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## **BUILDING CONSTRUCTION TECHNOLOGY ROADMAP**

Part 5:

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Impacts on Copper

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## PART 5:

# Impacts on Copper

## Implications for the Copper Industry

The implications of this Building Construction Technology Roadmap as they specifically relate to the copper industry are significant.

The world is changing and the way we will live is going to change. In analysing the implications for copper over the next 10 to 20 years we have tried to downplay technology fads, and we have looked rather at the opportunities for pioneering technology applications.

We have made technology subservient to the core trends and values predicted in building construction rather than the other way around. We have worked on the principle that the right technology will accelerate trends seen as emerging. We forecast that the home of the future will be increasingly 'connected' and that there will be a number of technologies emerging to enable the home to be operated more intelligently and efficiently internally and to connect more effectively with the outside world.

## Current Role of Copper

Copper's role in building construction has evolved gradually as the application of technology developments finds its way into the hands of consumers in the home.

From the original supply of water through copper tubes, copper now provides the platform or conduit for the following within the home:

- Power
- TV
- Audio
- Water
- Data
- Telephone
- Pumps, motors and actuators
- Gas
- Heating
- Cooling
- Meters
- Internet
- Computer chips.

## Key Trends

The Roadmap projects a future of increasingly complex technology in an aging, time-poor society with a decreasing base of technical service support.

Energy and water will become increasingly precious and costly commodities and there will be an increasing array of alternative energy services available which will struggle to gain viable market share.

More and more people will work from home or within their immediate communities as transport costs rise and security issues become more prevalent.

There will be an increasing demand for friendly and aesthetic systems to make life easier.

The population will age and they will increasingly have to stay in their own home and in their communities.

## Key Copper-Related Technology Opportunities

- The evolution of a reliable 'harnessed system' for wiring the home for all services. This harnessed system will be computer-designed and prefabricated for cost-efficient installation and will be able to be readily connected for extension to alternative systems such as fibre-optic and wireless.
- The development of a project to connect all appliances in the home via a data network so that they may be serviced and maintained by external analysis. This system also enables those appliances which are high in energy usage to be turned on/off by regional providers to avoid occasional peak demand breaches.
- The development of a project that will assist the merger of alternative energy sources such as solar photovoltaic and solar thermal to the existing network. This may include solar thermal storage batteries, solar collectors and piping systems.
- Participation in the development of water systems that require additional (recycling) piping, pumping and processing for water separation, collection and re-use.
- Development of a project to provide flexible power supply over a low voltage power bus.
- Development of highly efficient gas appliances to provide instantaneous water heating using copper heat exchangers. The project is to identify the potential for combining water heating and refrigeration (for air conditioning) at the same time.

## The Future Role of the Copper Industry

The Copper Industry will continue its role to support the Building Industry to meet the future demands of governments, partners and consumers.

## Technology Roadmap for Copper in the Home

The Building Construction Technology Roadmap project has identified a number of areas where the Copper Industry should be involved in either a technology development role or a collaborative market development role.

These areas have been ranked in the following pages according to their potential for the Copper Industry.

### Ranking 1

TREND	ENABLING TECHNOLOGY
Increased connectivity. Movement towards automatic home management. Increase in home entertainment. Increase in technology-driven amenity. Increase in home working.	Smart and star wiring for power and data transmission.

