

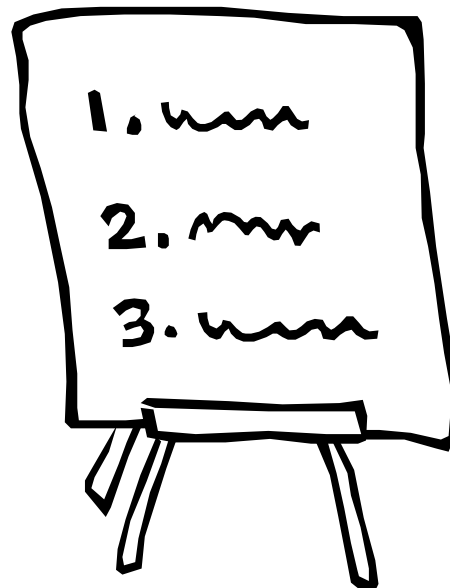
# Introduction

- **Concerning the documents referred to in this presentation:**
  - ❑ **Unless otherwise mentioned, you can download the documents at**  
**<https://houmollerconsulting.dk/facts-findings/>**
- **This PowerPoint presentation is animated**
  - ❑ **It's strongly recommended to run the animation when viewing the presentation.**
- **On most computers, you can start the animation by pressing F5.**
  - ❑ **Now the presentation moves one step forward, when you press Page Down. It moves one step backward, when you press Page Up.**



# Program for this presentation

- **First, this presentation shows how a financial contract works.**
- **Thereafter, the presentation explains volume risk and profile risk.**



# How a standard financial contract works



# The Financial Electricity Market – 1

- **You cannot buy or sell a single kWh at this market.**
- **The financial market is a market for price hedging and risk management.**
- **On the financial market “delivery” means that the financial contract is finally settled**
  - ❑ **It is delivery of money!**
  - ❑ **Not delivery of electrical energy.**
- **For supplementary description of how a standard financial contract works:**
  - ❑ **See the chapters on financial contracts in the PDF document *The Liberalized Electricity Market*.**



# The Financial Electricity Market – 2

- The contracts used at the financial electricity market are examples of the so-called **derivatives**.
  - ❑ In general, a commodity derivative is a contract whose value is dependent upon the price of the commodity in question
    - ✓ In our case, the commodity is electrical energy.
    - ✓ The spot price is used as the price of the commodity.
  - ❑ There are many types of derivatives
    - ✓ For example futures, forwards and options.
- In this presentation, we look at a producer, who has entered into a standard financial forward
  - ❑ *Standard* means the financial forward works as described in this presentation.
  - ❑ Such a contract works the same way as a so-called *two-way CfD* (two-way Contract for Difference)
    - ✓ At the outset. Other types of two-way CfDs have been proposed, though.



