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Submission to the Independent Inquiry into 2019 – 20 Victorian Fire Season

Summary
Real change is needed to the way we manage bushfires in this country. We are entering a new climate reality and past/current practices, including cultural burning, will not be sufficient to prevent major fires in future. Aging and declining numbers of volunteers will further reduce our capacity to deal with major fires. More burning will not prevent the spread of fires in this new climate and is not the solution. To prevent major fires, agencies must adopt more effective systems of initial attack. This requires better detection of fires with web-based cameras and using more effective technologies to control fires faster with fewer people. Rather than more large aircraft, a more effective ground-based system of using ground applied retardant with tracked carriers would allow agencies to control fires faster and at a lower cost. It would also reduce the reliance on volunteers. Better protection for communities and assets can be achieved at little or no cost to agencies by mechanically harvesting fire hazards and using them for energy. Adopting these measures will minimise both the economic cost of fire management and the occurrence of major fires.

Introduction - We need change
I, like many others who make submissions to this inquiry, have made similar submissions to previous inquires. I'm sure they also share my frustration with the fact that nothing changes, history keeps repeating itself, and we then have yet another inquiry. The Victorian government and agencies should use the current high level of public support to make substantial changes in the way we manage bushfires.

New climate reality
We are entering a new climate reality. The unprecedented level of destruction caused by these fires is ample evidence of thatVictorias' climate has changed from what it was 50 years ago and totally different from what existed prior to European settlement. We also exist in a new operational reality with much tighter controls and expectations on all aspects of land and fire management, combined with a shrinking window of suitable weather for burning. These new realities mean that we cannot continue to use the same techniques and practices in fires management that we used to. We can't just keep doing more of the same! These new realities also mean using Aboriginal burning practices won't be effective or practical. Another new reality that must be considered is our aging and declining numbers of volunteers. Increased frequency and intensity of bushfires along with higher operational standards means increased pressure on volunteers which will certainly lead to "burn out" and reluctance to be involved. Particularly for larger "campaign" fires.

Burning not the solution
While there have been numerous calls for more fuel reduction burns, anyone who has been directly involved with fuel reduction burning knows that fuel levels return to what they were prior to burning in 5 to 6 years. They also know that burns usually only achieve 60% to 80% coverage meaning, under bushfire conditions, a fire can use these unburnt areas to "skip" across a recent burn with little reduction in its rate of spread. The intensity of the fire will be reduced but unless there are crews on the ground ready to take advantage of that reduction in fire intensity, the burn will have no

impact on the eventual size of the fire. More frequent burning (less than 5 years) will reduce the average fuel load but will prevent overstory regeneration and favour grasses. This change to the vegetation structure will cause a loss of animal species and higher rates of fire spread. Much longer burning cycles (30 to 50 years) will result in a similar outcome as understory species senesce and overstory species reach a climax state. Broad scale burning should still occur but it should be based on the ecological needs of the vegetation community, not for fire prevention.

Effective Initial Attack
There is one aspect of fire management that still applies in these new realities. The fundamental truth that - "THE SAFEST, MOST EFFECTIVE AND EFFICENT WAY TO CONTROL LARGE FIRES IS TO PUT THEM OUT WHILE THEY ARE STILL SMALL."

Effective initial attack remains the key to preventing major fires. If we were 100% successful with initial attack then there would be no large fires in Victoria. While it's highly unlikely this will ever happen, it should be the goal of all agencies. If this inquiry wants to find out how to prevent these types of fires from happening again then it needs to go back to when they started and ask the question; why wasn't that fire contained during the initial attack. The answers will tell you what you need to change to prevent a reoccurrence.

Initial attack usually fails for the following reasons:

Not detected early – Effective initial attack relies on early detection to be successful. Victorias' fire detection system has remained largely unchanged for decades despite recent advances in technology. Modern web-based surveillance cameras allow fires to be detected quickly and at any time of the day, an example can be seen at: https://rockyags.cr.usgs.gov/dashboards/WebCam.htm While they are not a replacement for human observers, they allow detection of fires, particularly lighting strikes at night and at times or in places when lookouts are not manned. They are low cost and reliable and our fire agencies should adopt them. Attachment 1 is a project proposal to install up to 4 cameras in Western Victoria.

Initial attack crews arrive early but are unable to establish control line quickly enough – This is the primary reason why initial attack on bushfires fail. I recommend the inquiry obtain statements from crew members involved in the initial response to each major fire and ask them why they couldn't contain the fire. I'm confident their answer will be along the lines of "they couldn't get around it quick enough" or "it got too big too fast". The basic firefighting system used in Victoria (bulldozer and 4WD tanker with crew) hasn't changed in over 60 years. If we want to be more effective at initial attack, we need more effective technology.

Aircraft, particularly large air tankers, are often suggested as a solution. While small aircraft are extremely useful in providing initial suppression, they must be reinforced by ground crews and control lines. Large aircraft were deemed not cost effective after their use during the Victorian Ash Wednesday Fires in 1983 and an independent review of their performance during these fires will find nothing has changed. They suffer from what I call the Large Aircraft Paradox. Because they are so expensive, they aren't deployed to a fire until that fire is serious enough to warrant the expense. Unfortunately, by then it's too late for them to make a difference in controlling the fire. They can provide support for ground crews and look very impressive for the media but the funds would be better spent ensuring the fire was controlled much sooner. Aircraft usually can't be used at night or in smoke so investing heavily in a fire control system that can't be used for half the day or in smoke does seem questionable.

There appears to be a trend by agencies to favour indirect method of attack by using existing roads and tracks as the fire perimeter and back burning the unburnt areas between the existing fire edge and proposed control line. While this approach can be effective, it does increase the size of the fire significantly and means you have more fire area to manage with a longer control line. As a result, the risk of escape is much greater. Direct attack with heavy machinery, were possible, is the safest and most effective method of control.

Extreme fire behaviour makes initial attack too dangerous – This is certainly the case for front of bushfires burning in severe or extreme fire danger conditions but the flanks of those fires can be managed using methods of indirect attack. It requires experienced and suitably equipped personnel but it is possible to control the flanks, particularly the eastern flank, thereby limiting the spread of the fire if the wind changes.

A potential solution

There is a relatively low-cost fire suppression system that would allow small crews to contain bushfires much faster than we presently do. It's called Ground Applied Retardant (GAR) and was first used operationally in Australia by VicRoads during the 2003 NE Victoria Fires to protect timber bridges. Attachment 6 is a copy of technical note covering that use. In 2004 Parks Victoria staff used GAR as a control line for an ecological burn in important heathland. The GAR line worked extremely well despite being subject to intense fire behaviour from the long unburnt heath. In 2005 I wrote a report (Attachment 2), while employed with the organisation currently known as the Victorian Department of Environment, Land Water and Planning (DELWP), detailing the potential of using a tracked carrier system and GAR. Using this type of suppression system would not only reduce the size and cost of bushfires, it would reduce the reliance on volunteers.

Using GAR this way would allow fire line to be established at up to 15kph (10 to 30 times faster than other ground-based systems). The Department took no action on my report. In 2013 local Parks Victoria staff arranged a trial of GAR and a tracked skidder know as a Fire Tracker. The trial of this combination showed considerable promise. Attachment 3 is brief report on this trial. The Fire Tracker is a tracked logging skidder fitted with a 5,000 litre water tank, spray system and hose reel. It also has a dozer blade and forestry rated cabin. They are produced by KMC in Canada, see: https://www.kmc-kootrac.com/remanufacture/firetruck They normally only seat one person but can be fitted with additional seating. Attachment 4 is an email from the company regarding this.

A detailed report by Parks Victoria staff recommending increased the use of these machines was provided to DELWP but no action has ever been taken and the machine has never been used in a fire role since. Attachment 7 is a copy of this report (my brother Graeme, was the author). I have also attached another report by my brother on a trial of other types of retardant including jellied water (Attachment 8).

Better Community Protection

While effective initial attack should be the primary goal of all fire agencies, it's unlikely to ever be 100% effective and communities would still need to prepare for fire. At present fire hazards around communities and other assets are either burnt in a fuel reduction burn (FRB) or slashed. Achieving the desirable level of protection with FRBs is difficult due to the shrinking window of opportunity with weather and the increasing operational restrictions due to smoke management, hazardous trees, resourcing levels and environmental limitations. All of this makes burning difficult and expensive. Slashing is expensive and only alters the fuel arrangement, not the amount present.

A more cost-effective way to overcome these problems is mechanically harvesting this hazardous material and using it to heat a public facility such as an indoor pool or hospital. The harvested material would be supplied to these sites at cost thereby offsetting the harvesting cost while delivering increase protection from bushfires. Attachment 5 is a proposal to trial this system of hazard management including indicative costs. My preliminary costings show this approach would be economically viable and has the potential to both improve community safety and reduce operating costs for councils and fire agencies.

Conclusion

The technologies I have suggested to improve the detection and suppression of bushfires, as well as increasing fire protection to communities, would not only reduce the impact of bushfires on our landscape and communities, they would also reduce the operating costs of the various agencies involved. I hope those leading the inquiry will support these suggestions.

Yours sincerely,

Daryl Scherger

Attachment 1

Webcam – Early Fire Prevention Project

by Daryl Scherger

Why is this project needed?
Climate change has exacerbated both the frequency and intensity of bushfires and other extreme weather events. Adapting community responses to these events is critical for personal safety. Fires and storms develop quickly and critical information may be incorrect by the time its broadcast. Access to current information, at any time, on extreme weather events is needed to better inform both the public and emergency services. A better informed public will be safer and respond more appropriately. The earlier local fire services are aware of a fire the more likely they will be able to achieve a successful initial attack. Accurate local weather conditions are critical for both crew safety and effectiveness.

There are currently only 13 BOM automatic weather stations and half that number of manned lookouts covering the entire Grampians Region and the lookout are generally only staffed 8 hours per day. Increasing the number weather data and visual observation points will improve weather forecasts and fire response times.

What are the proposed outcomes?
The outcomes of this project will be better informed emergency services personnel and general public on bushfires and extreme weather events in their area. This will be achieved by providing access to real time video and weather data from strategic locations in the Grampians Region. The information provided by combination camera weather stations will be linked directly to the internet allowing residents and emergency services personnel to make better informed decisions which will lead to more effective response by emergency services and improved public safety.

What are the proposed outputs?
This project will place weather cameras on One Tree Hill and Bald Hill in Ararat Rural City and Camp Hill and Mt Emu in the Pyrenees Shire. They will relay live video and weather data via microwave links to the respective council offices and the live feed uploaded to the internet for public access. The camera located on One Tree Hill overlooks Ararat and the Eastern side of the Grampians (much of which is not covered by any lookout at present) and the one on Bald Hill overlooks Willaura and the Southern Grampians. The one on Mt Emu overlooks Skipton and Snake Valley and the one on Camp Hill overlooks Beaufort, Raglan and the Eastern side of Mt Cole.

