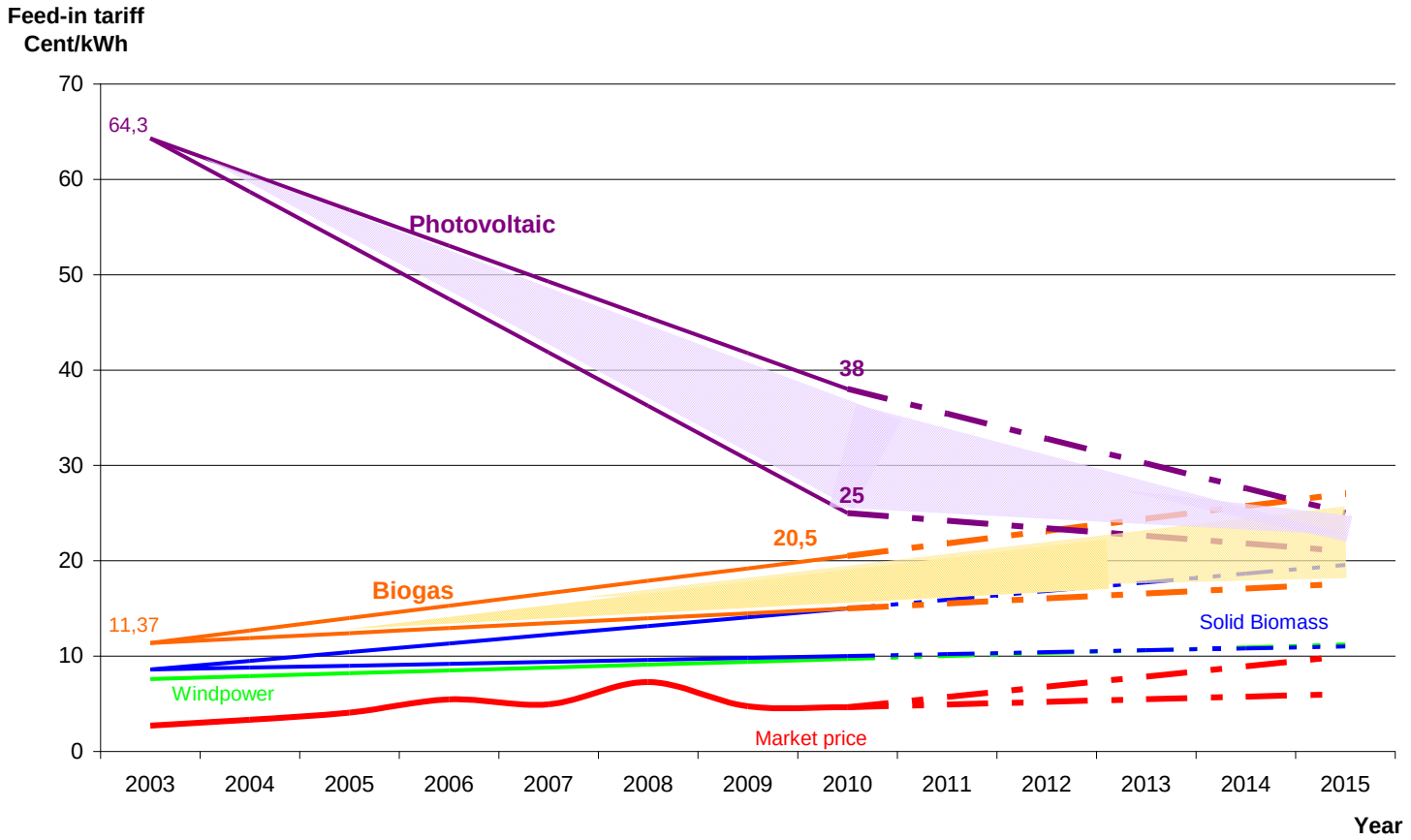
Simplified methodology to calculate FiT

Very different costs for different technologies

Feed-in tariffs and electricity market price 2003 - 2009



Source: Energie-Control GmbH

Ökostrombericht 2011

IRENA estimations of RET costs

	2010	2015		2020		2030		2050	
	$/kW	Ref.	Opt.	Ref.	Opt.	Ref.	Opt.	Ref.	Opt.
Small Hydro	4,000	3,901	3,804	3,804	3,618	3,618	3,272	3,273	2,676
Biomass	2,500	2,377	2,260	2,261	2,043	2,150	1,847	1,945	1,511
Geothermal	4,000	3,709	3,616	3,439	3,268	3,271	2,956	2,959	2,418
Wind On-shore	2,000	1,785	1,717	1,624	1,513	1,396	1,236	1,295	1,118
Solar PV (utility)	3,500	3,006	2,854	2,787	2,580	2,457	2,218	2,114	1,814
Solar PV (roof top)	5,000	4,077	3,869	3,501	3,155	2,934	2,578	2,524	2,108
PV with Battery	7,000	5,708	5,416	4,901	4,416	4,108	3,609	3,534	2,951
Solar thermal no storage	4,500	3,914	3,864	3,493	3,318	3,080	2,711	2,650	2,218
Solar th. with Storage	11,000	9,229	8,784	8,236	7,543	7,263	6,163	5,940	4,555
Solar th. with gas co-firing	1,968	1,860	1,825	1,791	1,735	1,725	1,650	1,725	1,650

METHODOLOGY

Introduction

A feed-in tariff (FIT) is a pre-defined guaranteed minimum price or a guaranteed premium on the market price for every kWh of green electricity generated. The tariff scheme is usually differentiated for different green electricity production technologies, with less developed technologies receiving higher prices for their output. The scheme is usually defined for a specified number of years, but again this can vary depending on the technology.

Overall aim

The overall aim when designing a set of feed-in tariffs is to fix a premium tariff which:

Covers the extra cost of electricity production using the given technology (thus stimulating investment)

While at the same time **avoids over-subsidizing the given technology** (thus creating windfall profits and making the system more costly)

METHODOLOGY

Relevant parameters

The most relevant parameters are on the one hand plant-specific data, and more general parameters on the other. The most influential parameters when determining the generation costs are:

- Investment and operational costs
- Full load hours
- Fuel price (in the case of biomass)
- Interest rate
- Expected return on equity
- Electricity price

METHODOLOGY

Because of the great amount of different variables, the renewable energy generation costs are generally calculated specifically. For this purpose a number of projects have developed mathematical models. A simplified calculation based on the most crucial parameters is presented

