E: Policy uncertainty in depth, part 1

Two kinds of risk:

1. Will policy X be **adopted** or made **more stringent**?
2. Will policy Y be **repealed** or **not enforced**?

Type 1 example:

Power plants and potential **adoption** of a carbon tax

Type 2 example:

Wind turbine investment and **risk of repeal** of a feed in tariff (FIT)

- Shows how **FIT policies** work
- Illustrates impact of **policy risk** on investment incentives
- Demonstrates **dynamic programming** for analyzing repeated risks

Turbine details:

Generating capacity: 1 MW

Costs:

Construction:	$1.5 million
O&M cost:	$0 (for convenience)
Lifespan:	∞ (for convenience)

Revenue:

Hours per year: 24*365 = 8,760 h

Maximum output: 1 MW * 8760 h = 8760 MWh

Capacity factor: 20%

Annual output, Q: 0.2*8760 = 1752 MWh

Buyer price of output, P: $30/MWh

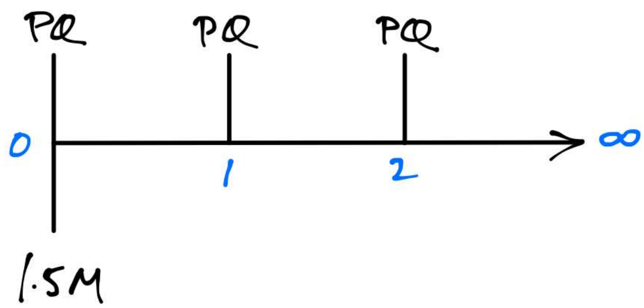
Timing:

Build in 0

Revenue starts immediately (for convenience)

Interest rate: r = 10%

Cash flow without FIT:



PV of revenue stream:

PQ = $30*1752 = $52,560

$$PV_{rev} = PQ + \frac{PQ}{r} = \frac{PQr}{r} + \frac{PQ}{r} = PQ\left(\frac{1+r}{r}\right)$$

$$PV_{rev} = \$52{,}560 * \frac{1+0.1}{0.1} = \$578{,}160$$

Define $V^{NF} = PV_{rev}$ without a FIT (NF = **no** FIT)

NF

$V^{NF} = \$578{,}160$

PV of cost:

$PV_{cost} = \$1.5M$

NPV:

$NPV = V^{NF} - PV_{cost}$ = \$578,160 - \$1,500,000 = -\$921,840

Decision:

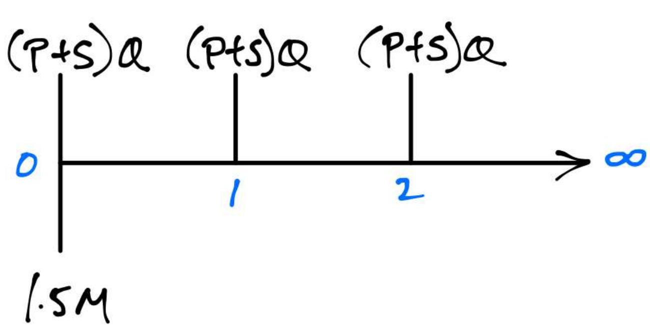
Negative NPV: would not build the turbine

Now add a FIT:

- Add subsidy $S = \$70$ to bring total payment to \$100/MWh
- Initially certain and permanent

Buyer price:	P	\$30/MWh
Subsidy:	S	\$70/MWh
Seller price:	$P + S$	\$100/MWh

New cash flow:



Revenue:

New revenue $(P + S)Q$ = (\$30+\$70)*1752 = \$175,200

$$PV_{rev} = (P + S)Q + \frac{(P + S)Q}{r} = (P + S)Q\left(\frac{1 + r}{r}\right)$$

$$PV_{rev} = \$175{,}200{*}\frac{1 + 0.1}{0.1} = \$1{,}927{,}200$$

Define $V^{PF} = PV_{rev}$ with a **permanent** FIT

V^{PF} = \$1,927,200

NPV:

$NPV = V^{PF} - PV_{cost} =$ \$1,927,200 - \$1,500,000

$NPV =$ \$427,200

Decision:

Positive NPV: would proceed