Each site will be a remote-controlled Pan, Tilt and Zoom (PTZ) camera linked to an automatic weather station with the outputs of both linked via microwave to the internet. Each site will have its own solar panel and battery storage to provide sufficient power to operate continuously. The camera will be housed in an all-weather housing with 360^{o} pan, 90^{o} tilt and lens cleaning capability.

The project outcomes will be reported on the DELWP and participating council. Because the cameras are continuously online, the results will be available and obvious to any interested party. Unfortunately, the true benefit of the project will only be realised in an emergency however it is expected there will be a large amount of general use by emergency service personnel and local residents monitoring the local area during high fire danger days and generally checking the weather in their area. Regular access will ensure emergency service personnel and residents become familiar with the sites and therefore more likely to use them in an emergency.

A dedicated project officer has been included in the proposal due to the complexity of the project as it would be occurring at multiple sites with multiple parties involved. A project officer would lead and champion the project and provide a point of contact for other groups/regions interested in adopting a similar program.

Project Budget
Below is an indicative budget for the project as described. Camera and communication technology are advancing rapidly with numerous companies offering these types of systems. The eventual cost of four camera systems is likely to be less than the indicated price meaning more than four systems may be possible. If less funding is available fewer cameras would be installed. Fewer cameras would reduce the projects potential but would still give an indication of what may be possible. It also would mean a dedicated office may not be required and the project could be managed as part of an existing council officer's duties.

Income Description	$	Expenditure Description	$
DELWP Grant	80,000	Weather camera – One Tree Hill	12,000
Lead Council in-kind - Project management, admin and IT support	13,000	Weather Camera – Bald Hill	16,000
Partner Council in-kind – project management and knowledge sharing	5,000	Weather Camera – Camp Hill	14,000
		Weather Camera – Mt Emu	13,000
		IT system and website development	6,000
		Staff salaries (project officer @ 0.2 EFT)	25,000
		Learning and Knowledge Sharing	5,000
		Project Administrative Costs	5,000
		Monitoring and Evaluation	2,000
Total	**98,000**		**98,000**

Project Milestones

Activity Deliverables and Payments Table			
Deliverable	**Demonstrating deliverable is complete**	**Due date**	**Payment amount (excluding GST)**
Milestone One Planning	Evidence • Project Control Group (PCG) established and terms of reference documented per PCG minutes • Project Officer appointed • Detailed Project Plan completed • Community engagement plan developed	TBA	$20,000-

	• Regulatory requirements identified and applications lodged Reports: Progress Report		
Milestone Two Design	Evidence • Detailed concept plan for each proposed site completed • Contract specifications for tender process • Community engagement commenced per PCG minutes • Copy of written permission to install proposed camera systems obtained from managers of the proposed sites (Parks Victoria for One Tree Hill, GWM Water for Bald Hill and DEPI for Mt Emu and Camp Hill) • PCG minutes Reports: Progress Report	TBA	$10,000-
Milestone Three Procurement and Construction	Evidence: • Summary of responses to tender process including copy of submission by successful contractor to supply camera system/s. • Quotes and/or invoices for equipment and works. • Purchase order • PCG minutes Reports: Progress Report	TBA	$30,000-
Milestone Four Build	Evidence • Copies of contractor invoices • Site inspections and reports • Council IT staff and website provider ensure data from the cameras is loaded onto websites and is publicly accessible	TBA	$15,000-

	• PCG minutes Reports: Progress Report		
Milestone Five	Evidence: • Information on accessing the cameras and weather data posted on the ARCC and Pyrenees websites and included in a newspaper article in local papers • Presentations on the camera systems provided to representatives from local emergency services in each municipality as well as regional emergency management committees • Site report including photographs • PCG minutes Reports: Audit Opinion and Final Report.	30/10/2020	$5,000-

Project Assumptions

The principle assumption in this project is the support from Pyrenees Shire and Ararat Rural City. These councils have expressed support for this project when it was first proposed a few years ago and there is no reason to assume, they would not support it now.

The Victorian Government and its agencies will support the project (if funded).

The general public and CFA brigades will support the project.

Project Constraints

The proposed camera system will not provide useful information. A local farmer has installed a small camera system on Mt Elephant, near Derrinallum, with surprisingly good results, see: http://www.lavanet.com.au/mtelephantfirecam/ The installation is supported and used by the Lismore and District CFA Group. This is a low risk.

The managers of the proposed sites may not give permission to install the cameras. Both councils have a good working relationship with these organisations and they are members of the MEMPC so this is a low risk.

Being unable to locate suitable technology or installers. There are a number of installers for these types of systems in the area and two have previously quoted on CCTV cameras for ARCC. The link below shows similar systems being installed in the US. This is a low risk, see: https://www.firesafemarin.org/fire-weather/17-site-content/182-forestwatch-remote-fire-detection-cameras-archived

The council website site being overloaded during an incident. This will need to be managed by council's IT staff and website provider. As it will be mostly local people accessing the site initially it should be manageable. A medium to high risk.

The public/emergency services not using the site. In recent bushfires and extreme weather events the general complaint by the public has been a lack of information. It is unlikely the public would not access the site if it was available. Emergency services would use the site if the information is relevant to their operations. This would be a low risk.

Example of a Weather Camera picture from Mt Tiburon in the USA. Note temperatures are in Fahrenheit.

Attachment 2

17/06/2005

THE POTENTIAL OF GROUND APPLIED RETARDANT AS AN ALTERNATE BUSHFIRE CONTROL SYSTEM

By Daryl Scherger

Summary
Ground Applied Retardant (GAR) using a high speed tracked carrier has the potential to significantly reduce both the size and cost of bushfires. When compared to conventional suppression techniques, GAR costs more per kilometre but the faster application speed could significantly reduce the size of fires resulting in lower suppression costs and reduced impact on the community. Tracked carrier maintenance costs are high but would be justified by the reduction in suppression costs. GAR could become a valuable addition to conventional control systems especially in open forests close to population centres.

Introduction
In the 22 years since the 1983 Ash Wednesday bushfires there have been numerous large fires resulting in the loss of many lives and property totalling billions of dollars. The various agencies responsible for fire control in SE Australia have invested huge sums in upgrading equipment, training and management structures but large destructive fires are still occurring. With Climatologists predicting even more severe fire weather conditions as a result of global warming, fire control agencies must rethink the way they fight fires.

"The safest, most effective and efficient way to control large fires is to put them out while they're still small." Successful initial attack is the key to reducing the impact of fires on the community and the most important factor in determining the success of initial attack is the speed of the control operation.

Fires develop exponentially. That is they increase in size at an increasing rate, even if conditions remain constant. Without any suppression activity, a bushfire that has burnt 5 hectares in the first hour will cover at least 20 hectares in the second and over 80 in the third. This exponential growth means early control is vital. If you halve the time taken to bring a fire under control you will at least quarter the size of the fire. The fastest ground based system for establishing control lines at present is Ground Applied Retardant (GAR).

In recent years aircraft have played and increasing role in firefighting and there are some that see them as the solution to controlling large fire. While an important resource they have four major faults: -

1. They are very expensive.
2. They are inaccurate (firebombing is a very difficult job and even experienced pilots regularly miss their target).
3. They cannot operate at night (this is when fires are usually the quietest and control measures most effective).

4. They cannot operate in smoke (the wisdom of relying on a firefighting system that cannot be used in smoke is questionable).

Bushfires are normally controlled by the construction of a control line. This is usually a narrow line where vegetation and overlying debris is removed exposing mineral earth. Mineral earth control lines are built either by hand or machine. The alternative to a mineral earth line is to treat the vegetation and debris with a chemical retardant that renders the coated material non-flammable.

Chemical retardants have been used to combat bushfires successfully for many years. They are usually applied from aircraft but can be even more effective when applied from the ground. Ground application is much more uniform and can be varied to suit fuel type and quantity as well as fire behaviour. GAR can be successfully applied to elevated fuels such as stringy barks or heavy ground fuels such as heath. The application rates are altered according to fuel type and load (1 litre per square metre is typical).

A table showing the components of the principle control line systems as well as their average speed and cost per kilometre are set out below.

Information in the table is based on the DSE publication *Park and forest firefighting resources guide* and is for flat ground with a high fuel hazard (15 tonne/hectare).

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Components	20 firefighters with hand tools	D4 bulldozer 3 slip-on units 6 crew	D6 bulldozer 3 slip-on units 6 crew	Tracked carrier Retardant mix 2 crew
Output – m/hr	200m per hour	400m per hour	700m per hour	5000m per hour
Cost per km	$5,500	$615	$380	$2026

Apart from hand trail, GAR is more expensive per kilometre than conventional methods of fire control however when the above outputs and costs are applied to various fire scenarios the true cost of each system can be seen.

If we use a typical fire burning on flat ground in mixed species forest with a fuel load of 15 tonnes per hectare and weather conditions that equate to a Fire Danger Index (FDI) of 20 (High) then we get the following results:

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Size of fire when crews arrive	1.6 hectares - Hand crews not suitable	1.6 hectares	1.6 hectares	1.6 hectares
Controlled size	N/A	99 hectares	7 hectares	1.9 hectares
Controlled cost	N/A	$4,120	$638	$1,722

If we raise the FDI to 30 (Very High) then the following is likely to happen:

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Size of fire when crews arrive	3.1 hectares - Hand crews not suitable	3.1 hectares	3.1 hectares	3.1 hectares
Controlled size	N/A	Control only achievable after conditions moderate – over 200 ha.	51.3	4.3 hectares
Controlled cost	N/A	>$10,000	$2,584	$2,614

At an FDI of 40 (Very High):

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Size of fire when crews arrive	5.4 hectares - Hand crews not suitable	5.4 hectares	5.4 hectares	5.4 hectares
Controlled size	N/A	Control only achievable after conditions moderate – over 200 ha.	Control only achievable after conditions moderate – over 200 ha.	7.9 hectares
Controlled cost	N/A	>$10,000	>$5,000	$3,586

These figure show that GAR is very effective at reducing fire areas and it becomes cost effective as the fire danger increases. Sloping ground reduces the speed of conventional control systems making GAR even more cost effective at a lower FDI.

It should be noted the above theoretical examples are only to compare costs and outputs of minimum initial attack numbers. In reality additional resource would be used in the conventional control system examples to control the fires sooner but at increased cost.

If a GAR system was applied to recent serious fires then it's likely these fires would have been controlled early with significant reductions in both the size of the fire and the losses caused.

An example is the Linton fire. A Departmental crew arrived at the Linton fire approximately one hour after it started. The fire was around 32 hectares at that time with a forward rate of spread of about one kph. If this crew were using a GAR system they could have checked the fire in less than 20 minutes and had it controlled in less than an hour. The final size would have been around 40 hectares with a controlled cost of approximately $5,000. This would have prevented the loss of 5 lives and a huge cost to the community.

