



Tech Talk: Changing Times and Mining Shovels

Posted by [Heading Out](#) on November 7, 2010 - 7:33am

Topic: [Supply/Production](#)

Tags: [buckets](#), [bucketwheels](#), [dragline](#), [shovel](#), [surface coal mining](#), [tech talk](#) [[list all tags](#)]

I have been discussing the technologies for oil well drilling and coal mining for quite some time, and am thinking that with that review available and just about complete, it might be time to switch the focus of these Sunday information topics. While I could give a more detailed discussion of the different topics that I have covered in the past, I suspect that this would be of decreasing interest to most and so I thought to change the subject matter. What I am planning on doing is to shift focus, and start to write about the different countries that have oil reserves (or had) and what we know about them.

The idea, in much the same way as with the technical talks, will be to provide an informative set of background notes, so that, for example, if the topic of the Yamal gas fields comes up, you would know a little about where they are (a peninsula in Russia), and how much gas (maybe 30 trillion cubic meters) is there, as well as how soon they will be developed ([not this year](#)).

That is the plan for the future, but before moving there, I would like to revisit coal mining to wrap up the discussion with a small number of posts about surface mining. The first use of coal came from finding outcrops where the coal could easily be picked out of the seam, or where, in the North of England, the sea would do the mining and wash the coal up on the beach, where it could be collected.

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Even today there are still areas around the world where there is coal very close to the surface, which can easily be uncovered and removed. Some years ago a farmer came to my office to discuss what he needed to do to mine a layer of coal he had found in his farm (in central Missouri) just below the surface. All that was needed, he thought, was a blade for his tractor to push the soil away, and then a loader to scoop up the coal and take it to market. I had to explain that those simple times had passed, and that there was a considerable body of regulation that he had to comply with before he could do that. And also he had to restore the land to the way it was, after he was done. The profit he had anticipated, faded as he went through some of the costs that he would have to face.

However, and this was part of my first talk at the ASPO-USA meeting in Washington [earlier in the month](#)) the technology for mining that coal on the surface remains at about the level of simplicity that he anticipated. Coal supplies, whether in Africa, Asia, Europe (though to a more limited extent) and America are still available that can be extracted with nothing more than a shovel. Now, having said that, the size of the shovel has undergone a significant change since the time that I manually wielded one, to move 15 yards of coal from the face to the conveyor (as I recounted in the video). And as an aside, the shape of mining shovels differs a bit from those usually seen at the surface.

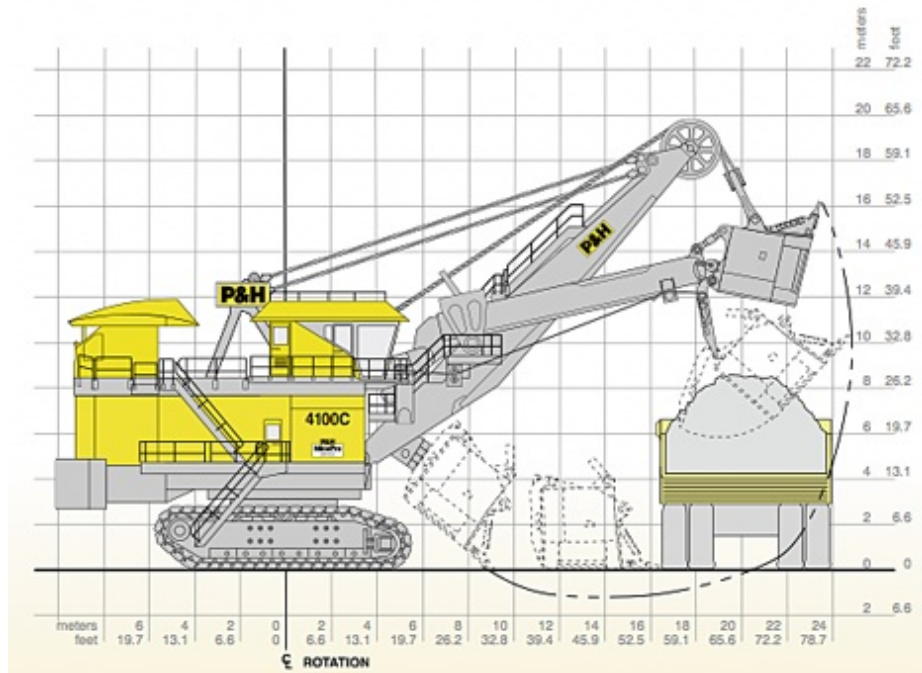


Mining shovels and a pick (with the Engineer at an early age) at the [Beamish Museum](#) in the UK

The heart-shape allowed you to get under the coal and pry in a way that the square and molded shovels more common on the surface did not, though most of them came without the cross piece at the top end. Today's shovels are electrically powered and have bucket sizes that can pick up between [7 and 36 cubic yards](#) of material in a single scoop. They routinely fill 400-ton haul trucks in two to three scoops in operations at the tar sands, and in mines around the world.



