Technology Solutions to Upgrading Transmission Equipment Capacity

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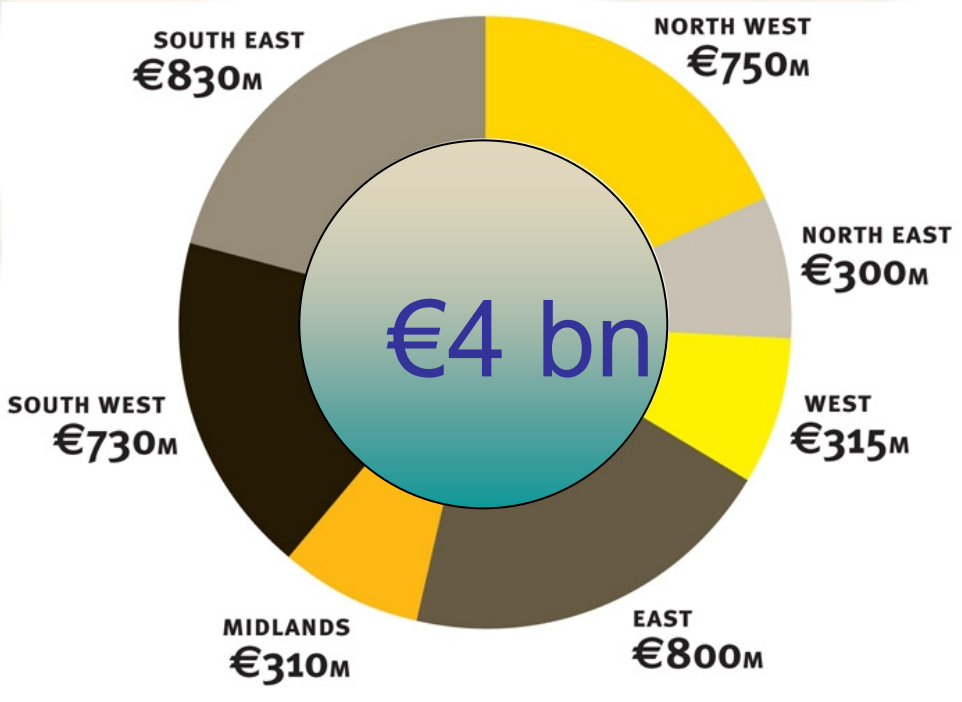
Developing the Grid - Grid**25**

2,300 km Upgrades

1,150 km New Build

€4 billion



Technology Solutions

- Overhead Lines
  - Conversion of AC circuits to DC operation
  - Voltage uprate of existing transmission circuits
  - Dynamic line monitoring
  - High Temperature Low Sag (HTLS) conductors

- Substations
  - Gas Insulated Switchgear
  - Compact Switchgear
  - HTLS busbar conductors
  - FACTS Devices
  - Temperature monitoring

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HTLS Requirements & Criteria

- Uprating Requirements

Voltage	Existing Conductor Type	Existing Rating (A/MVA)	Desired Rating (A/MVA)	Increase
110 kV	200 mm^2 ACSR	107	187	75%
110 kV	300 mm^2 ACSR	137	187	36%
220 kV	430 mm^2 ACSR	286	605	50%
220 kV	600 mm^2 ACSR	431	742	50%