Current Status	Project	Possible Participants
The concept and practice of smart wiring is in the market place and gaining acceptance. The installation process of smart wiring requires development and refinement to reduce costs, improve aesthetics and to widen application to existing dwellings.	<ol style="list-style-type: none"> <li>1. Improve installation design for new homes.</li> <li>2. Research and develop installation concepts for retrofit to existing dwellings.</li> </ol>	Design group co-ordinated by CDC such as: <ul style="list-style-type: none"> <li>● Services engineer – developer, architect, builder</li> <li>● Installer</li> </ul>
	<ol style="list-style-type: none"> <li>3. Develop cheaper, more compact, flat copper cable.</li> </ol>	<ul style="list-style-type: none"> <li>● Cable manufacturer</li> </ul>
	<ol style="list-style-type: none"> <li>4. Develop improved connectors across moveable wall panels.</li> </ol>	<ul style="list-style-type: none"> <li>● Electrical manufacturer</li> </ul>
	<ol style="list-style-type: none"> <li>5. Develop improved connectors: copper/fibre-optics.</li> </ol>	<ul style="list-style-type: none"> <li>● Electrical manufacturer</li> </ul>
	<ol style="list-style-type: none"> <li>6. Design installation of 12v bus and supporting system.</li> </ol>	<ul style="list-style-type: none"> <li>● Services engineer</li> </ul>
	<ol style="list-style-type: none"> <li>7. Develop improved ducts and skirtings for cable installation.</li> </ol>	<ul style="list-style-type: none"> <li>● Extrusion and moulding manufacturers</li> </ul>
	<ol style="list-style-type: none"> <li>8. Train installers.</li> </ol>	Industry associations, e.g.: <ul style="list-style-type: none"> <li>● Australian Electrical and Electronic Manufacturers Association (AEEMA)</li> <li>● National Electrical and Communications Association (NECA)</li> <li>● Custom Electronics Design and Installation Association (CEDIA)</li> </ul>

Ranking 2

TREND	ENABLING TECHNOLOGY
Domestic use of recycled grey water for garden irrigation, toilet flushing and possibly for external bush fire protection sprinklers.	The reticulation in and around the home of grey water – before and after treatment – using copper pipe.

Current Status	Project	Possible Participants
Some housing estates have treatment plants and hence third pipe reticulation in the home. The current use of grey water varies very much from state to state.	<ol style="list-style-type: none"> <li>Promote copper as material of choice.</li> <li>Develop acceptable colour coating or banding to identify use, both of pipe and joints.</li> </ol>	<ul style="list-style-type: none"> <li>CDC to co-ordinate</li> <li>Paint/coating suppliers</li> </ul>
	<ol style="list-style-type: none"> <li>Develop leak-proof joints.</li> </ol>	<ul style="list-style-type: none"> <li>Plumbing suppliers</li> </ul>
	<ol style="list-style-type: none"> <li>Market copper to developers/builders and plumbers for this application, for inclusion in new homes now, for future use.</li> </ol>	<ul style="list-style-type: none"> <li>CDC</li> </ul>
	<ol style="list-style-type: none"> <li>Support lobby to governments to permit use of grey water.</li> </ol>	<ul style="list-style-type: none"> <li>CDC</li> </ul>

### Ranking 3

TREND	ENABLING TECHNOLOGY
Domestic use of recycled grey water for garden irrigation, toilet flushing and possibly for external bush fire protection sprinklers.	Small packaged automatic treatment plant with diversion, pumping and storage of untreated and treated grey water.

Current Status	Project	Possible Participants
<p>For use as subsurface irrigation, only low-level treatment is required and several plants are currently on the market.</p> <p>For use in toilet flushing, spray irrigation and washdown, a higher level of treatment is required.</p> <p>Some plants are on the market but are expensive.</p> <p>Each state requires accreditation for health reasons.</p> <p>Several brands are accredited in Queensland. None are accredited in NSW.</p> <p>Suppliers consider it too difficult and costly to develop processes to meet NSW requirements.</p>	<ol style="list-style-type: none"> <li>1. Support the development of cheap, effective treatment plants which will meet the (especially NSW) government requirements.  (The technology is apparently quite complex and doubts exist in the industry as to its effectiveness).</li> <li>2. Support industry in approaching governments for more pro-active input.</li> <li>3. Support marketing of the use of treatment plants.</li> </ol>	<ul style="list-style-type: none"> <li>● State Government health departments – see as an example website<sup>1</sup> below</li> <li>● Manufacturers and suppliers – see website<sup>2</sup> below</li> <li>● Consulting engineers</li> </ul>

<sup>1</sup> <http://www.health.nsw.gov.au/public-health/ehb/general/wastewater/wastewater.html>

<sup>2</sup> [http://www.nrme.qld.gov.au/compliance/wic/onsite\\_sewerage\\_approvals.html](http://www.nrme.qld.gov.au/compliance/wic/onsite_sewerage_approvals.html)

### Ranking 4

TREND	ENABLING TECHNOLOGY 1
Increased use of gas as an energy source in the home – more efficient and more eco-friendly than electricity.	Distribution of gas to the home. Reticulation within the home using copper pipe.
	ENABLING TECHNOLOGY 2
	Instantaneous heating of water using gas gives higher efficiency and low waste. Store heat. Also use heat in air-conditioning for the home.