Modern shovel loading a haul truck ([P&H](#))

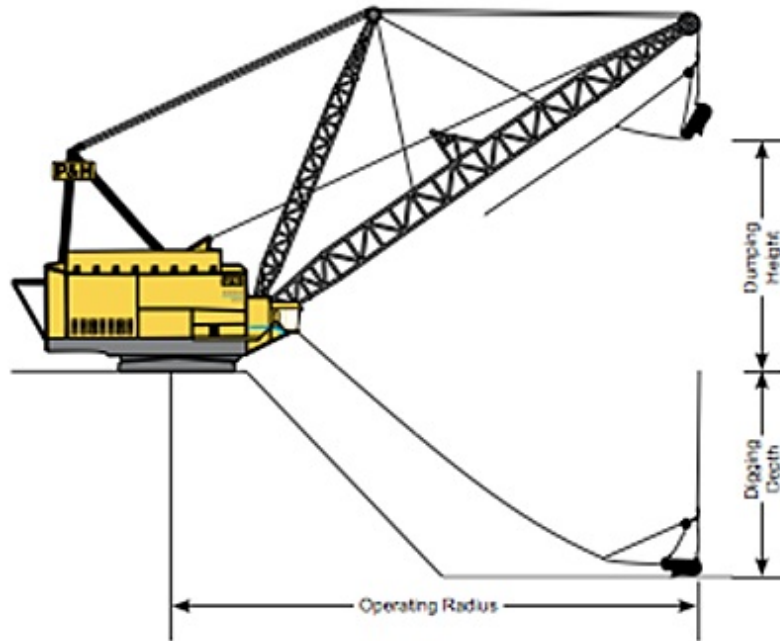


Shovel schematic to give an idea of size – the bucket can hold 170 tons, some 60 cu yds. of material.

With that relatively large-volume, simple approach it is difficult to envisage something that can be simpler or more economic, in the mining of minerals. And as long as this technology can be applied, the need for more advanced mining means does not exist. (And this was part of the talk that I gave at the ASPO meeting).

Mining shovels such as that shown above, which are generally powered by electricity – you can see the cable if you look closely – are used for the more precise removal of material that is needed

when mining the valuable material, whether tar sand, coal or a metal ore. To remove the rock and dirt that lie on top of this valuable material, where there is not quite the same need for precision, it is quite common to use a machine known as a dragline. (There is a video of one working [here](#).) Here the bucket is not rigidly connected to the boom as with the shovel shown above, but is instead connected through ropes. This, historically, made the bucket more difficult to control. However the arrival of the computer to both monitor and control rope position, now makes it much easier to "spot" and unload the bucket than in the past.



Working dimensions for a dragline (P&H)

A bucket might move 150 cu. yds at one time with an operating radius of some 350 ft, digging down to a depth of 180 ft and dropping the spoil in a height of up to 160 ft. That doesn't mean that they don't [get stuck](#), or [collapse](#) on occasion.

The size of the shovels thus make it possible to mine very large quantities of material at one time, and make the economics of large-scale mining practical. The critical dimension is typically the relative depth of the soil and rock over the coal seam, in relation to the thickness of the coal. It is known as the stripping ratio, so that a coal seam that is 5 ft thick, for example, at a depth of 100 ft, would have a stripping ratio of 20. Depending on the costs of mining, and the quality of the coal, that may or may not be worth going after at this time.

There are other machines that are used in different parts of the world, the largest being the bucketwheel excavator, which usually only get into the news when they are [on the move](#).



These machines work extremely well in a controlled environment, but are extremely expensive, and when they are down, so is production. (One of the main reasons that they are no longer used in mining tar sand in Canada.) Mind it is not wise to get one irritated, since they have been known to eat up other equipment.



That aside, the nature of the rock and other material overlying the seam will also influence how that material (which is called overburden) is removed, and I'll discuss that process in more detail next time.



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