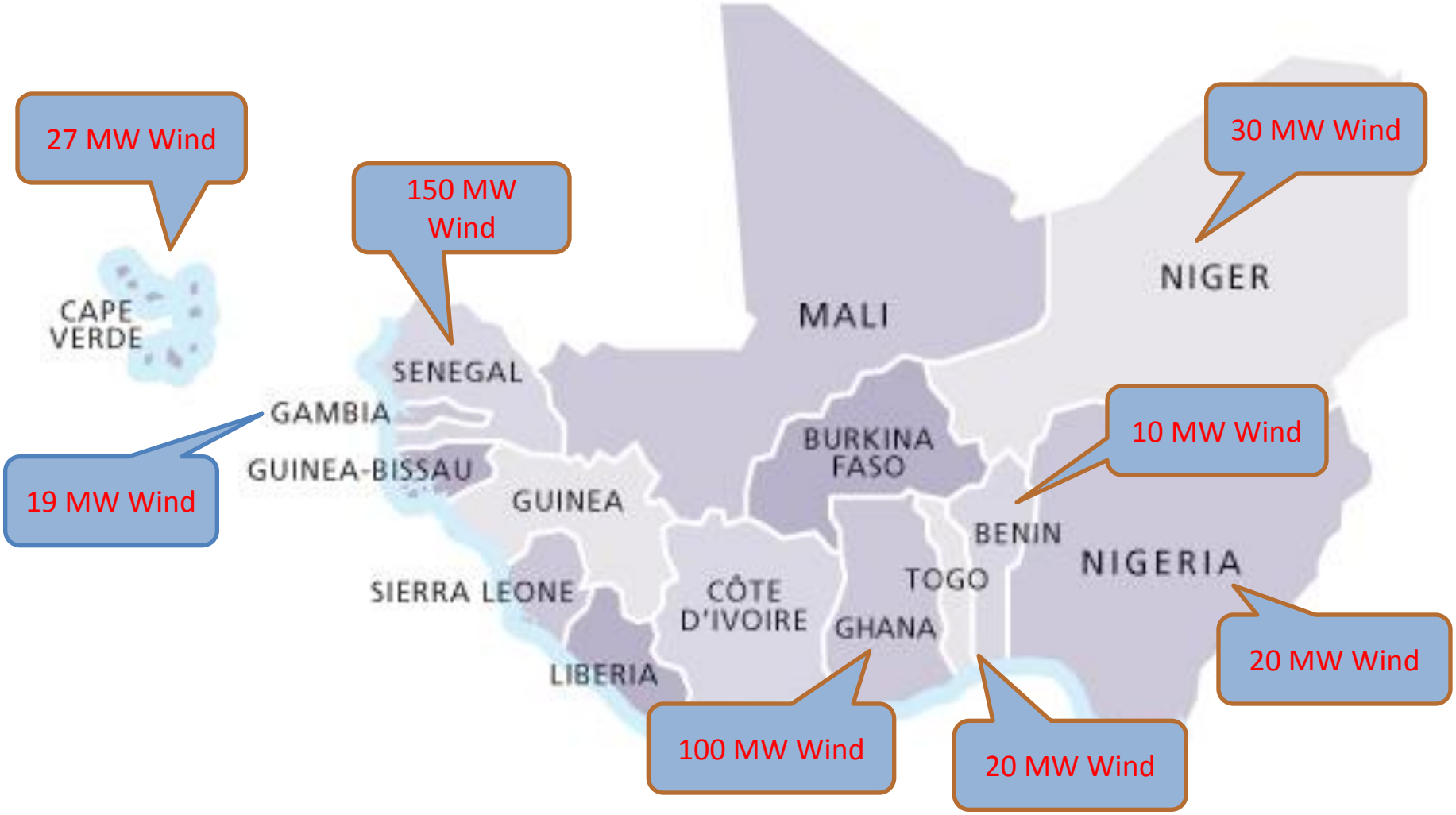
Determine the feed-in tariffs

Once the generation costs per technology are known, the level of the feed-in tariff can be fixed accordingly.

Policy considerations

The level of the tariff can finally be influenced by the explicit political decision to stimulate renewable deployment. For instance a national government can decide to introduce higher feed-in tariffs to reach a certain share of renewable electricity by a given year, or to activate a virtually non-existent sector, or to establish the renewable energy policy as an umbrella policy aiming to improve on other policies such as energy poverty, education, health care and gender issues.

On-shore wind Farms
2011-2020



On-shore wind Farms

Parameters	
Capacity (kWe)	1500
Full load hours/year	2000
Investment cost (€/kWe)	1100
Operation and maintenance cost (€/kWe/year)	40
Interest rate *r (per cent)*	6.5
Duration of support *t (years)*	10
Feed-in tariff (€/kWh)	?

On-shore wind Farms

The basis to calculate feed-in tariffs is the approach of net present value (NPV). NPV calculation is a standard method to consider whether a potential investment project should be undertaken or not. The interest rate is used to establish what the value of future cash flows is in today's money. A project is considered viable whenever the present value of all cash inflows minus the present value of all cash outflows (which equals the net present value), is greater than zero.

NPV = Σ* [(INCOME/year – COST/year) / (1+ r)t] - INVESTMENT COSTS

*Σ running over the duration of the support scheme

On-shore wind Farms

Income/year
The feed-in tariff is considered to be the only form of income:
1500 (kW) * 2000 (hrs) * FIT (€/kWh)