Current Status	Project	Possible Participants
1. Gas supply. Some areas within major cities are not connected to gas supply.	<ol style="list-style-type: none"> <li>1. Support lobby to gas suppliers to widen distribution.</li> <li>2. Promote the use of gas.</li> </ol>	<ul style="list-style-type: none"> <li>● CDC and gas companies</li> </ul>
2. Instantaneous gas, fired water heating. Technology exists – work in progress by manufacturers to produce cheaper and more efficient products, aimed at improved savings in energy and water.	<ol style="list-style-type: none"> <li>3. Support manufacturer in developments of heater/air conditioner package using heated water as part of a gas fired absorption refrigeration system for cooling interior air.</li> </ol>	<ul style="list-style-type: none"> <li>● CDC and hot water system manufacturers</li> </ul>

Ranking 5

TREND	ENABLING TECHNOLOGY 1
Increased use of renewable solar power, and solar heating.	<p><i>Solar Power</i></p> <p>Photovoltaic cells generate electricity which is then stored in batteries. Currently the market is increasing. Efficiency is also improving but cost remains uncompetitive with cheaper mains power. Costs are coming down.</p>
	ENABLING TECHNOLOGY 2
	<p><i>Solar Heating</i></p> <p>Solar panels capture heat. Heat stored and used for water heating and heating of the home. Can also be used in part of a system integration gas-fired water heating and refrigeration for air-conditioning.</p>

Current Status	Project	Possible Participants
Solar power technology is well-developed and is continually being improved. Developments in solid state electronics allow energy stored in batteries to be easily inverted to AC and transformed to required voltages. UNSW is a market leader in the technology.	<p>Support:</p> <ol style="list-style-type: none"> <li>1. The continuing improvement of efficiency and reduction in cost of output.</li> <li>2. Development of improved battery storage to overcome safety doubts associated with lead/acid batteries. UNSW is also a leader in development of Vanadium Redox batteries.</li> </ol>	<ul style="list-style-type: none"> <li>● CDC with:                             <ul style="list-style-type: none"> <li>– Solar research community</li> <li>– Battery manufacturers</li> </ul> </li> </ul>
Solar heating technology is well advanced. Solar thermal storage systems have been developed over the past 30 years by companies such as Rheem with input from CSIRO. Ongoing R&D in place to improve efficiencies.	<ol style="list-style-type: none"> <li>1. Assist in promotion, as increased cost of electricity and gas makes solar heating more competitive.</li> <li>2. Further R &amp; D to improve efficiency of heat transfer and storage.</li> </ol>	<ul style="list-style-type: none"> <li>● CDC to support</li> <li>● Hot water heater manufacturers</li> </ul>

## Ranking 6

TREND	ENABLING TECHNOLOGY 1
Use of small efficient electricity generators in the home as stand-by source and to provide peak lopping capacity. Sell surplus power back into grid. Use exhaust gas from turbine for heating of water and the home.	Mini/micro gas-fired turbo generator sets of about 8 kW capacity to meet maximum home need.
	ENABLING TECHNOLOGY 2
	Heat exchanger fitted to back end of turbine to utilise exhaust gas.

Current Status	Project	Possible Participants
Gas fired turbine/generators of about 20 to 100 kW capacity are currently on the market, sourced from the USA. European and Japanese companies are also developing equipment. Units are very compact (75 mm diameter). They spin at 100,000 rpm and exhaust gases are very high pressure and very hot. They are open cycle, and very expensive. Costs do not compete with mains supply costs.	<ol style="list-style-type: none"> <li>1. Support development of smaller, cheaper units.</li> <li>2. Support government legislation allowing sale back into the grid of surplus power.</li> </ol>	<ul style="list-style-type: none"> <li>● Motor &amp; generator manufacturers</li> <li>● Instrumentation manufacturers</li> </ul>
Heat exchangers not fitted to generator sets because of the high cost of overcoming the problems of high exhaust pressure and temperature – but technically feasible.	<ol style="list-style-type: none"> <li>1. Support development of cheap heat exchangers to marry with turbo generators.</li> </ol>	<ul style="list-style-type: none"> <li>● Heat exchange manufacturers</li> </ul>

## Ranking 7

TREND	ENABLING TECHNOLOGY
Increased awareness of the use of resources such as waste and energy.	Displays which show real time read out on power, water or gas consumption and cost.