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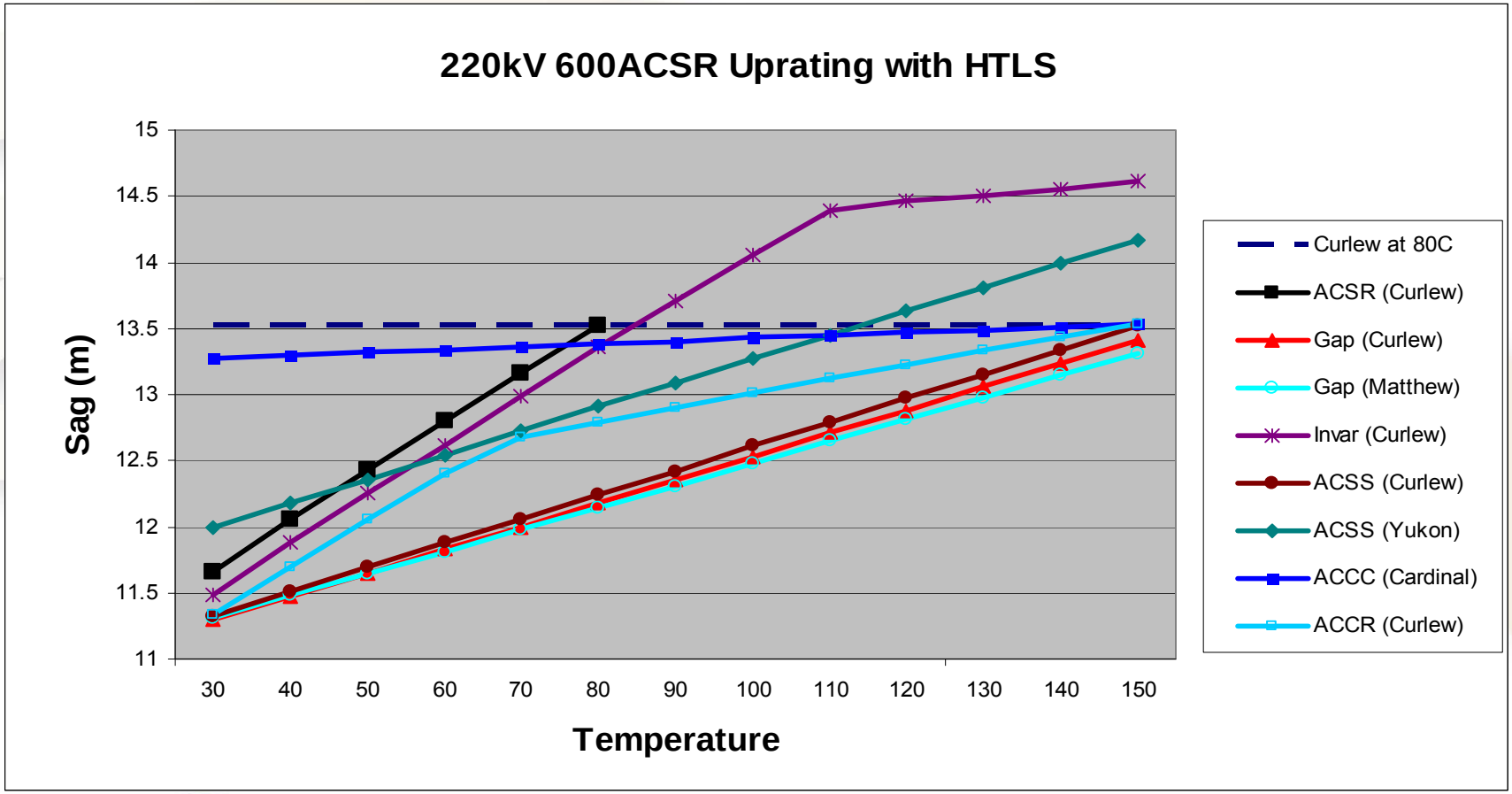
HTLS Conductors – Technical

5 Different Types of HTLS Conductors Considered :-

- ACSS : Aluminium Conductor, Steel Supported
- Invar: XTACIR/ZTACIR (Iron-Nickel alloy core)
- ACCR : Aluminium Conductor Composite Reinforced
- ACCC : Aluminium Conductor Composite Core
- GAP : G(Z)TACSR