# Example of a financial forward – 1

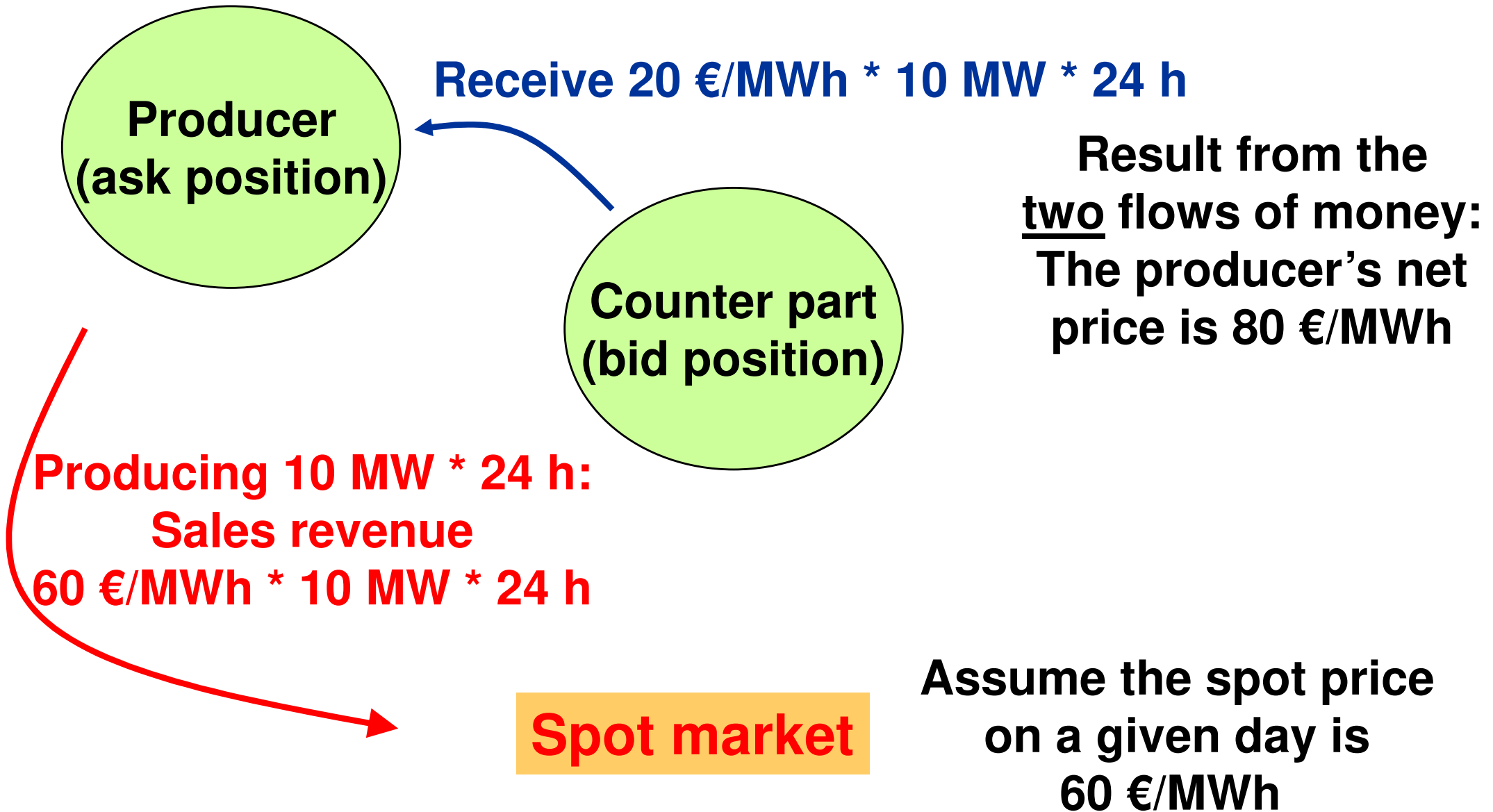
- We consider a power producer, who has an ask position in a forward contract
  - ❑ “Ask position” means the producer will be compensated, if the spot price is lower than the forward’s hedging price
    - ✓ And the producer must pay, if the spot price is higher than the forward’s hedging price.
- Hence, for a day where the spot price is lower than the hedging price, the producer is compensated by receiving

$$([\text{hedging price}] - [\text{spot price}]) * (\text{contract volume}) * 24 \text{ h.}$$
- **Example: assume the producer has an ask position in a 10 MW forward contract.**
- **Assume the contract’s hedging price is 80 €/MWh.**
- **For a given day, assume the day’s average spot price is 60 €/MWh.**
- **In this case, on the following bank day, the producer will receive**

$$(\mathbf{80} - 60) \text{ €/MWh} * 10 \text{ MW} * 24 \text{ h} = 4800 \text{ €.}$$