Ground Applied Retardant has been available to agencies for over twenty years. In 1985 the US Forest Service Roscommon Equipment Center published report No. 41A, *An Analysis of Ground Application of Retardants*. This report concluded that retardants are effective in controlling wildfire but expensive. This report did not analyse the effect of application speed. Monsanto, a major manufacturer of retardant, has done extensive research on the use and effect of retardants. In their publication, *Fire Retardants in Prescribed Burning: Application Guide*, a maximum application speed of 15 kph is recommended for effective application. Five kilometres per hour (walking pace) is the likely average speed for fire fighting but higher speed are possible if conditions suit.

A GAR system would consist of the tracked carrier and transporter.

Tracked carriers are essentially an armoured personnel carrier without the armour (Figure 1). They are widely used by armed forces including the Australian Army and are very good at carrying loads across country. Their flexible track system makes them better than bulldozers for this type of application. GAR machines would normally be fitted with a dozer blade and with a similar weight, longer track frame and more powerful motor they would have similar or better pusher power compared to a D4 bulldozer.

Along with a blade, the carrier would have an air-conditioned ROPS/FOPS cabin and a 4,000 litre tank for retardant. The cabin would have forestry guarding including heavy steel mesh on all windows. The crew would be two people, a driver and a spray monitor operator. The retardant would be applied using a remote controlled monitor mounted on the front of the cabin (Figure 2).


Figure 1 - M548/M1015 full tracked fire fighting vehicle developed at Roscommon Equipment Center.


Figure 2 - Remote controlled monitor - Roscommon Equipment Center project No. 58

The transporter would be a heavy machinery float with sufficient capacity for the fully laden tracked carry together with an additional 4,000 litres of water and 2 tonne of retardant powder (18 to 19 tonne in total). The transporter would act as a base for the carrier and have enough water to refill the carrier once and enough retardant for two further refills using water delivered by convention tankers. This would give the unit sufficient capacity to establish up to four kilometres of control line with minimal support.

The transporter would carry an eductor mixing system and the carrier crew could mix retardant as required.

Possible reasons for Fire Control Agencies not using GAR are: -

Retardant Cost

A retardant line costs around $0.50 per square metre or $2,000/km for a four metre wide line. As shown above, a simple per kilometre cost comparison makes the use of GAR unjustifiable to managers and this is the most likely reason agencies don't use it.

Safety

Agency managers are unfamiliar with the product and the risks involved with using both GAR and the high speed tracked carriers required for its effective application. The retardant itself is essentially the same as that used in fire bombing and poses no greater risk to personnel using it.

The restrictions on land clearing, phasing out of logging and the increased use of excavators has meant the numbers of experienced dozer operators available for conventional fire control systems is becoming less. The opportunities for dozer operators to gain or maintain the skills needed for effective control line construction, particularly in steep country, has become very limited.

This is a significant operational and OH& S issue for agencies. GAR doesn't involve ground disturbance so gaining approval for operators to practise their skills is likely to be easier.

A GAR system would be essentially the same as conventional control systems but replace a mineral earth break with a chemical one. In direct attack, GAR would be applied immediately in front of the fire edge so the carrier crew would be "taking the black with them" as with conventional systems.

In the event of a break down or other problem the crew have burnt out ground immediately behind them. In addition, they would have roll over (ROPS) and falling object (FOPS) protection. Protection crews in the slip-on units or tankers supporting a dozer in conventional firefighting do not have. Falling trees and branches or rolling over on steep ground are major hazards face by fire fighters.

A GAR system reduces the numbers of people needed to control a fire and provides them with better protection while they do it.

Handling and mixing retardant

In the past, retardant use was associated with handling unpleasant, messy chemicals in large mixing facilities. In recent years induction techniques have developed to the point where retardant can be easily mixed in the field, in large quantities and on demand with minimal equipment or exposure to the chemicals.

Purchase and maintenance costs of the tracked carrier

This has been raised as a reason for not using GAR. Tracked carriers are made by a number of companies to various specifications. The Russian Company Sibir-Technika produce a purpose built machine (Figure 3) for GAR use with a list price of $90,000. Together with a transporter and retardant mixing equipment the total cost of a GAR unit would be around $240,000 (about 20% more than a conventional 4 X 4 tanker).

Figure 3 - Sibir-Technika TLP-4M Forest Extinguishing Machine

High-speed tracked vehicles do have high track maintenance costs. According to personnel involved in the use and maintenance of Australian Army tracked carriers they have a track life of around 10,000 kilometres. Mackey Consolidated Industries in Melbourne carry out track maintenance for the Army and provided costing details

that amounted to around $10 to $15 per machine hour or about $5 per kilometre of a control line. This cost has been included in the figures in the above tables.

Environmental Impact

Chemical retardants have been used for a long time and their effect on various vegetation communities has been well researched. There are no known long-term effects on land plants but they can be toxic to aquatic communities so care must be taken not to apply them directly into streams, lakes, etc. The environmental impact of mineral earth control lines can be severe and long term. The rapid control of fires using GAR would result on much shorter control lines than with conventional systems so the environmental impact would be significantly less.

Effectiveness

GAR is an alternative to dozed mineral earth control lines. It can be used over a wide range of terrain but there are places where it would not be suitable. These include very steep and or rocky terrain and very heavy vegetation such as plantations or Ash regrowth. Traditional methods such as hand trails or using heavy dozers to construct control lines would have to be used in these situations. GAR could improve the effectiveness of these methods by allowing increased use of hose lay for hand trail situations and a lower standard of heavy dozer line.

As previously stated, chemical retardants have been used in fire control for many years and their effectiveness is well known. Mineral earth control lines have been used in the past to ensure fires do not continue to burn undetected and escape later on. The advent of Thermal Imaging technology allows fire fighters to be certain there is no residual fire activity (hot spots) making mineral earth breaks unnecessary.

With its speed of operation any spot overs or misses can be quickly picked up when the GAR unit does follow up patrols.

GAR can also be effective in swamps and other ground conditions were conventional fire control systems are unable to be used.

Conclusion

Ground Applied Retardant has the potential to significantly reduce the size of bushfires and their impact on the community. At the same time this system could reduce the risks to fire fighters and the cost of suppression operations.

It would not replace conventional firefighting systems in all situations but could have a dramatic impact in areas where open dry sclerophyll forests adjoin urban or rural residential development. In these environments full advantage could be made of the systems speed of action.

All Australian Fire Control Agencies should make GAR part of their suppression capabilities

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- Project 58 – Low Cost Remote Controlled Turret – 2000
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Fire Retardant in Prescribed Burning: Application Guide – Monsanto Company, 1993

Sibir-Technika Company website – www.sib-tech.ru

Attachment 3

Tiley Fire Tracker Trial at Mt Sturgeon Burn

by Daryl Scherger

The Tiley Industries Fire Tracker machine was trialled at the Mt Sturgeon Fuel Reduction Burn in the Grampians National Park on Sunday 17th November, 2013. The aim of the trial was to test the machines effectiveness in applying retardant to protect habitat/hazardous trees as well as protecting assets. A simple calibration test confirmed the machine was able to apply retardant at one litre per square metre over a spread of 3 to 4 metres at a speed of 5 kph. As the photos below show, the trial proved successful. In addition to the capabilities shown, a flame thrower is available to fit to the machine allowing it to establish control line and light the burn simultaneously. It can then patrol and black out without the need to construct control lines or access tracks.

Tiley Fire Tracker Unit at burn

Rear of machine

Close up of Magnum nozzle on rear of unit

Front view of machine

Spraying habitat and hazardous trees with retardant

Retardant sprayed trees during burn

Retardant sprayed trees after burn

Operator spraying retardant on burn edge

Direct attack with retardant

Protecting a building with retardant break

Close up of spray stream

Retardant sprayed vegetation

Fire behaviour approaching retardant break

Effectiveness of retardant break

Retardant break just after burn

Machine pushing over a burning tree

End result - tree was approx. 30cm DBH

Machine blading off a track

End result of blade work

Machine travelling through scrub

Vegetation damage

Close up of machine track and vegetation damage

Attachment 4

[redacted] | daryl.scherger@bigpond.com

KMC FireTracker

Hey Daryl,

We have received your inquiry on our website, thank-you. I have spoken to our engineer about the 3 person cab, and it's not something we would easily be able to do with the current canopy design. The current canopy could be widened, but would likely only fit 2 people on a bench seat. We have done up designs in the past with a secondary cab for additional personnel, behind the operators cab, but this is a rather complex and expensive design. It would be quite easy to put "jump seats" on the back of the cab, allowing for 3 passengers, and that's what we would recommend as designing and testing an all new canopy is rather costly. We greatly appreciate your interest in our machinery and wish you the best of luck in convincing the government, if you have any other questions feel free to let us know.

Regards,

[redacted]

KMC-Kootrac

Attachment 5

Harvesting Fire Hazards for Heating Fuel Project

by Daryl Scherger

The Gippsland fires have graphically demonstrated the importance of managing fire hazards around communities, along roads and around other important assets. At present fire hazards are either burnt in a fuel reduction burn (FRB) or slashed. Achieving the desirable level of protection with FRBs is difficult due to the shrinking window of opportunity with weather and the increasing operational restrictions due to smoke management, hazardous trees, resourcing levels and environmental limitations. All of this makes burning difficult and expensive. Slashing is expensive and only alters the fuel arrangement, not the amount present. This project intends to overcome these problems by mechanically harvesting this hazardous material and using it to heat a public facility such as an indoor pool or hospital. The harvested material would be supplied to these sites at cost thereby offsetting the harvesting cost while delivering increase protection from bushfires to local communities.

This project is based on the US Forest Service *Fuels for Schools and Beyond* program, see:
https://www.usda.gov/media/blog/2011/04/12/usda-forest-services-fuels-schools-program-turns-biomass-energy
A similar program is run by the Californian Government agency CAL Fire, see:
https://fire.ca.gov/programs/resource-management/resource-protection-improvement/environmental-protection-program/biomass-and-bioenergy/

The proposed harvesting system is the Anderson Biobaler and the costings are based on US trials of this machine. There are none currently operating in Australia. If the project achieves similar outputs to US trials then the expected average cost is $80 per dry tonne, depending on vegetation density. This equates to an energy cost of $6.35 per GJ which is significantly lower than current commercial natural gas prices. The benefits of turning fire hazards into energy are numerous. The primary benefit is a major cost reduction in managing fire hazards. The energy production pays for the harvesting operation. The resulting cheaper fuel would reduce operating costs for the facility with greenhouse gas emissions also reduced. The harvesting operation would help create local jobs and the funds spent on producing and delivering the fuel would remain in the local economy.

Reducing the operating costs of a public facility would free up funds to allow the facility managers to improve local services. This concept would allow councils and fire agencies to deliver a higher standard of fire prevention at little or no cost, further benefiting the local community and council/state government. If proven successful, this approach could provide increased bushfire protection for rural and regional communities at no cost while creating local jobs, reduced energy costs for public facilities and significantly reduced greenhouse gas emissions.

Anderson WB – 55 Biobaler

Biobaler harvesting Gorse

Gyrotrac Bio-energy Baler

The purchase of a Biobaler is required for the project as there are none of these machines in Australia at present and one would need to be imported. Installation of a whole bale boiler system is needed to provide a demonstration site for the project. The Boibaler unit could produce enough fuel to supply up to 12 boilers annually if required. An indicative budget for the harvesting side of this project is set out below. If fuel production rates are as expected and the resulting fuel bales can be sold at $80/tonne then the annual rate of return would be an impressive 26%.

