry to evolve in a particular bio-region.  The stove technology court becomes the focus for helping polarized interest groups  transcend their differences, explore latent commonalities, and discover cooperative solutions to what seemed at the outset to be a completely non-negotiable conflict of science, approach and interest. The challenge is to define, measure, and discover how to guide competing combustion technologies, different fuel supply chains, and even different assessment methodologies toward complementary outcomes that will create new synergies that serve the greater good of the community.  Competition between different biomass energy technologies, fuels, and systems can often be converted into complementarity (what Bucky Fuller liked to call synergy) by increasing the internal complexity and richness of the biomass energy economy.

Initially, there are likely to be winners and losers, but as stove S&T matures and ,earns how to more perfectly serve the public good, all the citizens and residents of a bio-region will benefit eventually be helped to prosper collectively and to thrive as individuals and families. This constructive process takes place when the S&T adjudication procedures and the criteria used to decide what stoves perform best in a given part of the world, or for a specific user groups, ensure that the bull-eyes mandated by the citizenry and particular stove using groups are validated and strengthened.  How do we get the stove scientists, stove producers, stove funding agents, and stove policy making government officials to all aim at the same bull-eyes?  It should be obvious that different stove using and biomass consuming publics benefits from cooperative stove R&D.  The costs of biomass energy will tend over time to decrease and the benefits increase as the stove science becomes more sophisticated, holistic, and powerful. If the major stakeholders and protagonists involved in the application of stove science and social science do not agree to cooperate and agree to collectively take aim at the same targets, what is the alternative?  They will divide and conqueror themselves and end up taking potshots at one another.  The village idiot will be put in charge of the stove technology assessment process which might well mean he will now busy himself painting circles on everybody's backside and wait to see who shoot first.  It is in our interest as a network of potentially aristocratic and even virtuous men and women of S&T to choose the high road, and to avoid High Noon shoot outs at all costs..

So, if you can’t take the heat I strongly recommend that you do the honourable thing and get out of kitchen and let all the other sweating stove scientists and producers get on with creating their second and third generation improved stoves.  However, there is such a diversity of different kinds of stove using groups and communities in the developing world  I am confident  that as we go forward there will be more than enough commercial niches for each and every one of the major different types of biomass combustors.

So be it!

In service,

Cecil Cook