GIS Mapping

Spatial Association and Interconnection

In this activity, we will generate our own accurate maps and at the same time explore some of the basic concepts of geography: Interconnection and Spatial Association in particular.

Maps can be much more than just 'directions'

We will be looking at placing specific elements into their correct locations or place on your map and then deciding if there is any relationship to some other element that we can also map. In other words, does this one feature on the map relate to this other particular map feature? For example, are rivers usually found in valleys?

Once this could have been a task that might take weeks of work but given the amount of digital information available today and the development of some very smart computer programs, we can rapidly produce different maps by creating and overlaying different datasets or layers, such as roads, bus stops and hospital or police station locations. Imagine if you had several sheets of tracing paper, each sheet contained an important part of an overall image. Your bottom layer is the "Base" and every other layer will add to the data displayed, building the picture as they are added.

These maps display 'integrated data' and the programmes that use it produce smart maps or GIS Maps (Geographic Information Systems – you can learn more here: (**National Geographic GIS Mapping**). Even better, we can learn by doing some of this mapping ourselves and use the Earth Resources Victoria **GeoVic** application for **free** to do it.

Activity Outline

Firstly, we need to have an idea of what it is we want to achieve and put some thought into what we are going to do. What it is that we **want** our maps to show and help explain?

In this 'demonstration lesson' we are going to focus on the **Latrobe Valley**, the underlaying **mineral resources** found there, demonstrate where this area is, its proximity to Melbourne and the important role it has played in providing power to Victoria. We will do this by creating some specific maps.

Later, you can look at other areas of Victoria on your own and use the various 'layers' available to make maps and answer other questions. For example, the sources of energy we use for providing power in our society to fuel industry or light our homes in our biggest cities like Melbourne are all unevenly distributed across the Earth's surface and may be located a

long distance away. Wind is most plentiful and cheapest to access for wind power in the windiest places – but that might be on a hill top or beach-side cliff top (see Approved Wind Farm Properties layer under Energy>Wind Resources/Farms); oil and natural gas might be cheapest to access and most abundant deep underground in the seabed e.g. in Bass Strait (see Petroleum layer under Wells and Boreholes in Energy>Wells), and even sunlight for solar power is most reliable, cheapest and abundant in cloud-free areas (see Approved Solar Farm Properties layer under Energy>Solar Atlas). In each case, including coal, these might be located a long way from where the energy is used so an issue is how can we transport the energy to where it is needed, or should we move the houses and factories close to the energy source.

1 – The first thing we will do is create a **base map**. Everything we create later will lay over the top of this base layer. This base layer will determine the size and scale of everything that we create later..

2 – Then we will add some detail (layers) and draw some conclusions from what we can see.

3 – We will continue to add or change layers so that we get a good overall understanding of the answers to our questions. It's important to critically examine the layers as you add them; does this layer better explain the story or does it make the story harder to "see"? By adding a layer, will I need to explain my map more to make the story clear?

Task Steps

Let's begin:

Open GeoVic - Resources Victoria (https://resources.vic.gov.au/geology-exploration/maps-reports-data/geovic) this is the online free mapping location. Then Click on the Anonymous User Tab

You should now see a window that looks like this:
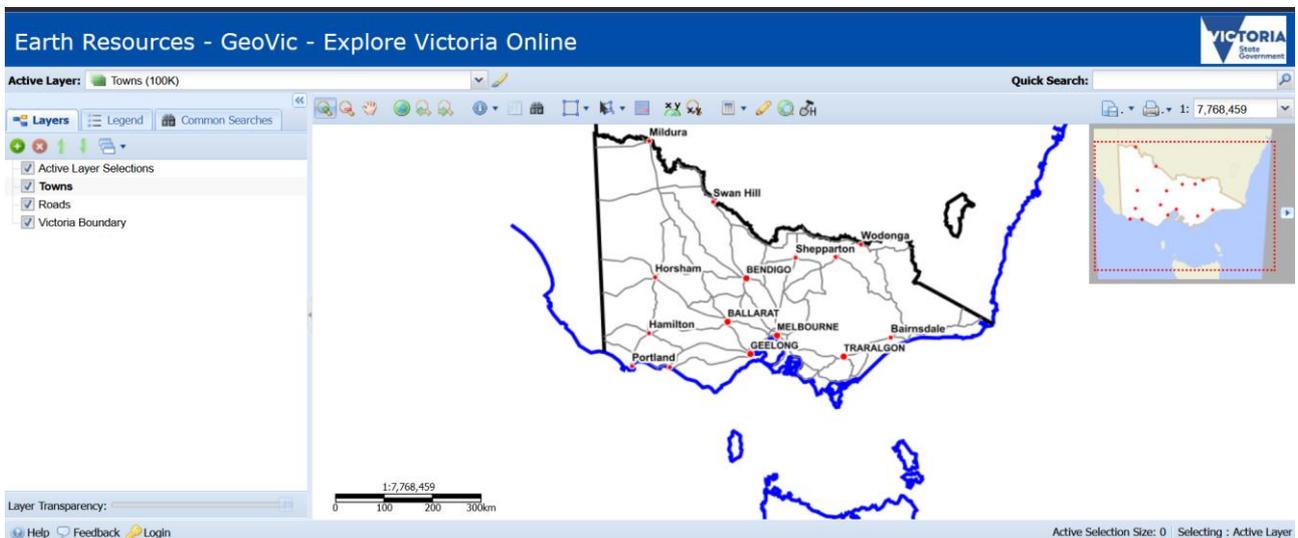

What you now have is a map of Victoria; In the box on the left of screen you can see the ticked boxes with the names of the information layers that are currently visible. On this initial, start-up map we can see the active layer selections of: Towns, Roads, and the Victorian State Boundary.