Reference: Demonstration of the Biobaler harvesting system for collection of small-diameter woody biomass - 2011 https://info.ornl.gov/sites/publications/Files/Pub34055.pdf

There are other options for the fuel harvesting system. For grassed roadsides and open spaces around population centers, conventional mowing and baling would be suitable. Areas that contain woody understory vegetation, small trees and bracken would need more specialized machinery and the Anderson Biobaler is proven system for this type of vegetation, see: https://grpanderson.com/en/biomass-press/bale-processor/biobaler/ For challenging terrain the

Gryrotrac Bio-energy Baler is an another option, see: https://gyrotrac.com/bbs-xp/ Again, there are none of these machines in Australia and their current purchase price would be around $1.2 million.

Installing a boiler system able to use whole bales as fuel is critical to demonstrate the use of this fuel source as energy. Whole bale heating boilers are the lowest cost option for this application and an indicative budget for such an installation is set out below. The economics appear reasonable with a payback of slightly over 6 years and a return on investment of 16%. The payback would be much better if the current cost of fire protection burning/mowing was included. One issue that will need to be considered is the plant footprint. Bales require more space to store and handle than chips or pellets so any site chosen would need sufficient space.

The other important part of the project is to employ a part time Project Officer/consultant to identify suitable sites for boiler installation and areas of fire hazard suitable for the use of a Biobaler. They will need to measure fuel loading at the proposed sites prior to and after harvesting, measure amount of material produced by the biobaler, arrange testing of material produced to determine energy yield and combustion characteristics of the fuel and produce a detailed business case to further develop the concept.

The project manager will also need to manage the boiler installation at the selected site, arrange storage of bales and supply to boiler site, other project management duties as required.

Harvesting System Budget

ITEM	EQUIPMENT COST	ANNUAL INCOME	ANNUAL COST
Project Manager - part time with overheads, project costs, etc.	$ 50,000.00		
Anderson Biobaler	$ 280,000.00		
Tractor - 250hp 4WD with loader	$ 300,000.00		
Tractor - 60hp 4WD with loader and trailer	$ 100,000.00		
Harvesting Hours per year - 1,800			
Operator cost including overheads - $60/hr			$ 108,000.00
Annual Service and Maintenance costs - 6% of capital			$ 74,000.00
Fuel Cost - 10 litres per hr @ $1.30/litre			$ 23,400.00
Average bale output per hr - 13			
Average dry bale weight - 330 kg			
Annual average bale production - 23,400			
Average tonnes of fuel produced per year - 7,700			
Capital Recovery Cost - 10% over 5 years			$ 224,364.00
Income from sale of fuel - 7,700 tonnes @ $80/tonne		$ 616,000.00	
TOTAL	**$ 730,000.00**	**$ 616,000.00**	**$ 429,764.00**
Annual Profit	**$ 186,236.00**	**ROI**	**26%**

Indoor Pool/Hospital Biomass Heating System

ITEM	CAPITAL COST	INCOME	EXPENDITURE
500 kW Straw Fuelled Boiler System with auto feed and de-ash	$200,000.00		
Buffer tanks	included		
Flue	included		
Controller	included		
Coolant additive	$750.00		
Freight/shipping	$20,000.00		
Delivery from Melbourne to Colac	$2,000.00		
Fumigation	$500.00		
Crane/lifting equipment hire	$5,000.00		
Overseas currency charges	$200.00		
Installation/ site works	$20,000.00		
Electrical	$10,000.00		
Commissioning	$3,000.00		
Insurance	$500.00		
Import duties	$1,500.00		
Import processing charge	$250.00		
Heat delivery system	$30,000.00		
Contingency Amount - 10% of capital cost	$40,000.00		
Operating hours per year - 8,500			
Plant foot print up to 150 m2			
Fuel - 600 tonnes of baled fire hazard @ $80/tonne			$48,000.00
Plant & Equipment Maintenance (2% of capital)			$6,674.00
Heating replacement value - 2,342,500 kWh @ $0.0407/kWh		$109,629.00	
TOTALS	**$333,700.00**	**$109,629.00**	**$54,674.00**
Profit	**$54,955.00**	**ROI**	**16%**

From [redacted]
Sent: Monday, 6 April 2020 7:49 AM
To: DJCS-IGEM-Contact (DJCS) <IGEM@igem.vic.gov.au>
Subject: Further Submission Information

Dear Sir/Madam,

Please find attached further information to my submission as suggested during the North West Community meeting. The Harrietville Fire Alternate Scenario was my submission to the inquiry into the 2013 Harrlettville Fire in which 2 DELWP personnel were killed. The Fuels for Schools presentation was given by the founder of the US program, Dave Atkins, at Ballarat in 2011. I am happy for this information to be made public.

Yours sincerely,
Daryl Scherger
[redacted]

The Harrietville Fire – An Alternate Scenario

This scenario is based on the use of a fire fighting technology called Ground Applied Retardant (GAR). This system has been used since the early nineties in the USA , Canada and Russia. The chemical retardant is essentially the same as that used in aerial fire fighting but has less thickener. Retardants have been used on bushfires for decades and their effectiveness is without question. Ground application is more accurate than aerial so is even more effective and efficient. Ground application can be from tankers or modified tracked carriers. In this scenario a modified tracked skidder that was purpose built by KMC in Canada is used. Called a Fire Tracker, it replaces the Ovens dozer that arrived at the initial fire at 4:15 PM on the 21st of January, 2013.

The Fire Tracker unit arrives at Northwest Spur Track, just north of the fire, on its transporter, a prime mover truck and low loader. The machine operator also drives the transporter. A support crew of two follows in a four wheel drive slip on unit. Their job is to act as hose crew when the machine reaches the fire. They will follow in the vehicle as far as possible then on foot. The Ovens machine is one of the original trial units. Later machines are fitted with a three person cab allowing all personnel to travel in safety and relative comfort of an air condition cab fitted with roll over and falling object protection (ROPS/FOPS).

Unloading commences as soon as the transporter arrives. While the flexible track system on the Fire Track makes unloading easier than conventional dozers, it's not an operation to be rushed. The machine weighs over 15 tonne fully loaded with over 4,000 litres of water and 800 litres of liquid retardant. The retardant is mixed with the water as required. The hydraulic angle/tilt blade at the front easily brushes aside the scrub ahead of the unit.

The unit begins pushing up the "fuel break" towards the fire. The fire is approximately 400 metres from Northwest Spur Track and the unit blades the regrowth off the existing break as it heads up the spur. On this machine the operator must not only drive the machine but also operate the forward spray monitor, the rear spray and the two way radio. In the later machines, the support crew operates the spray nozzles and radio.

At 4:45 PM the Fire Track unit arrives at the fire edge. The fire extends 50 to 60 metres from the track on both sides down a steep slope. The operator reports their arrival at the fire to operations. He also makes contact with the slip-on crew currently working their way along the western flank. Flame heights are one to two meters. The operator opens the valve to the remote controlled forward spray monitor. A dense fog shoots from the monitor nozzle mounted on the front of the machine, above the blade. The stream is around a metre in diameter and over 15 metres long. The unit heads briefly along the fire edge towards the point of origin of the fire as far as it can safely do so, around 40 to 50 metres. The stream of retardant extinguishes the fire and creates a non flammable zone up to four metres wide. After checking the location of the support crew, he then reverses back to the track and do the same on the eastern side of the ridge.

Once they unit has travelled as far as it can on the eastern side, the support crew begin deploying hose lay along the bottom edge of the fire. The hose is a "lay flat" canvas type stored on a "dead" reel on the fire tracker. The machine carries five hundred metres of this type of hose as well as two fifty meter hoses on conventional "live reels. The retardant spray quickly knocks the fire down and creates a secure break at walking pace. Much faster than constructing a break by hand. After running out 200 metres of canvas hose the crew have reached the lowest point of the fire and have checked the most active edge. By 5:30 PM the crew have return to the unit, rolling up the canvas as they go.

Once the hose lay crew have returned to the machine and secured the hoses, the machine then moves to the southern end of the fire where the same process is repeated. The western side is secured as far as the machine can go then the eastern side with machine and hose lay. The slip-on crew from the eastern side have now been deployed to patrol the retardant lines.

By 6:00 PM the hose crew have linked up with their retardant line from the northern end. They return to the machine leaving the slip-on crew to patrol the entire eastern side. The unit will now head to the northern end of the fire and repeat the procedure for the eastern side. The hose crew reach the point of origin on the western side with hose lay. The remaining south western flank is very quiet and the Fire Tracker crew expect to have the entire edge checked by 7 PM. The slip-on crew report very few issues on their side.

The hose crew link up the western side just before 7 PM. They return to the machine and the unit begins blacking out the fire, starting with the eastern side.   The radio operator reports they have contained the fire at 7:15 PM with a controlled size of less than 4 hectares. The crew have used almost 2,500 litres or over half their retardant mix so far but will not need to return to the transporter to refill until they have only 1,000 litres remaining. They continue blacking out the fire, running hose lay from the machine down the steep slopes along the sides of the ridge.

At 8:30 PM the Fire Tracker crew report that the fire is largely blacked out but can't be considered safe. The Ops officer thanks the crew for a job well done and advises them to pack up and head back to the depot. Another crew will check the fire tomorrow and deal with any residual hot spots.

The total area burnt is 3.8 hectares and on ground suppression costs for the day are $5,915 including $2,000 for the retardant, $1,400 hire cost on the Fire Tracker and transporter and $5 track maintenance cost for the Fire tracker. This last item is included because track maintenance costs are given as the reason for not using this type of equipment.

Suppression costs could be reduced by using water or foam instead of retardant but retardants superior ability to knock down a fire and hold an edge justify the additional cost.

Prototype Fire Tracker developed by Tiley Industries – Beaufort.