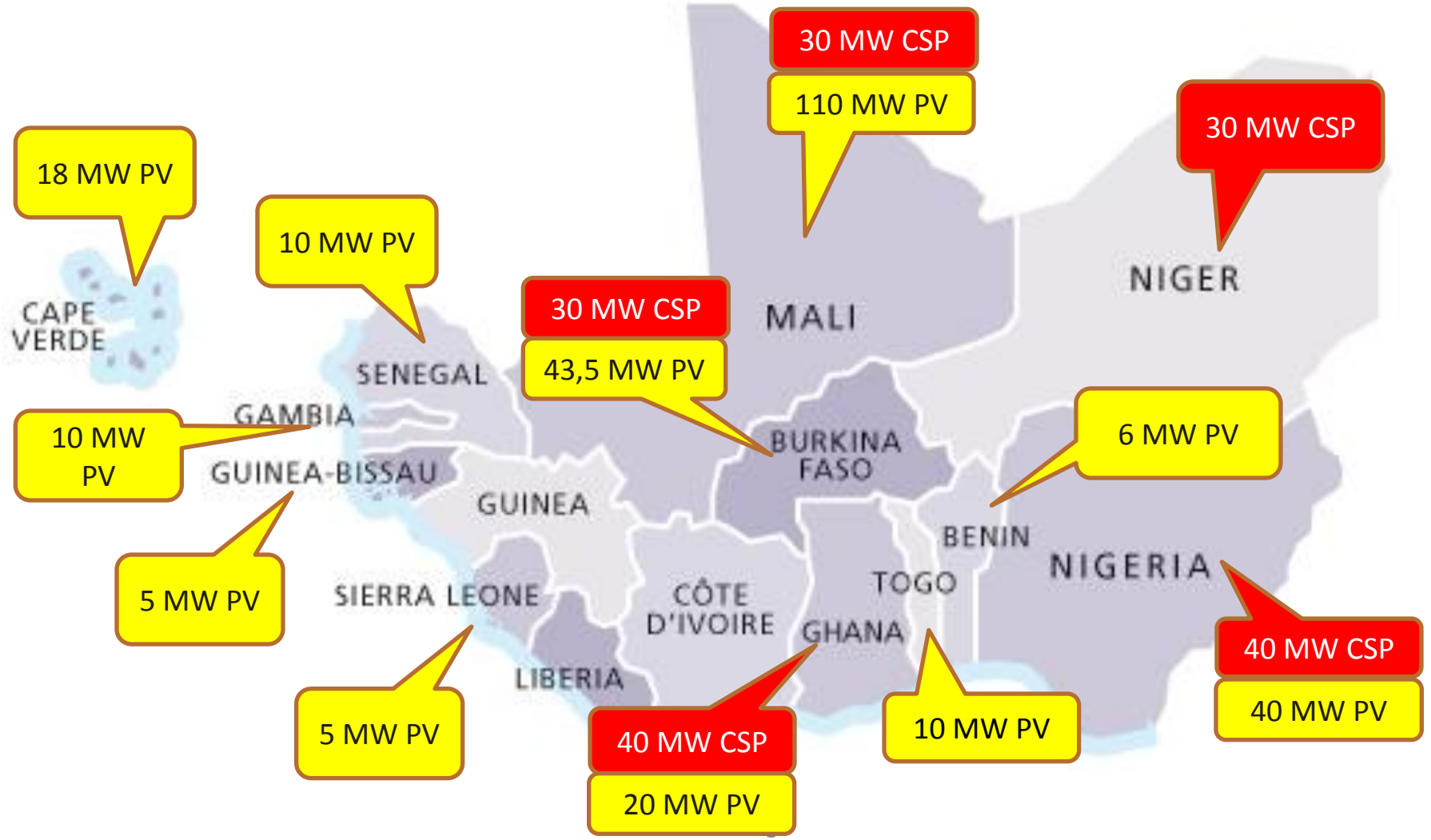
Cost/year
As costs, the operation and maintenance cost are considered:
1500 (kW) * 40 (€/kW) = 60,000 €

Investment cost
1500 (kW) * 1100 (€/kW) = 1,650,000 €

Calculation of the feed-in tariff
$\Sigma [(3{,}000{,}000 * FIT - 60{,}000) / (1.065)t] - 1{,}650{,}000 = 0$

FIT = 0.095 €/kWh = 95 €/MWh

PV Projects
2011-2020



PV Projects

Parameters	
Capacity (kWe)	2
Full load hours/year	1250
Investment cost (€/kWe)	6500
Operation and maintenance cost (€/kWe/year)	0
Interest rate *r (per cent)*	6.5
Duration of support *t (years)*	20
Feed-in tariff (€/kWh)	?

Income/year

2 (kW) * 1250 (hrs) * FIT (€/kWh)