Sag / Tension Example



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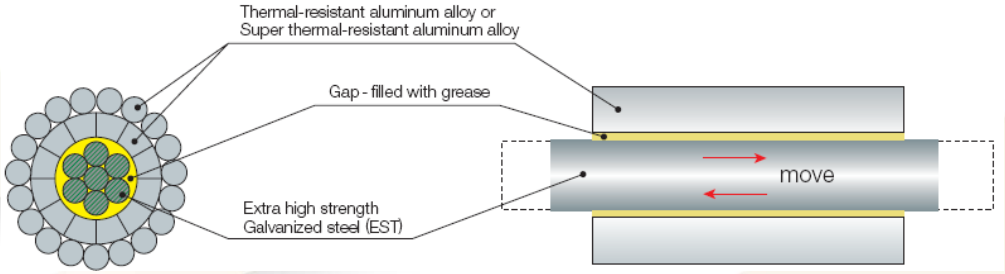
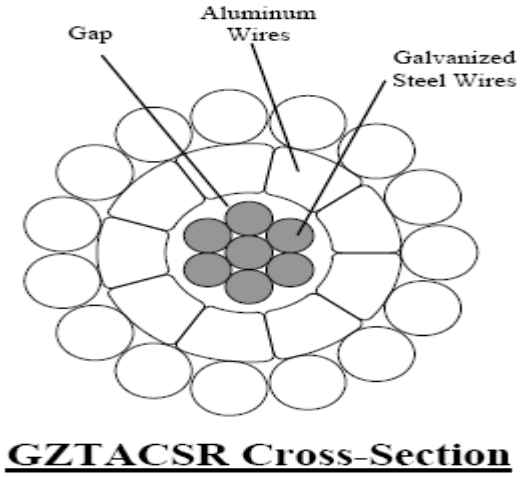
GAP Conductor Details





GZTACSR Cross-Section

- Unique Construction
- Steel core carries the load of the conductor (including aluminium)
- Combination of GAP construction and ZTAL outer wires offers excellent sag and current carrying characteristics
- Bespoke conductor designs available

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GAP Vs ACSR

- 430sq.mm Conductors
- 1600A DC Current
- 160°C DC
- GAP sags 1.1m less over 40m span

Installation Process

•Non – standard installation process (2 stages)

•Stage 1. Aluminium wires are destranded, Steel core exposed, compressed and left to settle

•Stage 2. Final sag adjusted and aluminium wires re-stranded

•Similar to OPPC installation

•10 – 15% increase in stringing duration

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Benefits 1/4

- Increased Rating:

Voltage	Existing Conductor Type	Existing Rating (A/MVA)	GAP Uprate (A/MVA)	Increase (Summer)
110 kV	200 mm^2 ACSR	562 / 107	981 / 187	75%
110 kV	300 mm^2 ACSR	719 / 137	1200 / 228	65%
220 kV	430 mm^2 ACSR	751 / 286	1500 / 570	100%
220 kV	600 mm^2 ACSR	1131 / 431	2025 / 771	80%

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Benefits 2/4

- Reduced Cost: (Note GAP costs are estimates and are subject to change depending on existing asset condition)

Voltage	Uprate Type	Standard Charge (per km)	GAP Uprate (per km)	Savings (per km)	
110 kV	200 mm^2 to 430 mm^2 ACSR	€259,000	€110,000	€150,000	≈60%
110 kV	300 mm^2 to 430 mm^2 ACSR	€259,000	€110,000	€150,000	≈60%
220 kV	430 mm^2 ACSR plus 50% extra	€172,000	€80,000	€82,000	≈50%
220 kV	600 mm^2 ACSR plus 50% extra	€700,000 (estimated)	€100,000	€600,000	≈85%

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Benefits 3/4

- Electric and Magnetic Fields
  - Electric Fields Unchanged
  - Magnetic Fields increased but within ICNIRP Guidelines
- Sustainability and the Environment
  - Utilising existing Assets
  - Optimising power flow along existing corridors
  - Minimal Land Damage
- Land Access
  - No new Towers
  - Minimal Landowner Interaction
  - No Planning Permission

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Benefits 4/4

- Reduced Outage Duration
  - Stringing Time
  - Occasional Tower Refurbishment
  - Estimated 50% reduction in duration.