From: [redacted]
Sent: Monday, 6 April 2020 7:49 AM
To: DJCS-IGEM-Contact (DJCS) <IGEM@igem.vic.gov.au>
Subject: Further Submission Information

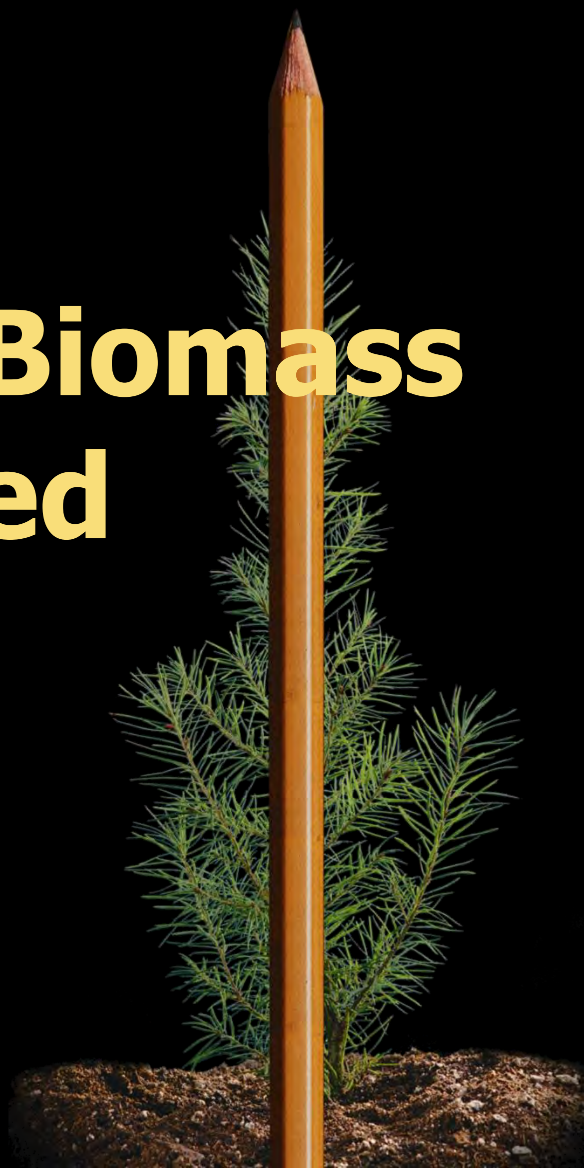
Dear Sir/Madam,

Please find attached further information to my submission as suggested during the North West Community meeting. The Harrietville Fire Alternate Scenario was my submission to the inquiry into the 2013 Harrlettville Fire in which 2 DELWP personnel were killed. The Fuels for Schools presentation was given by the founder of the US program, Dave Atkins, at Ballarat in 2011. I am happy for this information to be made public.

Yours sincerely,
Daryl Scherger
[redacted]

Fuels for Schools and Beyond

Small Scale Woody Biomass Lessons Learned



Dave Atkins
US Forest Service

Disposal Problem

- **STEP 1: Thin dense, unhealthy forests to reduce fire danger.**

- **STEP 2: Chip forest debris from thinning and haul wood chips to facilities with biomass heating systems.**

- **STEP 3: Use chips to fuel efficient burning systems that lower heating costs.**

This

Or

This

Why "Use It"?

- Reduce smoke from disposal burning
  - – Human/Enviro Health – SOX, NOX, GHG
  - – Airshed Aesthetics – "Smokey Air"
  - – GHG emissions
- Reduce cost to treat land
- Save on heat & power bills
- Energy independence - Renewable
- Engage communities in solutions
  - » Create jobs
  - » Small business opportunities


Before


After

Excess Biomass –

No Product

Fire Hazard & Bark Beetle Hazard Thinning Project

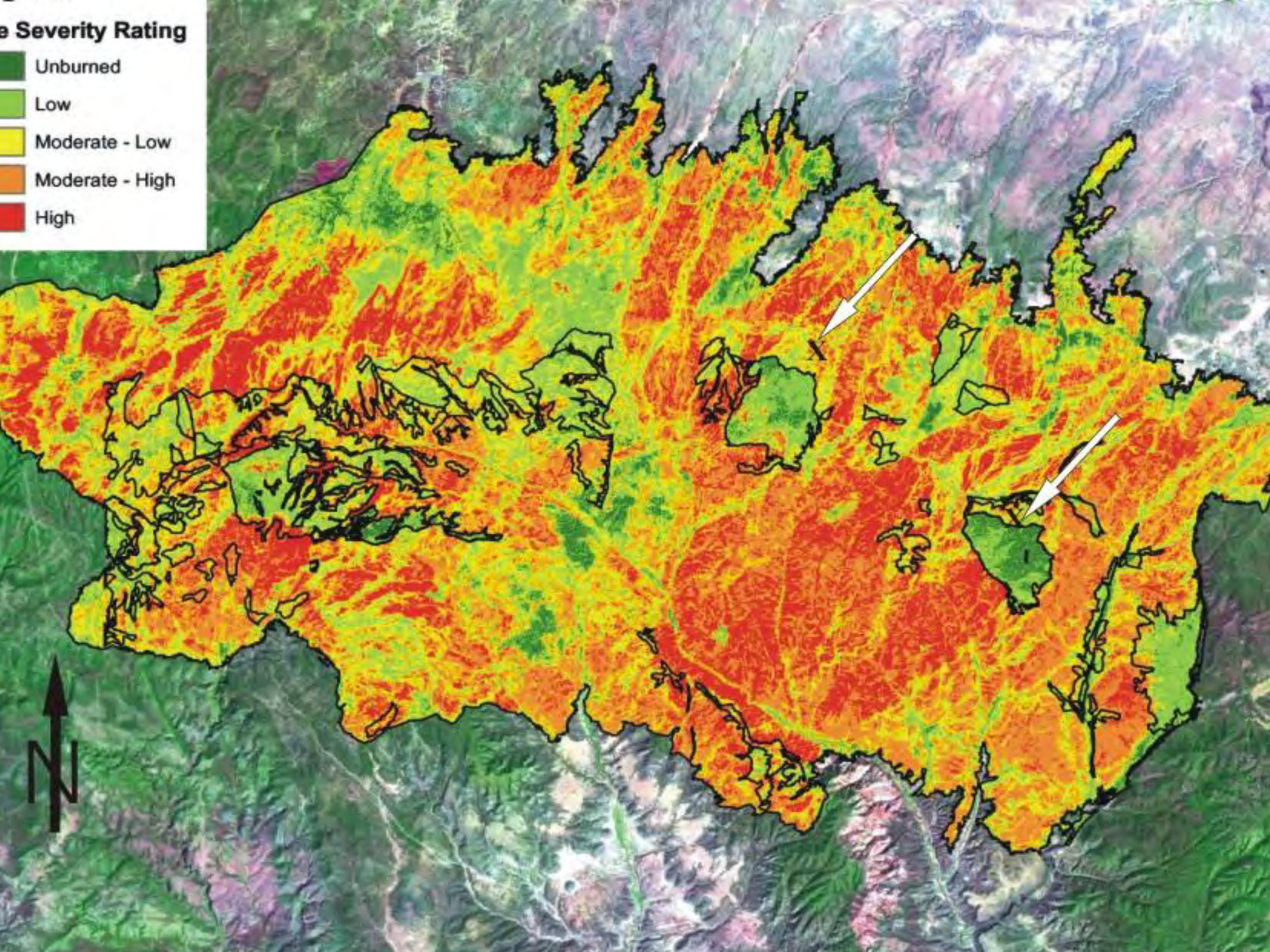
Slash, Pile and Burn or Pay to Thin Remove and Utilize

Treated vs. Untreated

Rodeo-Chediskeei Fire

Camp 32
Fire
2005

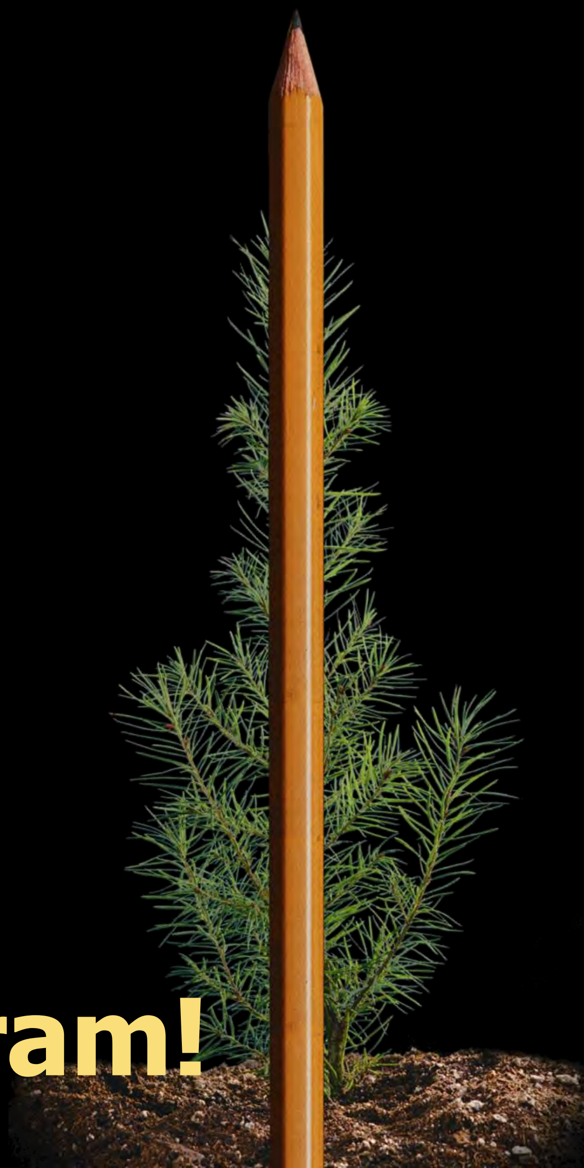
"The sharp line in the aerial photograph is obvious, abrupt and dramatic: black forest on one side, green canopy on the other. " Missoulian Sept. 2005. Camp 32 Fire Eureka, MT



e Severity Rating
Unburned
Low
Moderate - Low
Moderate - High
High
N

Who are the Partners?

- USDA Forest Service Regions 1 & 4
- 6 State Foresters
- Schools
- Bitter Root RC&D
- Private sector businesses
- Not a National Program!



Local Champion(s)

- **One or preferably More**
- **People who can provide:**
  - ***Leadership* in the community**
  - ***Organize* the process**
  - ***Coordinator-* work w/ experts**
- **Overcome the Fear Factors**
  - **Something "new untested"**
  - **Where's the wood coming from**
  - **I don't want to clear cut my forest**
- **Why Schools?**

Building a New Energy Sector

- Commercial/Institutional facilities
  - Creating demand
- Production & Quality of fuel
  - Chips? Hogfuel? Pellets?
  - Integration w/ combustion system
  - O&M considerations
- Distribution Systems
  - How does the new fuel get delivered?
    - Trucks available? Redundancy?