If we unclick or *deselect* these boxes, the map adjusts and looks like this:
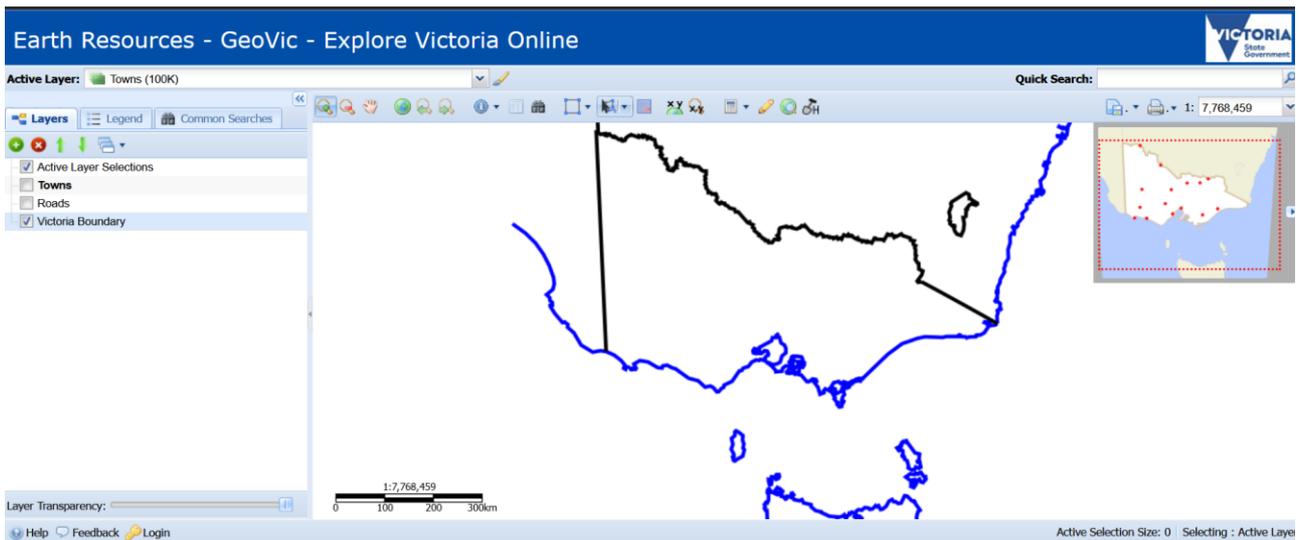
We have left the Victorian Boundary as an active layer, as without it the map would be completely blank. Try it for yourself. At any stage of your mapping, you can print a copy by clicking on the printer button – top right of the map you have created. Or rather than print a hard copy, there is the option to save your map as a .pdf copy as part of that same print menu. You can create one for each of the following steps if you like.