# Example of a financial forward – 2

*Volume 10 MW, hedging price 80 €/MWh. Settlement for one day*



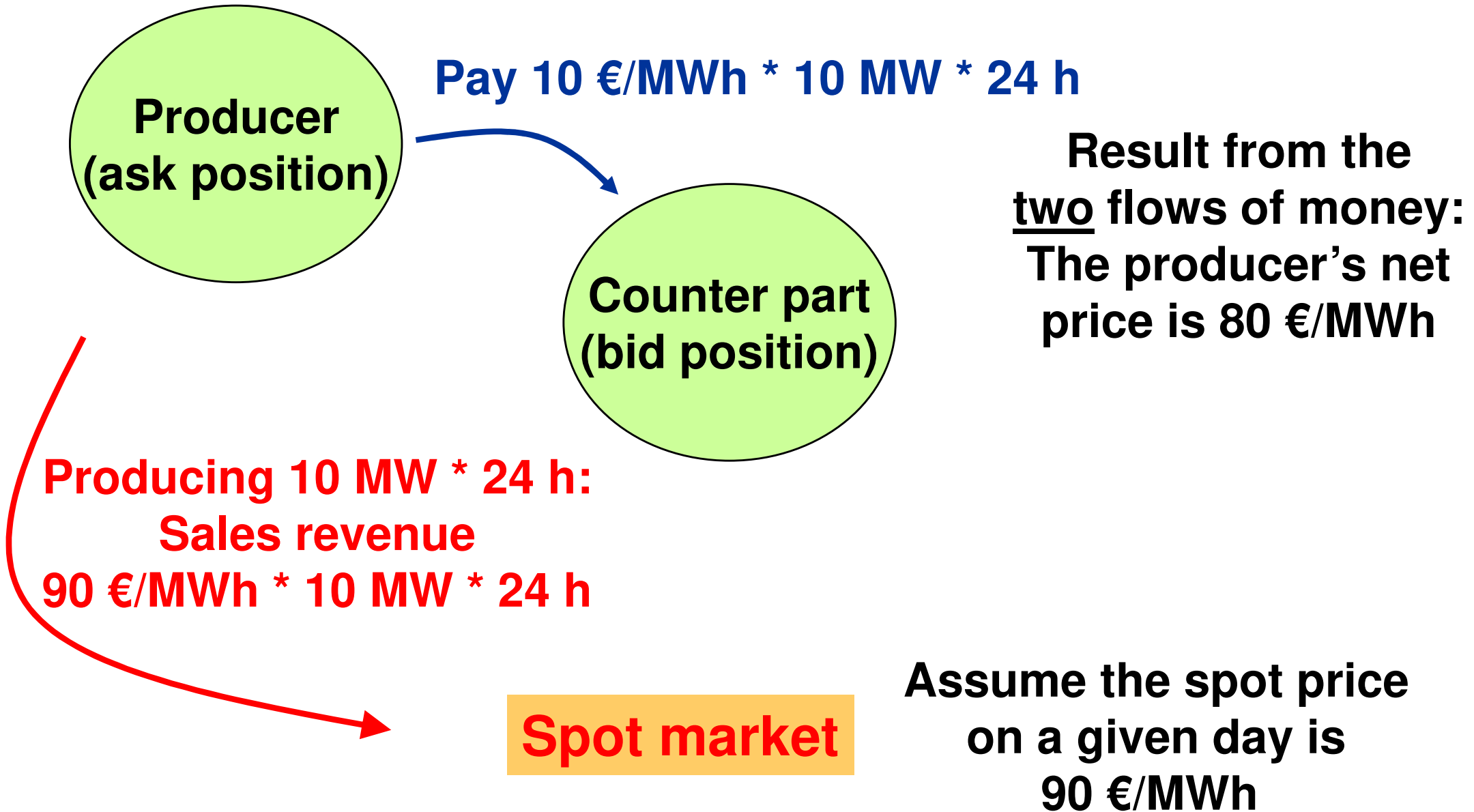
# Example of a financial forward – 3

- We consider a power producer, who has an ask position in a forward contract.
- For a day where the spot price is higher than the hedging price, the producer must pay to the contract's counterpart  
$$([\text{spot price}] - [\text{hedging price}]) * (\text{contract volume}) * 24 \text{ h.}$$
- **Example: assume the producer has an ask position in a 10 MW forward contract.**
- **Assume the contract's hedging price is 80 €/MWh.**
- **For a given day, assume the day's average spot price is 90 €/MWh.**
- **In this case, on the following bank day, the producer must pay**  
$$(90 - 80) \text{ €/MWh} * 10 \text{ MW} * 24 \text{ h} = 2400 \text{ €.}$$