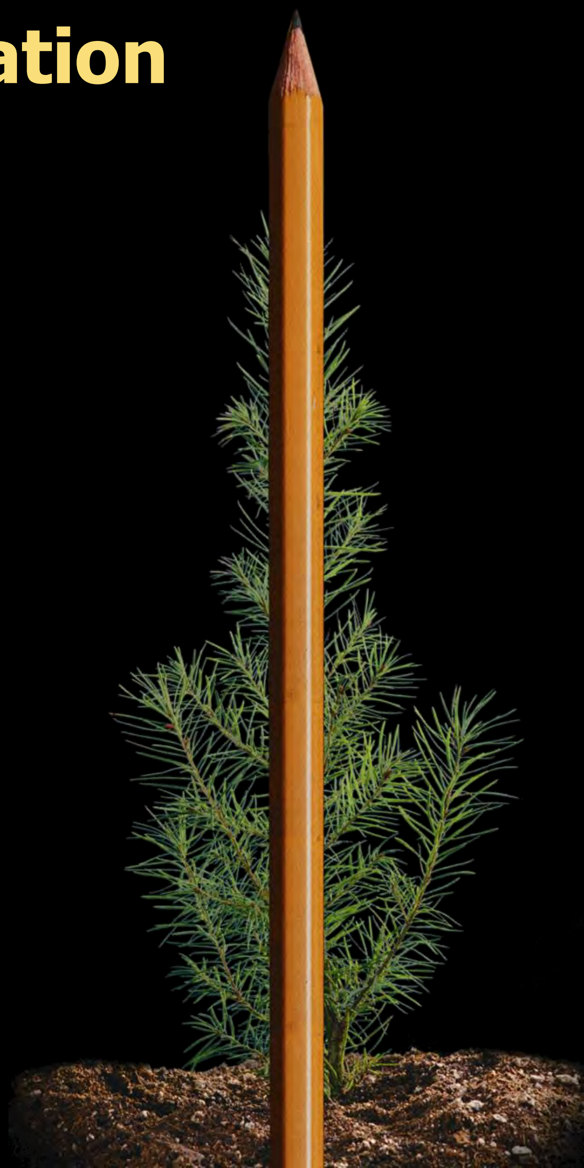
Public Investment-A Catalyst

Three Phase Implementation

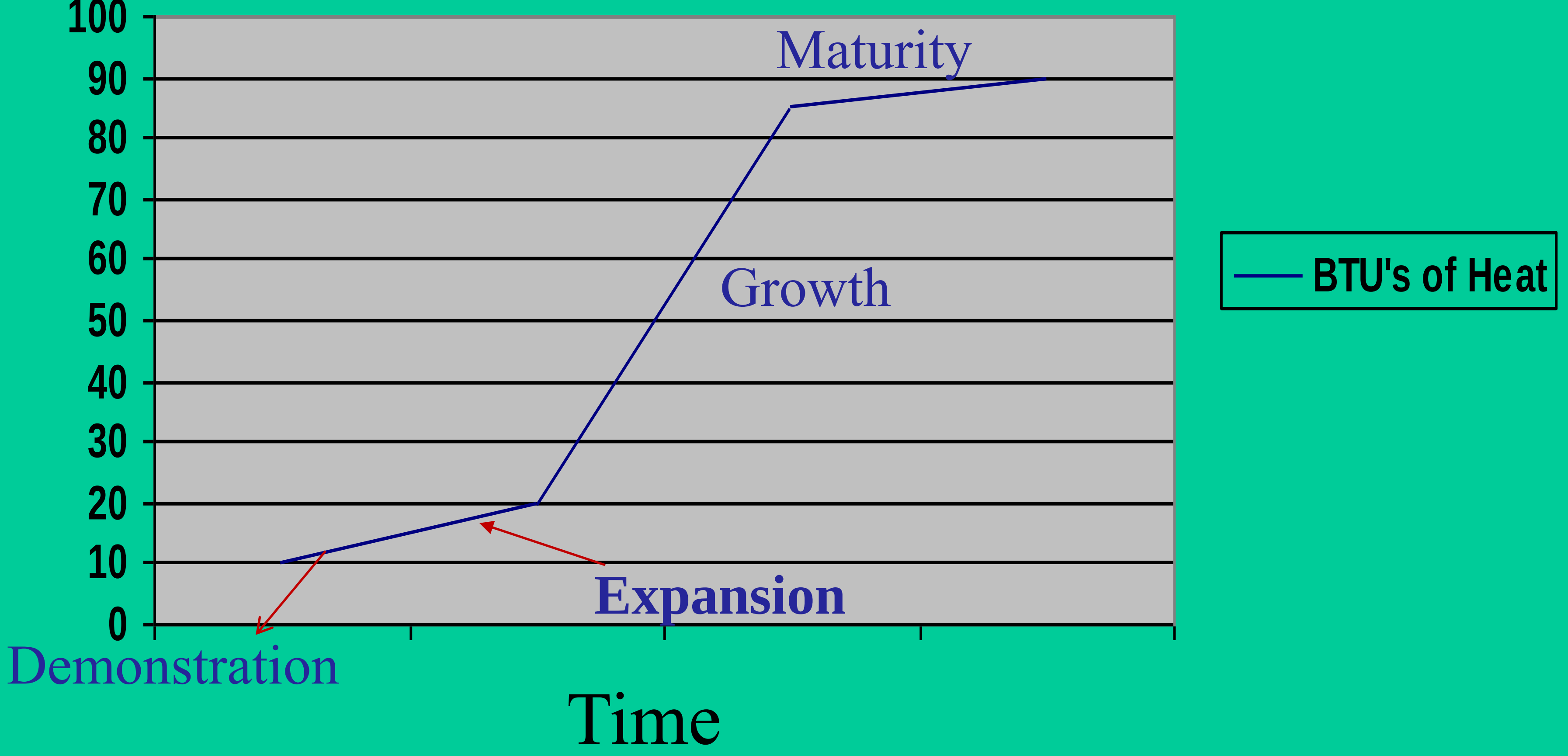
I. Demonstration

II. Expansion

III. Private Sector



Product Market Growth



- 19 systems built.
- 4 more design/construction.
- Other states AK, CO, OR, PA, MA, GA, SC, SD, NE, NM etc.
- Commercialization Studies.

Bitter Root
RC&D

FOREST SERVICE
U S
DEPARTMENT OF AGRICULTURE

Automated Facility

Darby, MT

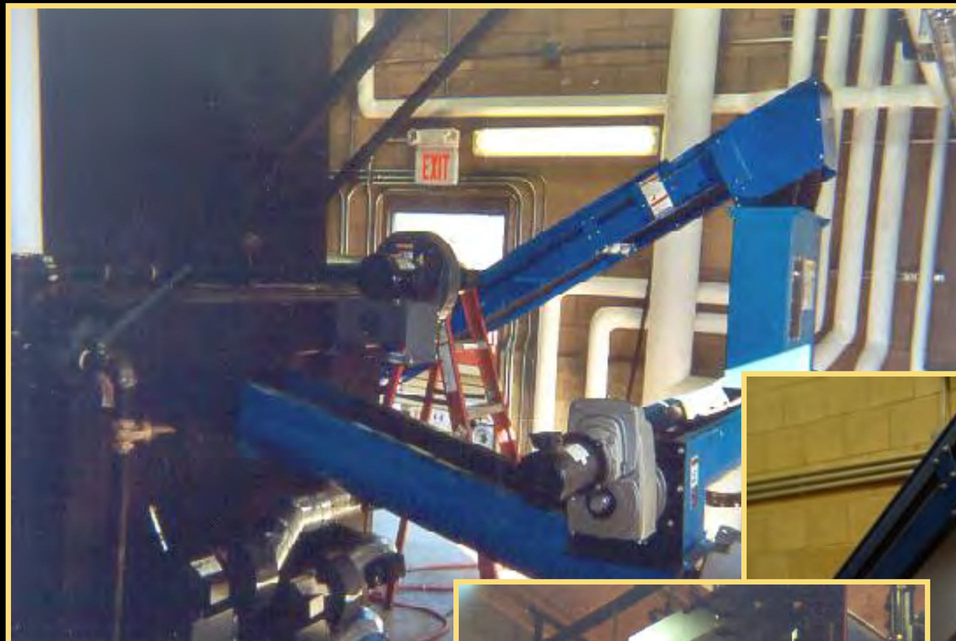
3 schools

3.3 mill btu/hr

Darby, MT

3.4k MJ/hr

$850k retrofit



Offset Fuel Oil –
52k gal/yr @ $3/gal

800 tons wood chips
@ $42/green ton

Saved $100-140k/yr
for past 4 years

Harney Co. Hospital – Burns, OR

CTA Group

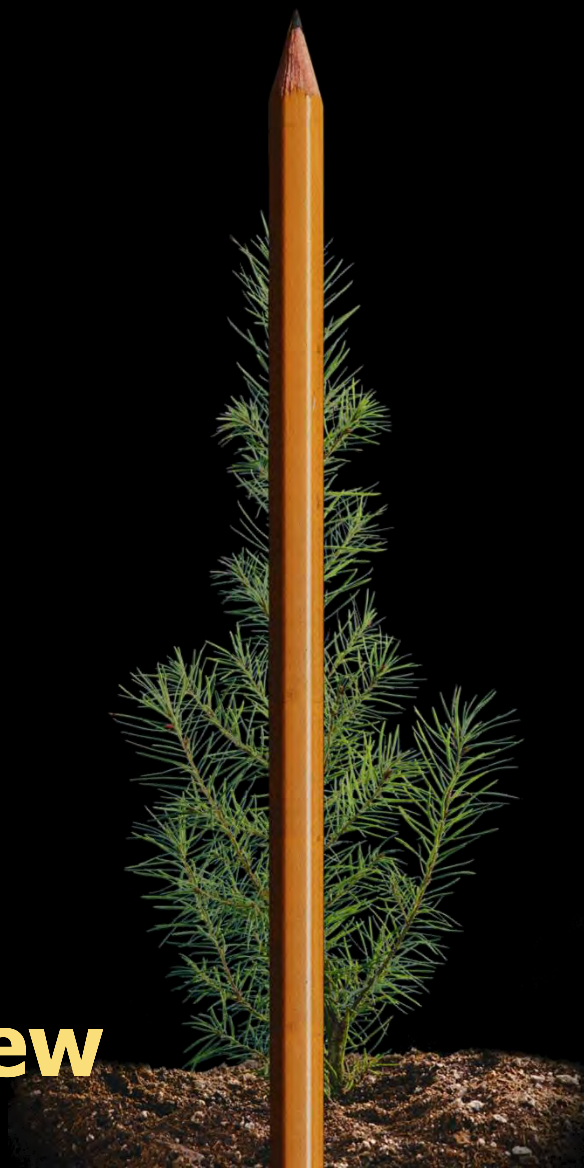
- 55k sq ft
- KOB 500 MJ/hr
- 100 tons/yr
- Boiler delivered in shipping container – "plug and play"
- Offsets Propane

U of Montana - Western

- 12.5k MJ/hr
- 3500 ton/yr
- Offset Nat Gas
- Saving $118k/yr
- $1.4 mill

District Energy

- Universities
  - U of Idaho
  - Northwestern Missouri State
  - Chadron State College, NE
  - U of So. Carolina
  - UM Western, Dillon MT
  - Middlebury College
- Communities
  - St. Paul, MN – 80+% wood fired
    - 31 mill sq ft heat
    - 21 mill sq ft of cooling
    - 25 MW of electricity
  - Seattle, WA District Energy
- Hospitals, Prisons, resorts, new development;