Investment cost

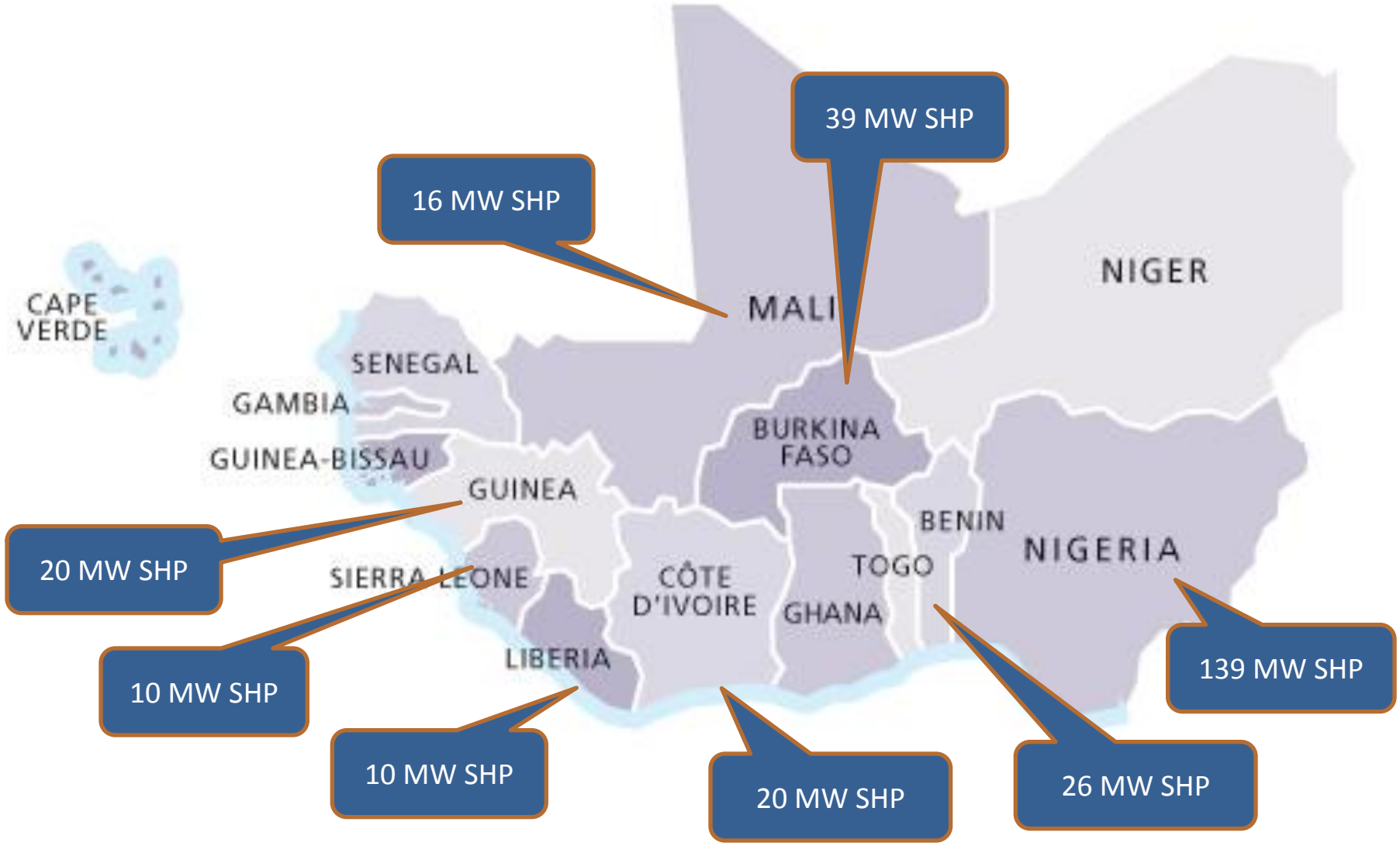
2 (kW) * 6500 (€/kW) = 13.000 €

Calculation of the feed-in tariff

$\Sigma [(2.500 * FIT) / (1{,}065)t] – 13.000 = 0$

FIT = 0.470 €/kWh = 470 €/MWh

Small Hydro Power
2011-2020



Small Hydro Power

Parameters	
Capacity (kWe)	100
Full load hours/year	6000
Investment cost (€/kWe)	2500
Operation and maintenance cost (€/kWe/year)	3
Interest rate *r (per cent)*	6.5
Duration of support *t (years)*	10
Feed-in tariff (€/kWh)	?

Income/year

Following the same approach as before, the income is:

100 (kW) * 6000 (hrs) * FIT (€/kWh)

Cost/year

Operation and maintenance cost /year: 100 (kW) * 2500 (€/kW) * 0.03 = 7500€

Investment cost

100 (kW) * 2500 (€/kW) = 250,000 €

Calculation of the feed-in tariff

$\Sigma [(600{,}000 * FIT - 7500) / (1.065)t] - 250{,}000 = 0$

FIT = 0.063 €/kWh = 63 €/MWh

Merci! Thank you! Muito Obrigado!

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