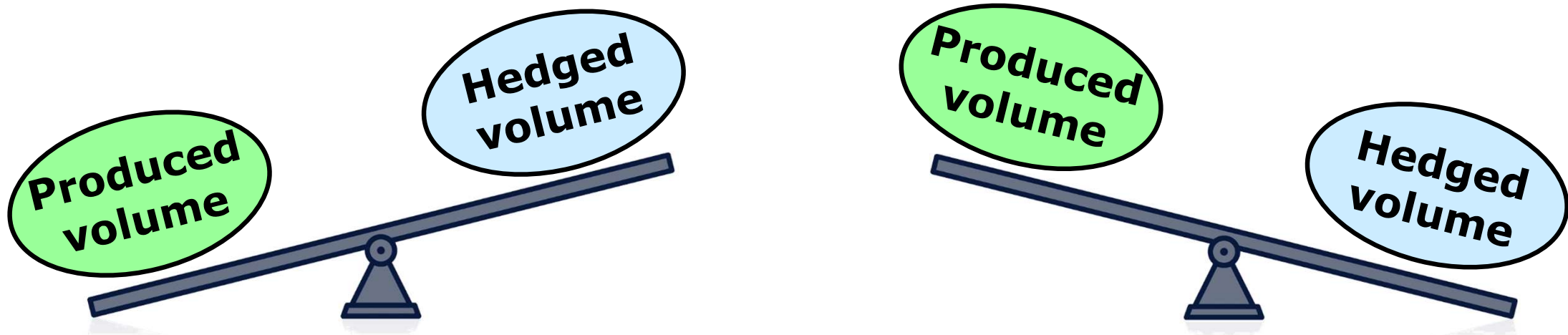
# Example of a financial forward – 4

*Volume 10 MW, hedging price 80 €/MWh. Settlement for one day*



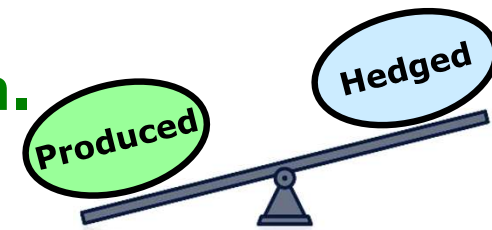
# Volume risk

**When there is imbalance between the produced volume and the hedged volume**



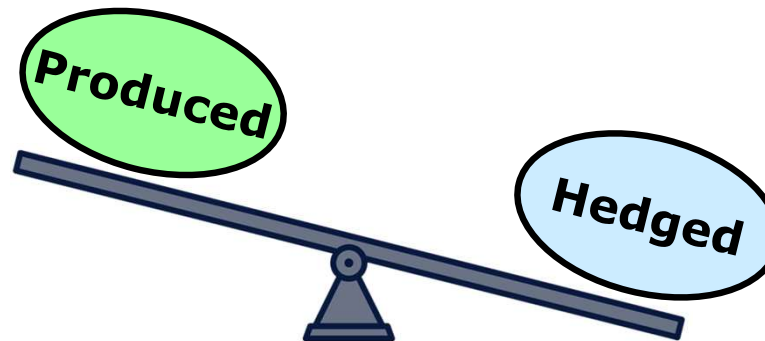
# Volume risk – an example – 1

- Consider a power producer, who has a 10 MW ask position in a forward contract with a hedging price **80** €/MWh.
- For a given day, assume the day's average spot price is 60 €/MWh.
- For one day, the hedged volume is  $24 \text{ h} * 10 \text{ MW} = 240 \text{ MWh}$ .
- Hence, the following bank day, the producer will receive  $(\mathbf{80} - 60) \text{ €/MWh} * 240 \text{ MWh} = 4800 \text{ €}$ .
  - ❑ Hence, for a volume of 240 MWh, the producer will be compensated for the low spot price.
- However, for this day, assume the producer's unit produces 280 MWh
  - ❑ For the extra (280-240) MWh, the producer will only receive the spot price.
  - ❑ The revenue from the extra 40 MWh is only:  
 $(\text{spot price}) * 40 \text{ MWh} = 60 \text{ €/MWh} * 40 \text{ MWh}$ .