Case Study 1 – Killonan - Knockraha

- 220kV Line constructed in 1960s
- 430mm^2 Bison Operated @ 60°C
- Fully Refurbished in 2006

- Uprate to 430mm^2 @ 80°C required for 2010 (associated with Cork CCGTs)

- 3 Uprate Options Considered
  - 1: ACSR
  - 2: AAAC
  - 3: GAP (HTLS)

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Case Study

Summary	430mm² ACSR @ 80°C	AAAC Equivalent	GAP Equivalent
No of spans violated (ground clearance)	92	32	0
No of violations below 0.4m	13	14	0
% of ground clearance violations along the line	38%	13%	0%
No. of structures to be replaced or modified	79	18 + 37 IMPs	0
Summer rating (A)	943	1005	1409

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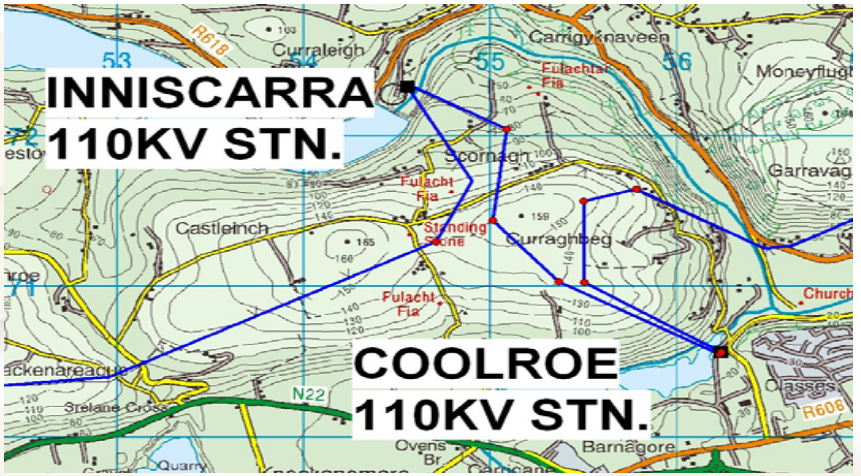
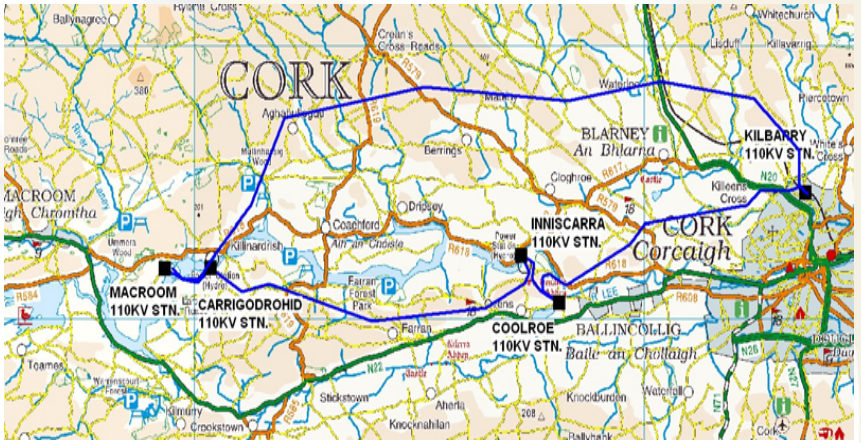
Case Study 2 – Cork Loop-ins

- Coolroe – Kilbarry, Coolroe – Inniscarra, Inniscarra - Macroom
- 11 recently build towers
- 25% of Towers in 8km Section
- Cost Saving >€1m





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Case Study 3 – Limerick - Moneteen

- 7km total length
- 2km double circuit section
- Construction / Planning Issues
- Cost Saving ~ €0.8m

Current Status & Next Steps

- Killonan – Knockraha
  - Contract award: 2009
  - Construction: July – October 2010
- Term Contract Conductor
  - Contract award: Q1 2010
- 2011 Projects
  - Cullenagh – Knockraha 220kV
  - Coolroe – Inniscara 110kV
  - Dunmanway – Macroom 110kV
  - Corduff – Ryebrook 110kV
  - Limerick – Moneteen 110kV

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Thank you

Questions?

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