In problem solving, when we're working with problems with potential and kinetic energy, remember we have our main concept that the non-conservative work causes potential energy and kinetic energy to change.

K final minus K initial plus U final minus U initial.

Now, how are we going to apply this in problem solving?

Well, what we'd like to introduce is a tool, which we're going to refer to as our energy state diagrams.

So the way this works is-- let's have an example to think about.

Suppose you have a dome.

So here's some dome.

We can think of this as the MIT Dome.

And you have an object that is initially at the top of the dome.

And then this object is sliding down the dome and at a later time it's at a point somewhere along the dome.

Now eventually it's going to fall off the dome, but that's a separate question.

So how can we use our energy ideas to analyze this situation?

And the way we do it is that we choose first initial and final states that we're considering.

Because our first idea in the energy diagram is to compare the change in kinetic energy between the initial and change of potential energy between the initial and the final states.

So in our dome problem, we would choose our initial state.

Let's draw our object at the top.

And in our final state, separately, let's draw the object over here.

And then we want to parametrize these states by some type of coordinate system.

So here we're going to have some type of coordinate system that we use for both.

Energy is a scalar, so we don't have to worry about it.

And what I'll do is I'll define an angle theta final.

Here from the vertical, here theta initial is 0.

And I've now parametrized my initial and final states.

Now, the important thing that we'll do in the energy diagram is to choose our 0 potential energy.

Where are we going to choose this?

So we could say either a surface-- we'll call that potential energy.

And in this diagram, I can choose my 0 for potential energy anywhere I want.

But I want to draw it on my initial and my final states.

So I'm going to choose it right here, and I'll denote this as u equals 0.

And now I can now make a list-- so I want to identify.

So step three is to identify the K and U for each state.

So here we have K initial, it's at rest 0.

And U initial, well, I didn't introduce a parameter R. U initialize is how high the gravitational potential energy.

So in this particular case, Mg times R.

Now over here, K final, is 1/2 M V final squared.

And U final, we can denote it here if I plot this out-- and that's R. And then you can see that this is R cosine theta final.

So that's MgR cosine theta final.

Now, the fourth step is to identify W non-conservative.

Is there any non-conservative work?

Now, here let's assume the dome is frictionless.

And that means that W non-conservative is 0.

And our last step 5 is we can apply the energy principle, which is W non-conservative equals delta K-- let's write out everything explicit now that we've defined K final-- minus K initial plus U final minus U initial.

And you see the power of these diagrams and this methodology is we've now defined very explicitly every single term that appears in the energy principle.

And so we can write out our result that 0 K final, 1/2 M V final squared, K initial, 0 plus U final, MgR cosine theta final, minus U initial, MgR, and there we have applied the energy principle using the tool of energy diagrams.