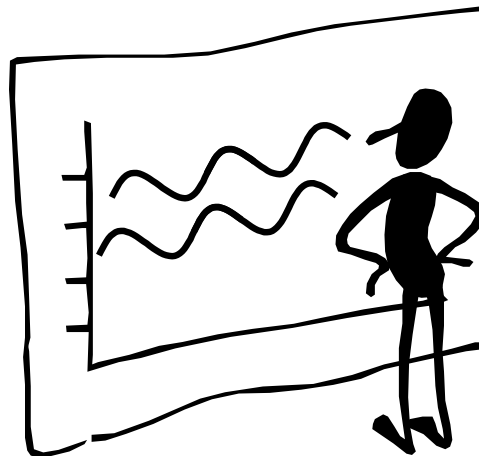
# Volume risk – an example – 2

- We consider a power producer, who has a 10 MW ask position in a forward contract.
- Assume the contract's hedging price is 80 €/MWh.
- For one day, the hedged volume is  $24 \text{ h} * 10 \text{ MW} = 240 \text{ MWh}$ .
- For a given day, assume the day's average spot price is 90 €/MWh.
- In this case, on the following bank day, the producer must pay  $(90 - 80) \text{ €/MWh} * 240 \text{ MWh} = 2400 \text{ €}$ .
- However, assume the producer's unit produces only 200 MWh during this day
  - ❑ For the missing (240-200) MWh, the producer has no income from the spot market. However, the producer must still pay the whole sum of 2400 €.



# Profile risk

**When the average price, the producer gets from selling to the spot market, is lower than the unweighted average spot price, which is used in the settlement of a financial forward**



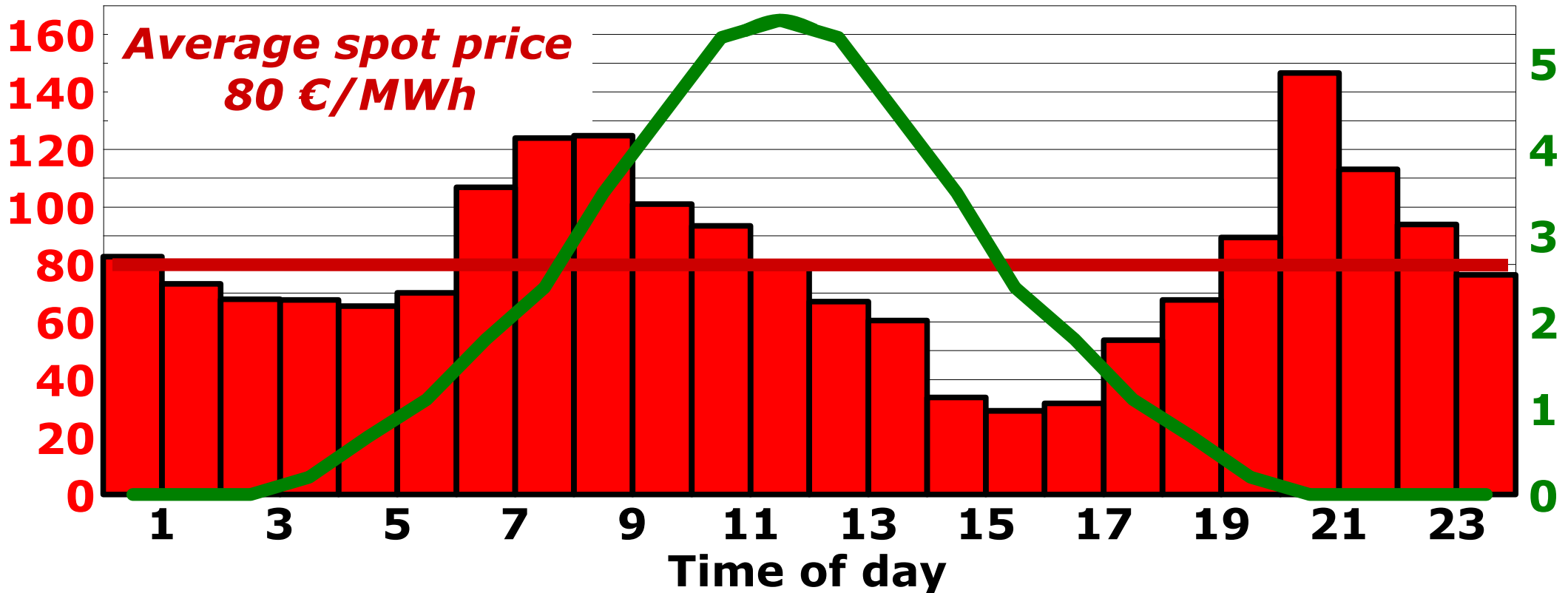
# Example of settlement of a financial forward

