



Oregon

Theodore R. Kulongoski, Governor



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September 25, 2007

Tom Eckman
Charles Grist
Northwest Power and Conservation Council
851 SW Sixth Avenue
Suite 1100
Portland, OR 97204-1348

Re; Field study of Northwest Energy Efficient Manufactured Home Program (NEEM) home performance co-funding request

Dear: Mr. Grist and Mr Eckman,

Please find below the proposal for the 2007 Field Study of NEEM Home Performance and corresponding Proposed Statement of Work. As you know efforts to improve the energy efficiency of manufactured housing in the Pacific Northwest have proved quite successful over the past decade. Even after the incentives offered by BPA's Manufactured Housing Acquisition Program (MAP) ceased in 1995, manufacturers continued to respond to consumer market demand for homes built to Model Conservation Standards and the Oregon Energy Code.

The performance of these homes depends critically upon shell and duct air sealing, as well as insulation and window performance levels. While prescriptive air-sealing requirements have remained constant, some manufacturers have adopted more aggressive duct sealing strategies, in - plant duct testing and more change is on the way. With the advent of the Energy Star homes and PTCS, the manufacturers have become more interested in meeting more aggressive, performance-based duct sealing standards.

Over the years three random samples of homes have been tested in detail to establish the impact of the envelope and duct sealing specifications on the homes as sited. The field-testing undertaken as part of the MAP evaluation used a sample of sufficient size to allow inferences about performance differences between states. Field results, coupled with the in-plant quality assurance (including duct testing and inspection) have been the basis for identifying areas that need improvement in the manufacturing and set-up process.

Given the changes in specifications and the new requirements for Energy Star, a field study of Energy Star Manufactured Homes should be undertaken. Furthermore, agreements with the Energy Star program as well as the regions utilities have committed the region to a periodic evaluation of the homes as sited.

For this work, the Oregon Department of Energy and Washington State University, Idaho Department of Water Resources and the Montana Department of Environmental Quality have agreed to provide the staff to do the field testing, and findings will be shared with home manufacturers and policymakers. Current commitments from State Energy Office and NEEM funding sources would cover only part the field work required.

The RTF has been a consistent supporter of energy efficient manufactured housing programs in the past and its assistance on this project is key to further understanding the current state of the industry. The RTF funds along with Bonneville funds and Alliance funds would leverage the existing funding sources to provide sufficient resources to ensure a regionally representative sample that can be used to evaluate the performance of the Energy Star homes from 2006 production. The overall impact of the RTF, Alliance, and Bonneville and participation would be to increase the number of homes sampled (improving statistical confidence intervals), increase the measures investigated and to expand the analysis to include a more detailed hot water and heat pump and lighting usage in addition to the data which will be gathered that is comparable to the previous field studies.

Proposed Statement of Work

The Proposed SOW is to complete a field study on manufactured homes built to current Energy Star specifications which will be the first look at Energy Star only homes. Work will be carried out on at least 114 units, the sample size being dictated by the expected coefficient of variation in the key measurements (e.g. duct tightness and envelop air tightness). Sampling should be done to provide adequate state-by-state samples in the states of this region. It is expected this will lead to numbers on the order of 38 sites for Oregon and 43 sites for Washington, and approximately 35 sites in Idaho and western Montana.

Table 1 Sample Designs

State	Sitings	Samples			
		Random All	Random Region	Random State	Purposed
AK	25	0	0	5	0
AZ	4	0	0	4	0
CA	434	9	0	17	0
CO	6	0	0	6	0
ID	595	12	15	18	18
MT	231	5	6	17	17
NV	131	3	0	16	0
OR	1435	30	36	18	36
UT	217	4	0	17	0
WA	1720	36	43	18	43
WY	11	0	0	11	0
Total	4809	99	100	147	114

Table 1 shows the distribution of various sample designs for the purposes of this effort. At the outset, the regional sample was meant to establish performance values of the mean population at the level required to maintain a 95/5 confidence and significance criteria. For the individual states a minimum 90/10 sampling requirement was maintained. With this criteria an overall sample size was calculated to be 114 individual cases selected at random throughout the

region. The distribution shown here assumed that such a random sample would be distributed as the ratio of individual states to the overall production.