If we want to add another layer of information to the map, we need to select it from the list of information provided. To see this list and to select a layer; Click on the green 'plus' + button on the top left of the layers box. You will see a pop-up box appear on screen.
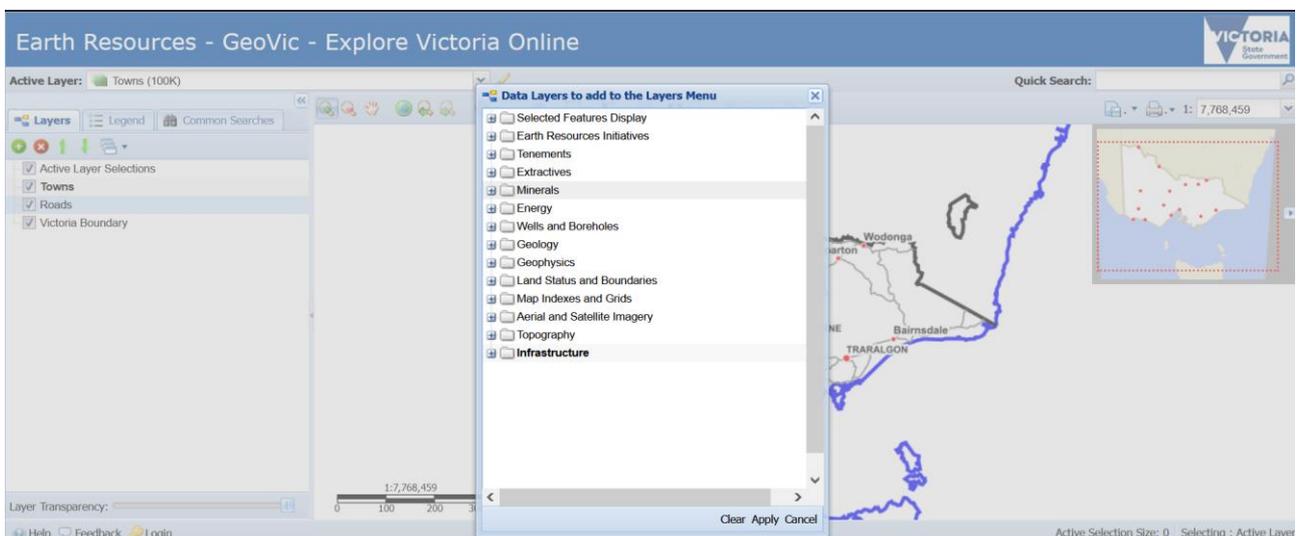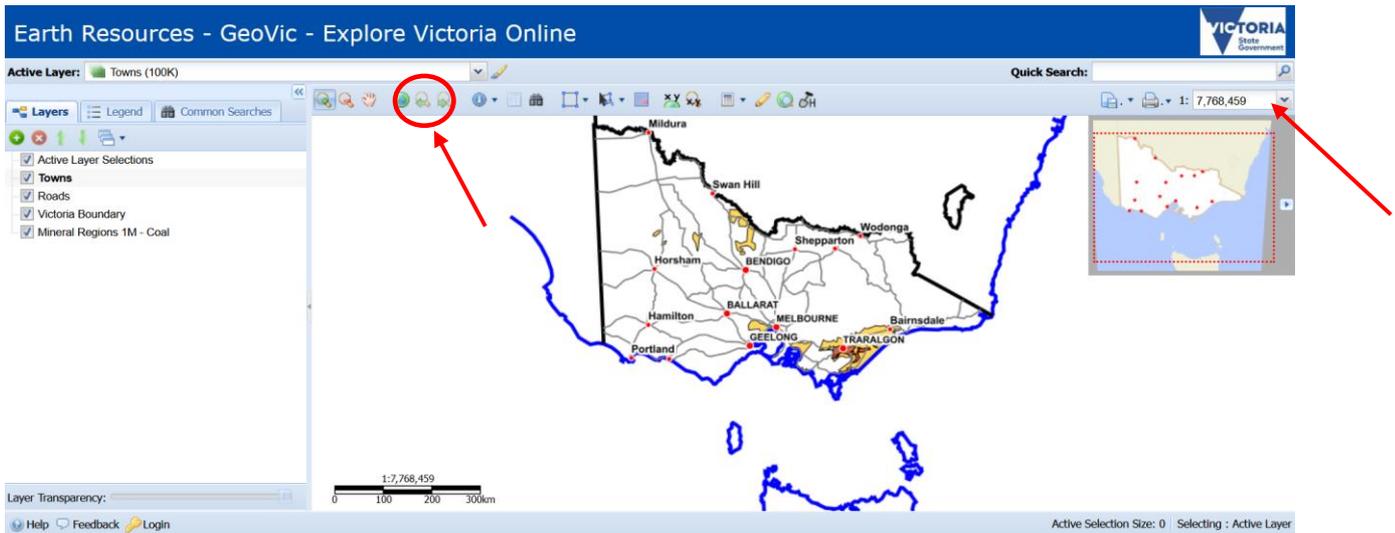

There are lots of layers you can experiment with from this page, however today we want to look at Coal deposits and where they occur.

- Click on the + next to Minerals … then click on Mineral Areas …. Then check the box next to Coal – it should look like this:
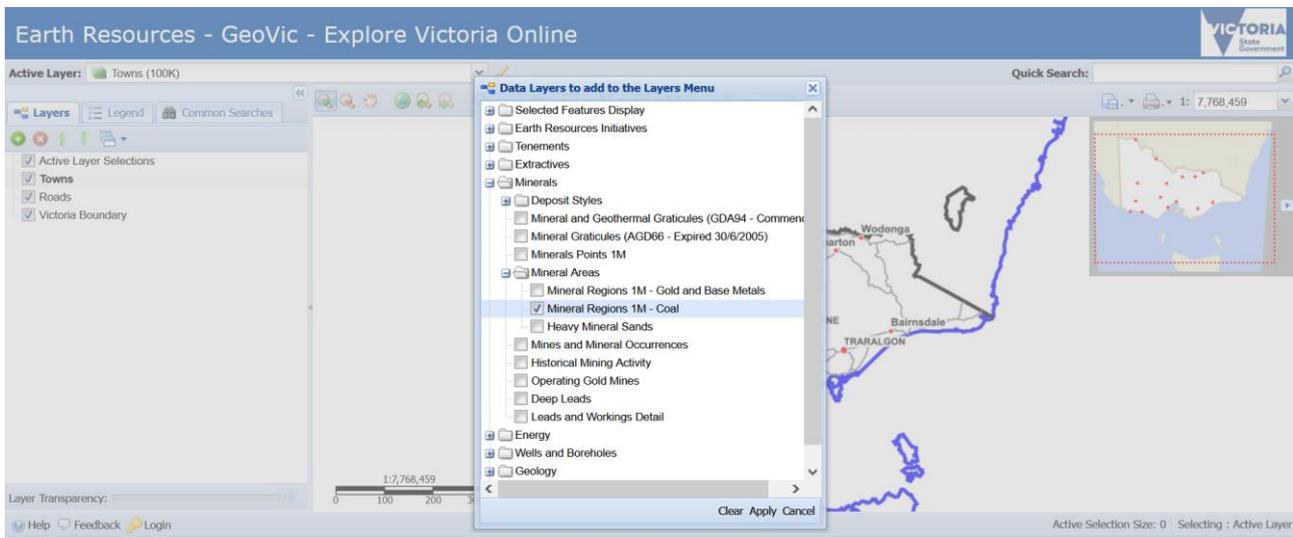
- Click on 'Apply' at the bottom of the pop-up page …

- Click on the Hand image at the top of the tool bar. This allows you to drag the view of your new map. Use the scroll wheel on your mouse to zoom in and out or adjust the view scale