New Construction

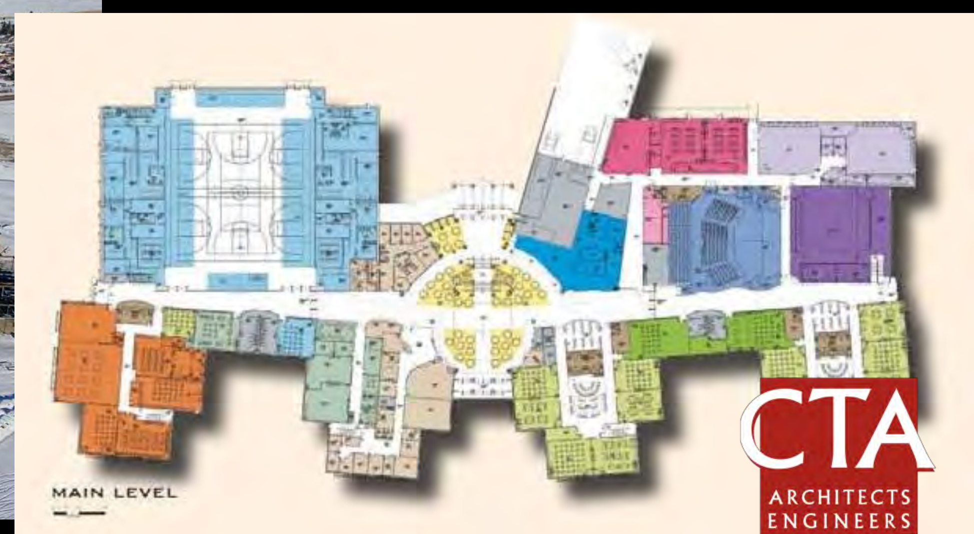
Glacier High School

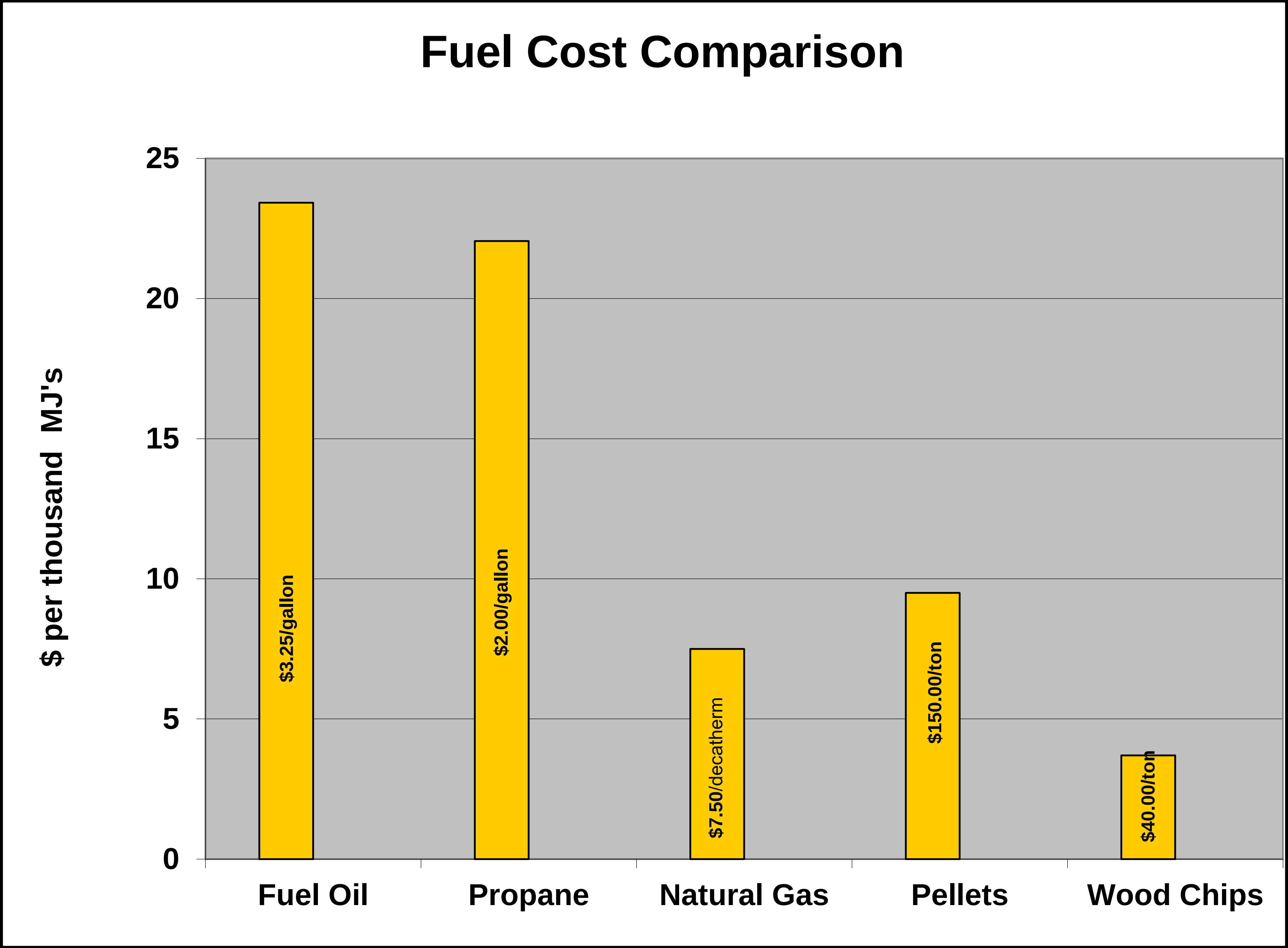
Integrated wood during design cost 2/3 conversion

Wood system meets ½ peak load 95% annual.

Offset natural gas saving $100k/yr – 5.7k MJ/hr

Project cost: $550k




Fuel Cost Comparison
$ per thousand MJ's
25
20
15
10
5
0
$3.25/gallon
$2.00/gallon
$7.50/decatherm
$150.00/ton
$40.00/ton
Fuel Oil
Propane
Natural Gas
Pellets
Wood Chips

When Pellets vs. Chips? Finding the Sweet Spot

- Space to put a system in;
- Heat load 2,000 MJ /hr breakpoint?
- Initial cost vs. fuel cost;
- Fuel consistency/energy density
- Ease of operation and maintenance
- Fuel oil, propane, electric heat

What are the Barriers?
Real of Percieved?

- Who will deliver?
- Reliability?
- Architects, HVAC, Contractors
  - Recent Study Wood Ed Resource Center
- Price compared to other fuels
- Financing projects
- Not every project has succeeded
  - One out of 19 has failed

Target Sectors

- Propane, Fuel oil, Electricity
  - Commercial, Institutional, Residential
- Economies of scale – District Energy Systems – any fuel
  - Universities
  - Hospitals
  - Resorts
  - Prisons
  - Cities
- CHP at industrial sites if stars align

Roll-Off at Landing

Whole tree processing at landing

Minimizes handling costs

Less Move-in cost for grinder


WASTE WOOD
SALVAGE


WASTE WOOD
SALVAGE


WASTE WOOD
SALVAGE

Dump at Central Location

Slash Collection Report

Accumulation Yard

Moisture management

www.fuelsforschools.org click on new information

“Canned Wood”

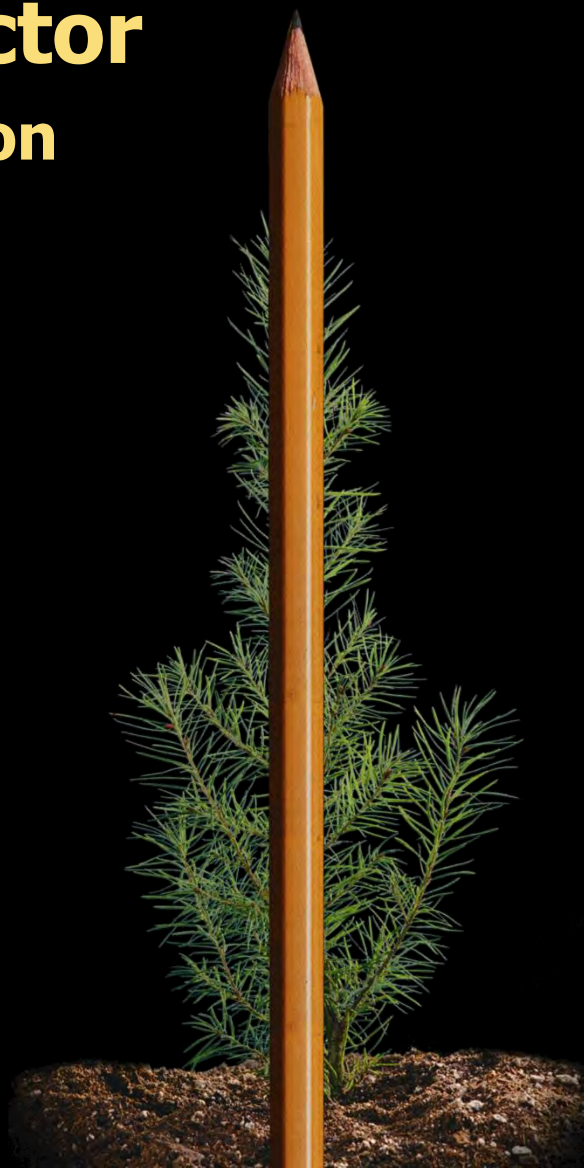
Chip in woods vs central collection yard?

Pellets/Briquets

- Refined fuel
- Consistent low fuel moisture
- Flowability
- Higher energy density higher cost

Take Home Message

- **Developing a new Energy Sector**
  - Production, distribution, consumption
  - Local champion(s)
- **Segmented Market**
  - Small LPG, Fuel Oil, electric heat
  - District Energy systems colleges
  - CHP – 3-30 MW
- **Fuel Factors**
  - Pellets vs Chips vs Ground wood
  - Upfront investment vs. annual cost
  - Operation and Maintenance



From: [redacted]
Sent: Friday, 10 April 2020 10:52 AM
To: DJCS-IGEM-Contact (DJCS) <IGEM@igem.vic.gov.au>
Subject: RE: Further Submission Information

I've attached a draft project proposal I'm currently working on for the DELWP, Grampians Regional Climate Adaptation Strategy, that may be of interest to the inquiry. I'm happy for it and the attachments to be made public.

Regards,
Daryl.

From: [redacted]
Sent: Monday, 6 April 2020 7:49 AM
To: DJCS-IGEM-Contact (DJCS) <IGEM@igem.vic.gov.au>
Subject: Further Submission Information

Dear Sir/Madam,

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Yours sincerely,
Daryl Scherger
Mob: [redacted]

DRAFT Ground Applied Retardant Trial

Why a trial is needed

Climate change will bring hotter, drier and longer fire seasons and any fires that do start will develop quickly and become difficult to control sooner. Controlling fires quickly, at any time of the day or night, will be critical in preventing major fires. Ground applied retardant is a fire control option that offers much faster control than any other ground based systems.