Current Status	Project	Possible Participants
<p>Meters designed in Australia and manufactured in China that give electricity read out are now on the market through Clipsal.</p> <p>Development is underway to include gas or water read-out.</p> <p>Display can either be wall mounted or portable hand-held.</p>	Support further development and marketing of meter.	<ul style="list-style-type: none"> <li>● Electrical equipment manufacturers</li> <li>● Instrumentation manufacturers</li> </ul>

**Ranking 8**

TREND	ENABLING TECHNOLOGY
Use of programmable and/or remotely controlled features including windows, shutters, doors, security and climate control, lighting, audio and entertainment.	A combination of accessible power and data in and to the house via smart cabling. Sensors, micro processors and electric motors activate the features and appliances.

Current Status	Project	Possible Participants
The enabling technology is available and on the market. Remote control door locks are now entering the market.	<ol style="list-style-type: none"> <li>1. Support continuing development to reduce cost.</li> <li>2. Support marketing of product.</li> </ol>	<ul style="list-style-type: none"> <li>● CDC with:                             <ul style="list-style-type: none"> <li>Electrical equipment manufacturers</li> <li>Hardware manufacturers</li> </ul> </li> </ul>

**Ranking 9**

TREND	ENABLING TECHNOLOGY 1
<p>Appliances are networked to allow reduction of peak power consumption by programmed priority and/or remote control.</p> <p>Appliances have condition monitoring sensors which transmit data to a central maintenance provider or to the manufacturer, giving enhanced reliability and maintenance service.</p>	ENABLING TECHNOLOGY 2
	<p>Appliances connected by a data network – as part of the overall cabling of the home. Programmable controls provide the management function.</p> <p>Condition monitoring sensors built into appliances. Data flow via broadband network to central location, where diagnostic analysis carried out.</p>

Current Status	Project	Possible Participants
Appliance networking technology exists, but requires assembling and packaging into an attractive and marketable concept supported by manufacturers.	<p>Support development of packaged system by manufacturers to provide an attractive and efficient product for home owners.</p> <p>Support development of maintenance systems – both data acquisition and transmission – and response function.</p>	<ul style="list-style-type: none"> <li>● CDC</li> <li>● Appliance manufacturers – system integrators</li> <li>● Electrical equipment manufacturers</li> <li>● Electronic equipment manufacturers</li> </ul>

## Ranking 10

TREND	ENABLING TECHNOLOGY
<p>Programmed furnishings for comfort, entertainment and possibly health monitoring, particularly for the elderly and infirm.</p>	<p>Programmable functions for furnishings – incorporating electric drives for positioning and temperature, audio controls – can be linked in with entertainment systems, to enhance feel and sound.</p> <p>Touch pad life sign monitors with data transmission to central location for analysis and diagnosis.</p>

Current Status	Project	Possible Participants
<p>Much of the technology is already incorporated into motor vehicle seating and in some furniture.</p> <p>Further development is required.</p> <p>The health monitoring aspects require development in concert with the bio-diagnostics industry.</p>	<p>Support development of the concept of the "enviro pleasure chair".</p> <p>Support development of the incorporation of health monitoring into furnishings.</p>	<ul style="list-style-type: none"> <li>● CDC               <ul style="list-style-type: none"> <li>– Furniture industry association, AEEMA</li> <li>– Equipment suppliers</li> <li>– Medical diagnostic companies</li> <li>– Bio-engineering companies.</li> </ul> </li> </ul>

**BUILDING CONSTRUCTION  
TECHNOLOGY ROADMAP**

Part 5

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