In my example, I've zoomed in using the scroll wheel … notice the scale information adjusts automatically. That's good to know if you are going to use the map in any investigation or exercise you do, as you can accurately describe your illustration e.g. "Figure 1 - Map describing coal deposits in Victoria, Aust. Scale 1:971057"
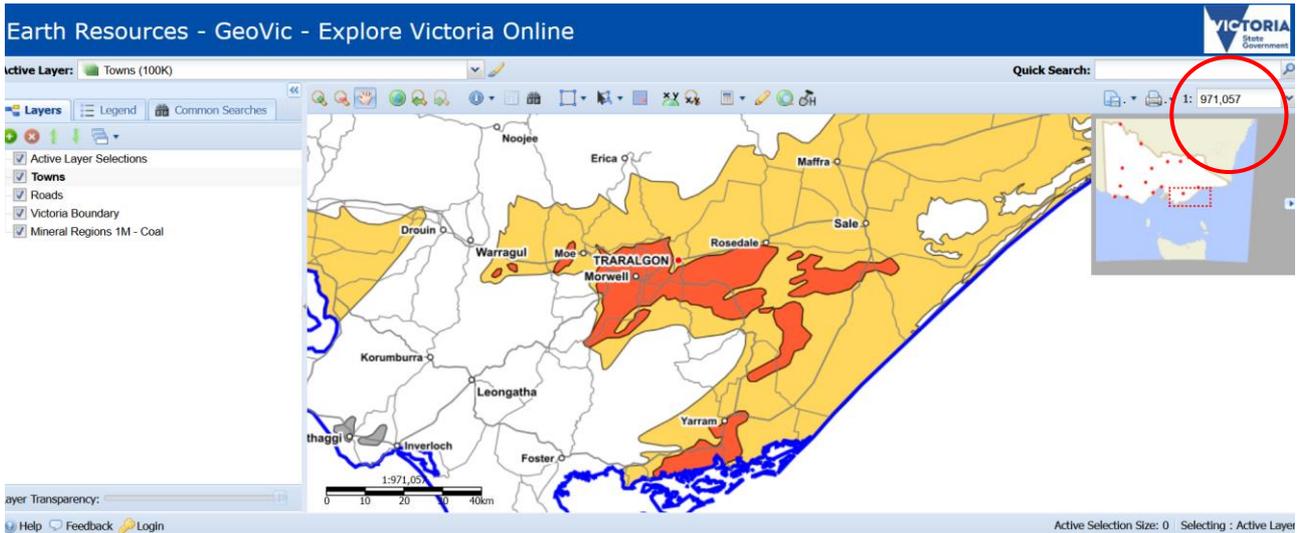
We now have a map that shows the coal deposits in Victoria, and we can see the **Scale**.
A good map has several other features too though: Think; B.O.L.T.S.S(cale)

- Click on the **Legend** tab next to our Layers button.

The Legend gives us an explanation of what the map is showing us, generated from the Active Layers we selected in the beginning. You can now see the presence of Cities and Towns - their relative scaled sizes are indicated by dots. The major roads are described and also the State and coastal boundary (remember the State boundary doesn't end at the beach).
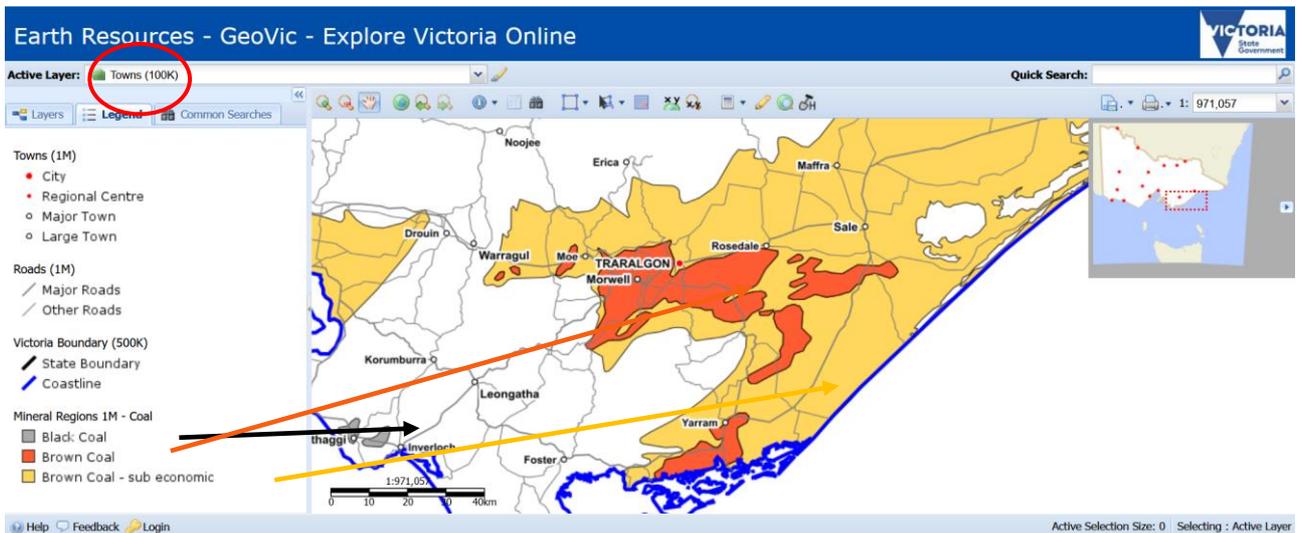
We can also see that the presence of Coal is colour coded on our map. There are 3 entries for Coal:

Black Coal – some deposits near Wonthaggi/Inverloch

Brown Coal – a much larger deposit centred around Traralgon and Morwell

Brown Coal (Sub -economic) – meaning it is still brown coal but the cost of extracting it is too high to make it worthwhile.