The study will be designed and managed by Ecotope, Inc., who will also train field technicians, do the analysis and write the report. The basic study design and protocol would parallel the previous studies. Field work will be carried out by experienced field technicians (many of whom worked on previous field assessments). The project's term would run from November 2007 to December 2008. Work will commence as soon as a sample can be drawn. Fieldwork should begin in November and be substantially complete by March 2008.

Specific field activities:

- Measure tightness of building shell and duct system
- Measure airflow and static pressure in the HVAC system in order to calculate supply leakage fraction (which has direct bearing on overall heating system delivery efficiency)
- Measure flow rate through whole-house exhaust fan
- Evaluate compliance of home set-up with statewide set-up rules
- Record other key data which have a bearing on home performance and occupant health/safety (such as whole house fan run-time, etc)

Proposed Budget

1. Sampling and recruitment

Baylon	40	hrs	120	4800
Phone recruitment	250	homes	80	20000

2. Protocol and training

Baylon	12	hrs	120	1440
Davis	40	hrs	100	4000

3. Field work

Homes	114	homes	800	91200
Davis	40	hrs	100	4000

4. Data entry and cleaning

Strand	80	hrs	85	6800
Baylon	24	hrs	120	2880

5. Data analysis & report

Davis	48	hrs	120	5760
Baylon	100	hrs	100	10000

Total				150880
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Proposed Funding

ODOE contribution (USDOE BAIHP) - Committed	35880
NEEM (fees from manufacturers & SEO inkind) - Committed	25000
Northwest Energy Efficiency Alliance (amount requested)	25000
Regional technical Forum (amount requested)	15000
Bonneville Power (amount requested)	35000
IOU utility 5K each PSE, ETO, IP (amount requested)	<u>15000</u>
Total	150,880

Since this represents a significant regional field project several added components to the scope of work would be feasible. These components would go beyond the current field protocol and budget:

1. The manufactured home lighting design is unique in the residential sector in that typically the overhead lighting is all on a single circuit and not part of the outlet circuits. This provides an opportunity to directly measure lighting use and assess the on-time of the lights in the circuit using conventional CT monitoring equipment. A complete assessment of the lighting system would include a detailed light assessment including a LPD review and an assessment of the degree to which the “lighting” circuit handles the full lighting. Such a review would provide a direct measure of aggregate lighting on-time in residential occupancies. We believe that such a review could be done with a single CT but it may be desirable to add other circuits
2. An added CT to monitor DHW would be a straightforward addition. This sort of data could be used to reassess the RCDP findings (which haven’t been repeated since 1990). Such information might be expanded some to assess the potential for HP Water Heaters as a potential measure.
3. A visual assessment of the potential for mini-splits in these homes could be added although the uses of ductless systems might not be as easily marketed to home with an existing duct system.

Supplemental Funding not in the above budget

Lighting monitoring and audit:	
Equipment: 50 homes	25000
Audits, placement	10000
Analysis	10000
DHW review	
Equipment 50 homes	20000
Audits, Placement, Analysis	5000
Mini-Split review	<u>5000</u>
Total supplemental	75000

Proposed Deliverable Schedule

Detailed sample drawn and protocol prepared	October 2007
Initial fieldwork begun	November 2007
Fieldwork substantially complete	March 2008
Draft report	June 2008
Final report	September 2008
Billing analysis	December 2008

NEEM would expect to perform a similar random field survey every 3-4 years in the future and would appreciate working with the RTF and the regional utilities and planning bodies to make that possible.

Tom and Charlie, the NEEM program would like to thank you and the RTF for considering participation in this critical random sampling project. If you have any questions regarding our request, please contact me, Tom Hewes, at the Oregon Department of Energy at 800-221-8035.

Sincerely,

A handwritten signature in dark ink that reads "Thomas Hewes". The signature is written in a cursive style with a large initial 'T' and 'H'.

Thomas Hewes
Manager of Northwest Energy Efficient Manufactured Home Program
Oregon Department of Energy