Ground Applied Retardant (GAR) and was first used operationally in Australia by Vicroads during the 2003 NE Victoria Fires to protect timber bridges. A copy of technical note covering that use is attached. In 2004 Parks Victoria staff used GAR as a control line for an ecological burn in important heathland. The GAR line worked extremely well despite being subject to intense fire behaviour from the long unburnt heath, see information below (courtesy Phos-Check Australia)

Example:- We have a planned burn of 500 metres. Fuel height is close to 2 metres in parts and it is estimated fuel loading is around 10MT/ha. Typical eucalypt forest in a 25 inch annual rainfall environment, typical of SE Australia. Some stringy bark trees make mop-up sometimes difficult. The Park Manager would prefer not to send a dozer in to the habitat sensitive area because it could cause erosion.	
Solution:- Spray a 4 metre wide retardant line at around 1lt/m2 for 500m. Retardant required is 2,000lt. Ground applied retardant (currently G75F) mixed cost is around $0.50/lt. Materials cost $1,000.	

In 2013 local Parks Victoria staff arranged a trial of GAR and a tracked skidder know as a Fire Tracker. The trial of this combination showed considerable promise and a brief report on the trial is attached. The Fire Tracker is a tracked logging skidder fitted with a 5,000 litre water tank, spray system and hose reel. It also has a dozer blade and forestry rated cabin. They are produced by KMC in Canada, see: https://www.kmc-kootrac.com/remanufacture/firetruck They normally only seat one person but can be fitted with additional seating. An email from the company regarding this is attached.

The 2013 trial showed GAR could be successfully applied at 5kph and according to the manufacturer ICL, in can be applied at speeds up to 15 kph, see: https://www.phos-chek.com.au/pdf/ground-applied.pdf This is 10 to 30 faster than other ground based systems. Attached is a company brochure on using GAR. A detailed report by Parks Victoria staff recommending increased the use of these machines and GAR was provided to DELWP shortly after the trial was conducted.

The aim of this trial is to build on the success of these initial trials and demonstrate the potential of the technology to control fires quickly.

Retardant is expensive with an applied cost of around $1.20 per litre. A typical application rate of one litre per square meter on a 4 metre wide control line a would give a cost of $4,860 per kilometre. A conventional mineral earth line using a D6 dozer and 3 Slip On Units (SOU) would cost around $850 per kilometre. A First Attack D4 Dozer (FAD) and 3 Slip On Units (SOU) would cost around $1,225 per kilometre. A hand trail built with 10 crew would have a cost of around $4,500 per kilometre. A table showing the components of the principle control line systems as well as their average speed and cost per kilometre are set out below. Information in the table is based on the DSE publication *Park and forest firefighting resources guide* and is for flat ground with a high fuel hazard (15 tonne/hectare).

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Components	10 firefighters with hand tools	D4 bulldozer 3 slip-on units 6 crew	D6 bulldozer 3 slip-on units 6 crew	Tracked carrier Retardant mix 2 crew
Output – m/hr	100m per hour	400m per hour	700m per hour	5000m per hour
Cost per km	$4,500	$1,225	$850	$4,860

GAR is more expensive per kilometre than conventional methods of fire control however when the above outputs and costs are applied to various fire scenarios the true cost of each system can be seen. In these scenarios no other resources are used although in reality additional resources would be added (at additional cost). Patrol, blacking out and rehabilitation costs are included at a nominal $500 per hectare, reducing once fires reach around 50 hectares as blacking out then only occurs within 100m of the edge. GAR lines require little if any rehabilitation.

If we use a typical fire burning on flat ground in mixed species forest with a fuel load of 15 tonnes per hectare and weather conditions that equate to a Fire Danger Index (FDI) of 20 (High) and a Rate Of Spread (ROS) of 350m per hour. Rates of spread are from the CSIRO Forest Fire Danger Meter. Crews do not arrive at the fire until one hour after ignition. Below are expected results for each system.

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Size of fire when crews arrive	1.2 hectares - Hand crews not suitable	1.2 hectares	1.2 hectares	1.2 hectares
Controlled size	N/A	65 hectares	3 hectares	1.5 hectares
Perimeter - km	N/A	5.5 km	1.2 km	0.85 km

Control line cost	N/A	$6,738	$1,020	$4,131
Patrol and blackout	N/A	$27,500	$1,500	$750
Total controlled cost	N/A	$34,238	$2,520	$4,881

If we raise the FDI to 30 (Very High) and a ROS of 510m per hour then the following is likely to happen:

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Size of fire when crews arrive	2.8 hectares - Hand crews not suitable	2.8 hectares	2.8 hectares	2.8 hectares
Controlled size	N/A	Control only achievable after conditions moderate – over 120 ha.	45 hectares	4.3 hectares
Perimeter - km	N/A	9 km	2.5 km	1.3 km
Control line cost	N/A	>$12,000	$2,125	$6,318
Patrol and blackout	N/A	>$45,000	$22,500	$2,150
Total controlled cost	N/A	>$57,000	$24,625	$8,468

At an FDI of 40 (Very High) with ROS of 680m per hour:

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Size of fire when crews arrive	4.2 hectares Hand crews not suitable	4.2 hectares	4.2 hectares	4.2 hectares
Controlled size	N/A	Control only achievable after conditions moderate – over 300 ha.	Control only achievable after conditions moderate – over 250 ha.	5.6 hectares
Perimeter - km	N/A	20 km	12 km	1.8 km
Control line cost	N/A	>$25,000	$10,500	$8,748
Patrol and blackout	N/A	>$100,000	>$60,000	$2,800

Total controlled cost	N/A	>$125,000	>$70,500	$11,548

At an FDI of 50 (Very High to Extreme) with ROS of 850m per hour:

System	Hand trail	Dozer line – D4	Dozer line – D6	GAR
Size of fire when crews arrive	10 hectares Hand crews not suitable	10 hectares	10 hectares	10 hectares
Controlled size	N/A	Control only achievable after conditions moderate – over 1,000 ha.	Control only achievable after conditions moderate – over 480 ha.	36 hectares
Perimeter - km	N/A	30 km	20 km	2.5 km
Control line cost	N/A	>$36,750	>$17,000	$12,150
Patrol and blackout	N/A	>$150,000	>$100,000	$18,000
Total controlled cost	N/A	>$186,750	>$117,000	$30,150

As can be seen from these examples, as fire danger increases, a significant reduction in the fire area can obtained by using GAR which reduces the overall cost of controlling a fire, as well as the risks of escape and hazardous trees.

Attached is an alternate scenario for the 2013 Harrietville Fire. This fire burnt 37,000 hectares of public land, caused the deaths of two DELWP employees and had an estimated economic cost of $40 million. The scenario replaces the DELWP First Attack Dozer (FAD) with a “Fire Tracker” tracked carrier system using GAR. The estimated cost of containing the fire in this scenario is $5,915.

Implementing the trial

The Grampians Region already has a Fire Tracker available for use in a trial. It’s the same machine used in the 2013 trial in the Grampians and is owned by Tiley Industries in Raglan, near Beaufort. Attached is a company brochure on the machine. The input costs for a trial are set out in the table below.

ITEM	COST
Fire Tracker tracked skidder and operator – per hour	$300
D4 FAD and operator – per hour	$190
Ground applied retardant – per litre	$1.20
Transport Float – per hour	$150
Retardant tanker – per hour	$120
Water tanker – per hour	$120
Slip On Unit – per hour	$50
Driver/crew/support staff – per hour	$40

A suitable site to conduct a trial would be an area of reasonably long unburnt native forest that is scheduled for a fuel reduction burn. To ensure the trial is as realistic as possible, a fire would be started at one point and allowed to burn for an hour before any suppression work starts. The fire tracker would then be deployed on the burn as if it was a fire (starting from the pint of origin and tracking the East side first). A FAD and SOU's would follow up the Fire Tracker to monitor the effectiveness of the retardant break and to provide support if needed.

A trial of this nature would demonstrate the effectiveness of the GAR/tracked carrier system in a real-world situation without undue risk. An alternative to native forest could be a stubble burn or heath burn but native forest would be the most applicable.

ITEM	UNIT COST	TOTAL COST
Fire Tracker tracked skidder and operator – 6 hours	$300	$1,800
D4 FAD and operator – 6 hours	$190	$1,140
Ground applied retardant – 5,000 litre	$1.20	$6,000
Transport Float – 4 hours	$150	$600
Retardant tanker – 2 hours	$120	$240
Water tanker – 2 hours	$120	$240
Slip On Unit – 4 x 8 hours	$50	$1,600
Driver/crew/support staff – 14 x 8 hours	$40	$4,480
TOTAL COST		**$16,100**

Discussion

The tables above comparing the performance of different fire line construction systems show the significant cost advantage using GAR would provide fire management agencies. Savings in direct suppression costs of 80% to 90% are possible. A reduction in area burnt of 30% to 98% would mean significant reductions in environmental damage, property and economic losses. The cost of the GAR system is also less than comparable conventional systems further reducing overall fire management costs as well. If this trial proves as successful as previous use of GAR has been then DELWP, and perhaps the CFA to a limited extent, should begin introducing the system some of the more fire prone areas of the state. If the system continues to perform as expected and as agency personnel become familiar with the technology, it can be rolled out to all areas.

A fully remanufactured, as new, Fire Tracker with angle/tilt blade, airconditioned crew cab (full ROPS/FOPS) and 4,500 litre tank with pumps and reels would cost around $600,000 AU. The Fire Tracker is able to spray retardant to quickly create a control line and construct a mineral earth line if needed. The front mounted spray monitor can knock down flames ahead of the machine to reduce heat and risk to the machine and occupants as well as extinguish spot overs and flames high in trees. Should the Fire Tracker break down or become stuck/bogged, the crew could use the remaining retardant in the tank to create a fire proof zone around the machine protecting it and the crew from the fire.

A D6 dozer with angle/tilt blade, airconditioned crew cab (full ROPS/FOPS) and 4,000 litre 4WD tanker would cost over $1 million and be less capable. The dozer must build the fire line for the tanker to travel on so line construction speed is much slower than using retardant. The tanker must remain some distance back from the dozer due to the risk of falling trees and is therefore unable to protect the dozer from heat and knock down flames ahead of it. Should the dozer break down or become stuck/bogged, the tanker and crew could move forward and protect the machine and driver as well as themselves.

Bushfires cost Victoria tens of millions of dollars on average each year. This seasons' fires are predicted to cost the state hundreds of millions and the Bushfire Royal Commission put the total cost of the 2009 Black Saturday fires at $4.1 billion. Ground Applied Retardant has the potential to save the state and the Victorian community huge amounts of money, not to mention avoiding the personal and economic losses associated with bushfires as they currently occur.

Hey Daryl,

We have received your inquiry on our website, thank-you. I have spoken to our engineer about the 3 person cab, and it's not something we would easily be able to do with the current canopy design. The current canopy could be widened, but would likely only fit 2 people on a bench seat. We have done up designs in the past with a secondary cab for additional personnel, behind the operators cab, but this is a rather complex and expensive design. It would be quite easy to put "jump seats" on the back of the cab, allowing for 3 passengers, and that's what we would recommend as designing and testing an all new canopy is rather costly. We greatly appreciate your interest in our machinery and wish you the best of luck in convincing the government, if you have any other questions feel free to let us know.

Regards,

KMC-Kootrac