- What is the difference between Brown and Black coal? You can find lots of information here: **Geoscience Australia Coal**

Let's use another map system to make an observation:

- Open a new browser tab (don't close your GeoVic tab) and then open Google Maps/Earth

- Look for the places where coal is shown on GeoVic; the Latrobe Valley. We want to observe this location so try the layer 'Satellite View". You should see something like this:

Yallourn, Hazelwood, Loy Yang (Google Earth)
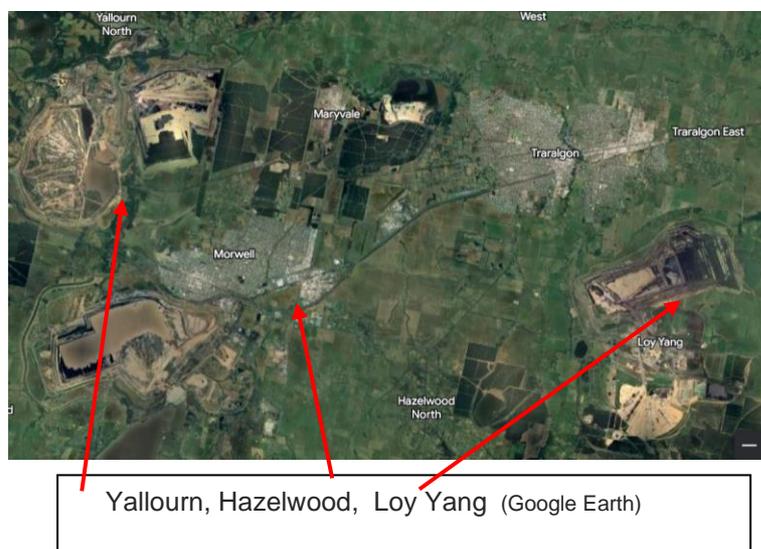
In this image you can see Traralgon and Morwell, two of the larger Latrobe Valley towns and you can see the three major coal mines: Hazelwood, Yallourn, and Loy Yang.

- Why do you think the mines are located where they are? Is there a **Spatial Association** between where coal mines are located and where coal deposits have been mapped?

It's important to understand, however, that while coal is an important element in the production of electricity it doesn't actually make it. Coal is burned to produce heat, which is used to make steam. That steam is then used to drive turbines that make electricity. The processes involved in the supply of power means that it is easier and cheaper to make the electricity and send it via wires (e.g. suspended on tall metal towers above ground as Transmission lines) to where power is needed than to transport bulky coal by road or rail and then use it to generate electricity.

The largest power stations that generate power therefore are located next to the coal mines and not in Melbourne or its surrounding suburbs.

Yallourn Open Cut Mine and Power Station: Google Earth

Transmission Tower: Loy Yang

In the satellite image above, you can see the **spatial association** between the coal, coal mine, and power station (circled) at Yallourn.

Coal has been mined in the Latrobe Valley since the late 1800's, its use in generating electricity came a few decades afterwards. One of the first uses of brown coal was to crush and reform the crushed coal into a type of coal dust brick called a "briquette". These briquettes could then be used as fuel in boilers and furnaces in Melbourne as an alternative to the more expensive and difficult to obtain black coal.

Again, note the **spatial association** of the coal mine and the briquette factory (Below)

Briquette Factory Yallourn circa 1950's State Library Victoria IE885772

- The manufacturing of briquettes lasted well into the 2000's. You can, however, still do a virtual tour online of the Morwell Briquette Factory facility despite it being closed for business. Here


**Briquettes being transported from Yallourn Briquette Factory**

Railway State Library Victoria ek 0007063 & ek 0007064

There is an **interconnection** then between the Latrobe Valley and Melbourne and we can 'draw a picture' with a map to help explain what that looks like.