Volume 10 MWh, hedging price 80 €/MWh. Settlement for one day

Spot price €/MWh

Solar farm

Production MW

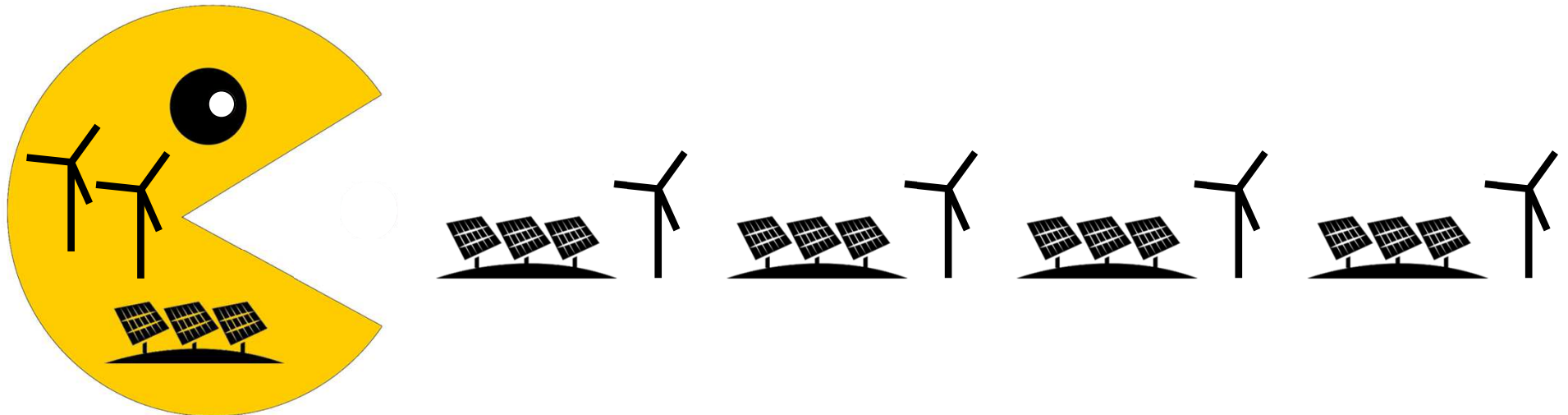


- The unweighted average spot price is 80 €/MWh.
- Hence, as the hedging price is 80 €/MWh, the forward settlement gives no exchange of money between the two parties.
- However, the producer's average price is only 77.5 €/MWh!
  - ❑ Because the producer does not produce much during the morning and evening peak hours.

# Profile risk

## And cannibalisation

- **In the example at the previous slide, the strong dip in the spot prices during the afternoon is caused by high afternoon production from other solar farms.**
- **Hence, these solar farms are in a much worse position than the solar farm in our example**
  - ❑ **As their production peaks during low-price hours.**
- **This is the so-called cannibalisation:**
  - ❑ **Renewables lowering the spot price due to simultaneous high production from lots of renewables.**



# More information

- **See the PowerPoint presentations**
  - ❑ ***German forward prices for electricity.***
  - ❑ ***Nordic financial prices and spot prices – annual contracts 2002-2017.***
  - ❑ ***Nordic financial prices and spot prices – quarter contracts 2006-2017.***
- **These presentations give you historical experiences from the German and Nordic markets for power derivatives.**





# **Thank you for your attention!**

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