- On your GeoVic mapping page, deselect your active layers to leave just your base map. We have left the 'Towns' layer active so we can see some locations.
  We have also adjusted my **Scale** so that I can see all of Victoria.
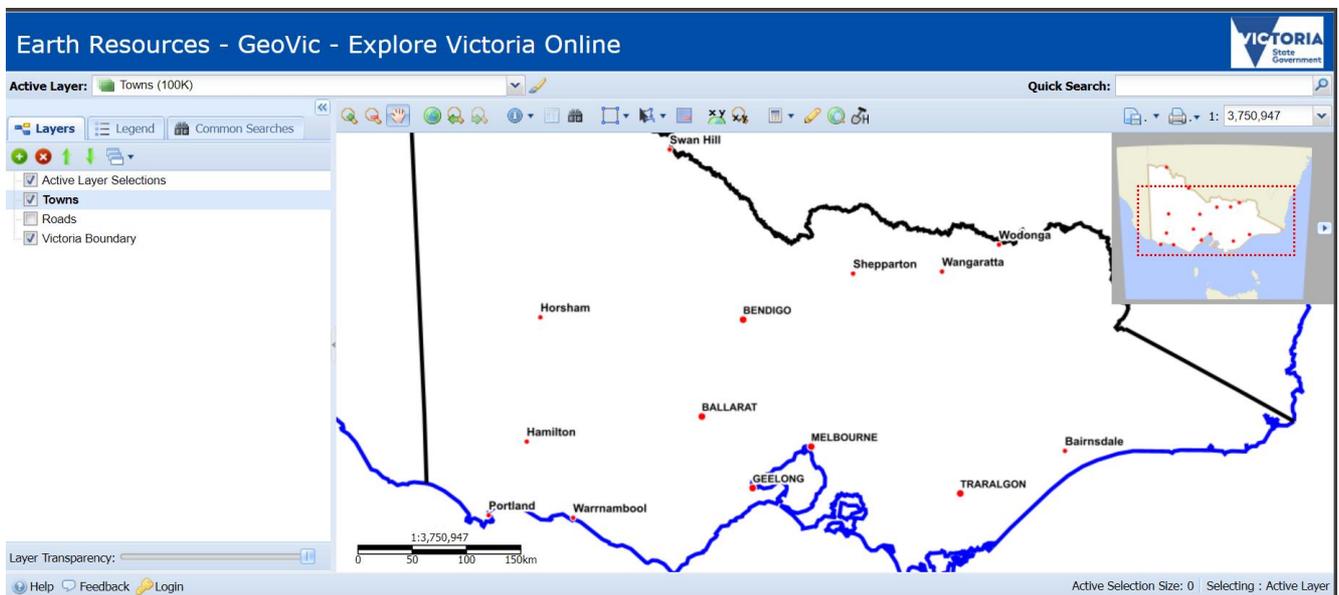

Now from the drop-down layer menu add **Infrastructure** – Railways. A good description and outline of infrastructure and its meaning can be found Here.
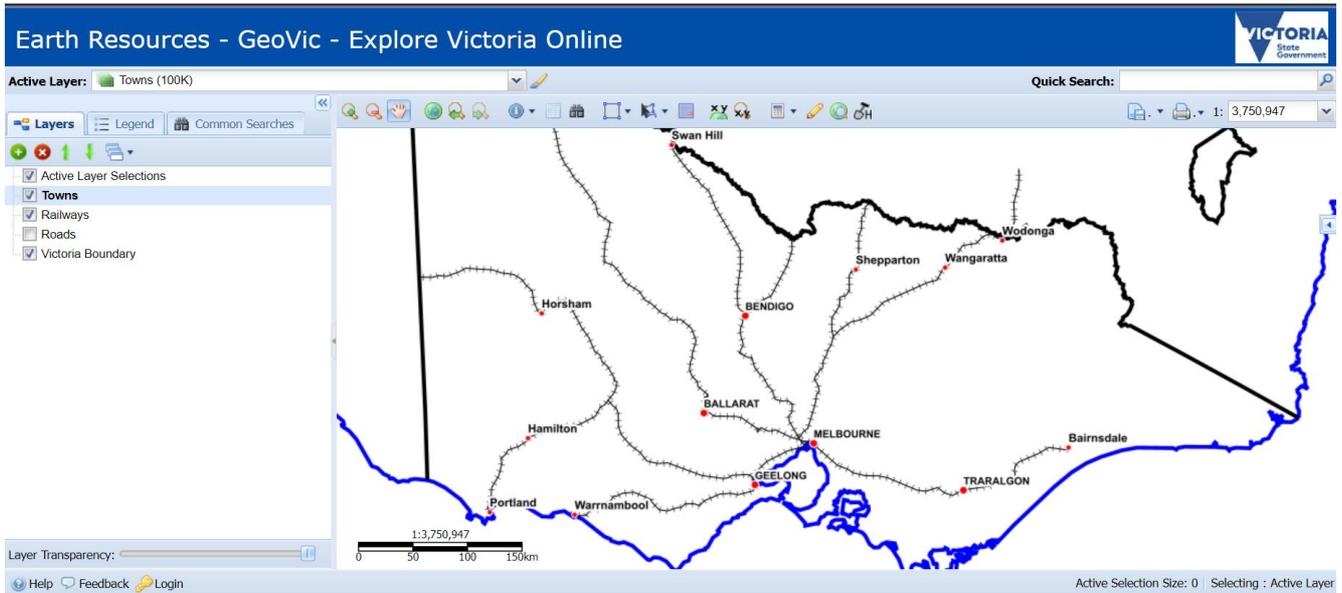
- How might Melbourne, The Latrobe Valley and Coal be **Interconnected**?

So, how does the power generated in the Latrobe Valley get to where it is needed? What pathway does it take? Can we explain by mapping it?

- Deselect the Infrastructure/railways layer and reactivate the Minerals/Coal layer.

- Next, select Power Lines from the choices and click Apply
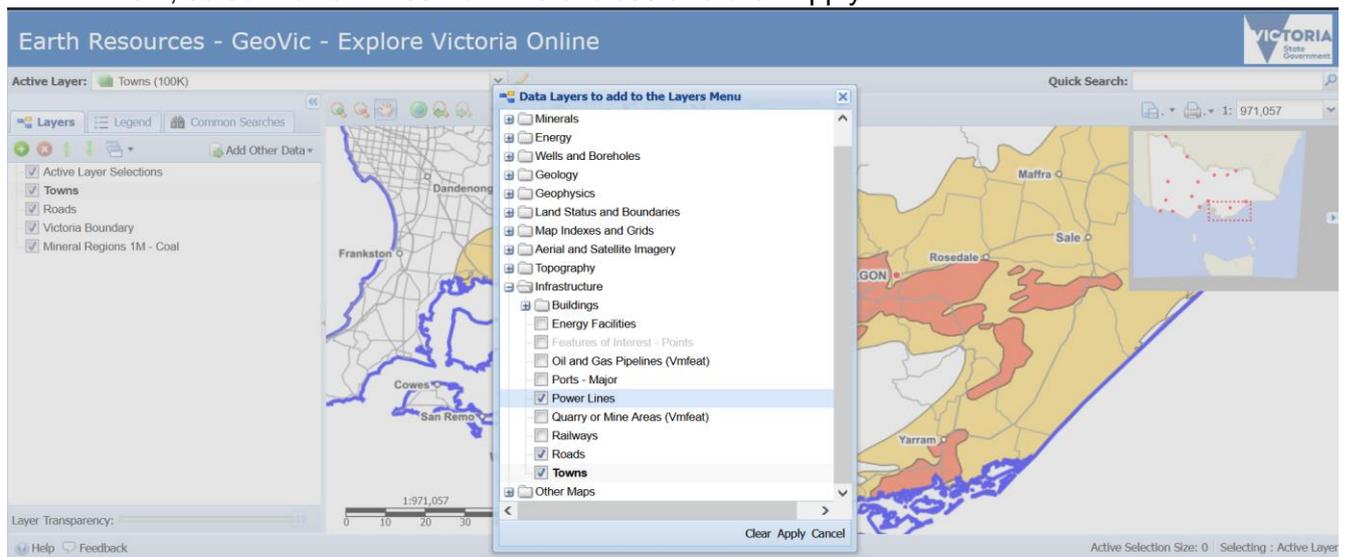
A map is produced. It now shows the locations of towns and cities, the locations of coal deposits and now, the path and destinations of where the electricity is delivered via the power lines from the power generators located near the coal mines.
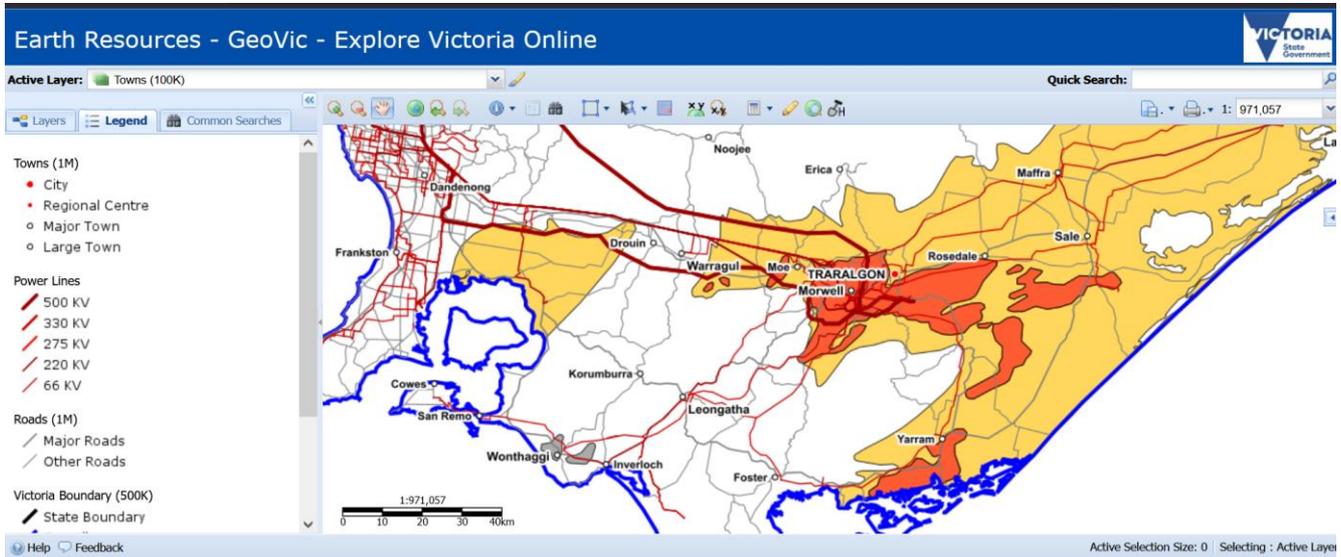
We can now see the various physical pathways that have transmission towers in place to hold the lines that carry electricity to where it is needed. Larger capacity (eg 500 KV – Kilovolts, 500,000 volts) travel along a different pathway than smaller capacity lines. Perhaps you might like to use Google Maps and zoom in to see some of the transmission towers along the pathway?

To get a better, overall view, adjust to what geographers call a small-scale map (that shows large areas in smaller detail).
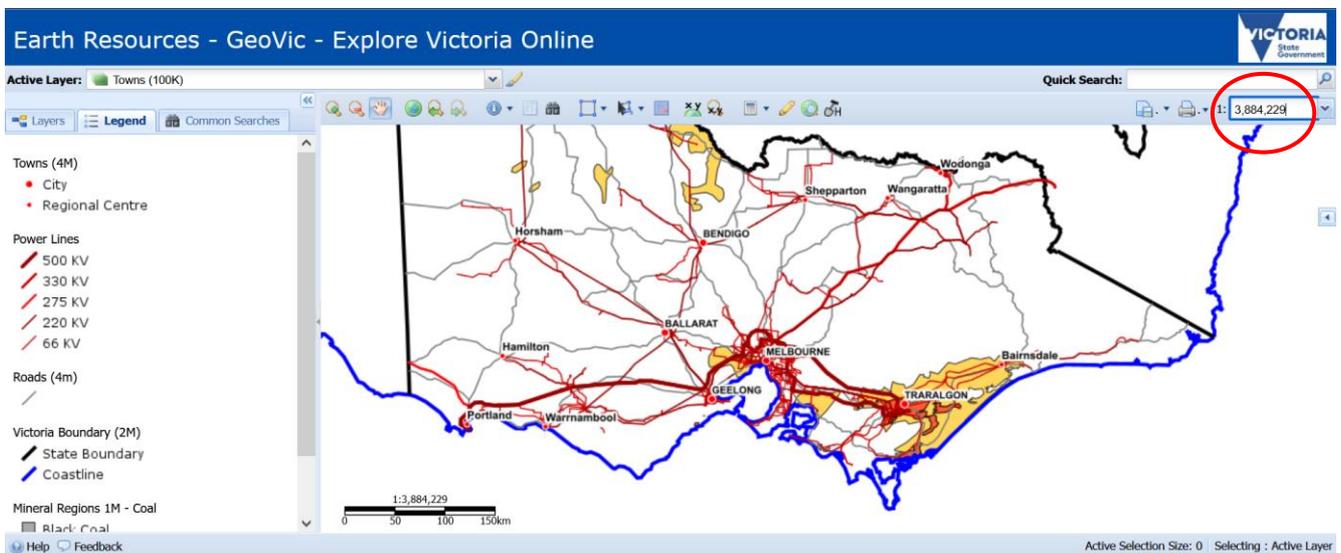
- Given what you can see on your maps, explain the **interconnection** between the Latrobe Valley and Melbourne?
- What is the current **spatial association** between power generation and coal?

- Next, deselect your layers until you get back to your 'Base Layer'

The Geography of Other Resources

By selecting Energy from the drop-down menu on the GeoVic mapping site, you can create other maps that will outline new energy generation and locations. Again, just like coal, you can map how they are **spatially associated** with their local, regional and state-wide networks. Their **interconnection** is as relevant today as it was for coal 100 years ago. Will these change over time too?
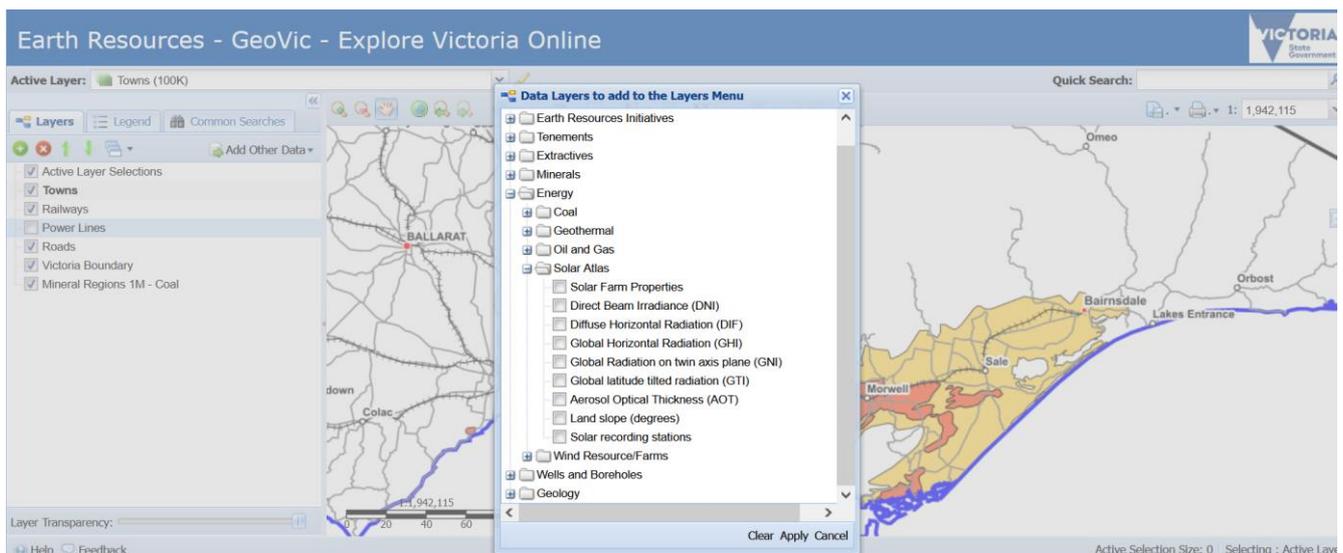
- Explore where solar energy is operating or will be operating from. Do transmission lines allow the power generated in these areas to be shared? Examine where wind power might be located, will that power connect with existing systems?
- In 20 years where will the energy that you need come from, and how will it get to you?

Further Exploration

The role and future uses for coal are debatable. It has been a ready resource that has provided power to Victoria for over 100 years. If other sources of energy can replace it, what then becomes of the vast mines that are left behind? How do we make these places safe, stable and sustainable? What kind of land use changes need to be considered and then made? This is another example of the key elements of study in Geography, **Change**.

The Mine Land Rehabilitation Authority (MLRA) has produced a number of short videos that are designed to help understand these issues and this need for change. Entitled: "A Changing Landscape", they can be found here.

The MLRA always encourages feedback from the public and we especially would appreciate the ideas about the work we do from students of today who are the Geographers of the future. Feel free to send us your thoughts to: Contactus@mineland.vic.gov.au